Transactions of the Wisconsin Academy of Sciences, Arts and Letters. volume XLVII 1958

Madison, Wis.: Wisconsin Academy of Sciences, Arts and Letters, 1958

https://digital.library.wisc.edu/1711.dl/B44YAM2CN6YXH8B

TRANSACTIONS

OF THE

WISCONSIN ACADEMY

OF

SCIENCES, ARTS AND LETTERS

VOL. XLVII

NATURAE SPECIES RATIOQUE

MADISON, WISCONSIN
1958

OFFICERS OF THE WISCONSIN ACADEMY OF SCIENCES ARTS AND LETTERS

PRESIDENT
Robert J. Dicke, *University of Wisconsin, Madison*

PRESIDENT-ELECT
Henry Meyer, *Wisconsin State College, Whitewater*

VICE-PRESIDENT (SCIENCES)
Roy J. Christoph, *Carroll College, Waukesha*

VICE-PRESIDENT (ARTS)
Cyril C. O'Brien, *Marquette University, Milwaukee*

VICE-PRESIDENT (LETTERS)
Haskell M. Block, *University of Wisconsin, Madison*

SECRETARY-TREASURER
Roger E. Schwenn, *University of Wisconsin, Madison*

LIBRARIAN
Walter E. Scott, *1721 Hickory Drive, Madison*

COUNCIL

The President

The Vice-Presidents

The Secretary-Treasurer

The Librarian

Past Presidents:
Paul W. Boutwell
A. W. Schorger
H. A. Schuette
L. E. Noland
Otto L. Kowalke
W. C. McKern
E. L. Bolender
Katherine G. Nelson
C. L. Fluke
Ralph N. Buckstaff
Joseph G. Baier, Jr.
Stephen F. Darling
Rev. Raymond H. Reis, S. J.

COMMITTEES

Publications:
The President, *ex officio*
The Secretary, *ex officio*
Stanley D. Beck, *Editor, Transactions*

Membership:
Harold A. Goder, *Chairman*
Berenice Cooper
Otto L. Kowalke
Fred Kaufmann
John F. Vozza
Frederick W. Hainer
The Secretary, *ex officio*

REPRESENTATIVE ON THE COUNCIL OF THE A.A.A.S.
Stephen F. Darling, *Appleton*

CHAIRMAN, JUNIOR ACADEMY OF SCIENCE
John W. Thomson, *University of Wisconsin*

EDITOR, WISCONSIN ACADEMY REVIEW
Walter E. Scott, *1721 Hickory Drive, Madison*

EDITOR, TRANSACTIONS OF THE WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS
Stanley D. Beck, *University of Wisconsin, Madison*

TABLE OF CONTENTS

SCIENCES

ARTS AND LETTERS

The *Transactions* welcomes sound original articles in the sciences, arts, and letters. The author or one co-author of a submitted paper must be a member of the Wisconsin Academy of Sciences, Arts and Letters. Manuscripts should be double-spaced throughout, including footnotes, quotations, and bibliographical references. The address to which galley proofs are to be sent should be typed in the upper left-hand corner of the first page. They should be mailed flat or rolled, never folded. Manuscripts should be addressed to Stanley D. Beck, 105 King Hall, University of Wisconsin, Madison 6. Papers received prior to July 31 will be considered for publication in the *Transactions* of the current year.

THE ISOTOPE ABUNDANCE RATIO AND THE CHEMICAL ATOMIC WEIGHT OF BORON

JOHN L. MARGRAVE
Department of Chemistry, University of Wisconsin, Madison

The chemical atomic weights of most elements are now known with high precision from mass spectographic isotope abundance ratios, X-ray unit cell-density measurements, classical combining weight studies, gas-density-compressibility studies, optical spectroscopic intensity measurements, nuclear reaction studies and other techniques. In the recent tabulation of Nier[1] boron had the least accurately known atomic weight of any element. The 1956 chemical atomic weight chosen was 10.82, a value which has been accepted without revision since the late 1920's.[2] The uncertainty quoted by Nier is ± 0.01, or one part in 1082. Wapstra[3] has given the value for the chemical atomic weight as 10.822 ± 0.002 on the basis of two mass spectographic studies.

Since the masses of the two stable isotopes are very exactly measured ($B^{10} = 10.016114$ and $B^{11} = 11.012789$ on the physical atomic weight scale), the large uncertainty in the atomic weight of the natural isotopic mixture is directly related either to (1) a real variability in the B^{11}/B^{10} ratio for naturally occurring boron, or (2) a real variability of the B^{11}/B^{10} ratio created during chemical conversion of boron samples for analysis, or (3) an apparent variability in the B^{11}/B^{10} ratio caused by unsatisfactory experimental techniques for measuring isotope ratios.

Values for the chemical and physical atomic weights as a function of the B^{11}/B^{10} ratio are listed in Table I. It is apparent that small variations in the isotope ratio have little significance in the atomic weight determination if an accuracy of only 0.1% is desired.

Experimental values for the isotope ratio and the chemical atomic weight are presented in Tables II, III and IV, along with original references. The wide range of observed values seems to weaken the suggestion that unsatisfactory techniques *per se* are the source of trouble since each of the methods cited has been previously and precisely applied in many other cases.

It thus appears that boron isotopes are appreciably fractionated in chemical and physical processes and consequently that variations

[1] A. O. Nier, Z. Elektrochem. 58, 559 (1954).
[2] E. Wichers, J. Am. Chem. Soc. 78, 3235 (1956).
[3] A. H. Wapstra, J. Inorg. Nucl. Chem. 3, 329 (1957).

in the B^{11}/B^{10} ratio are to be expected in laboratory compounds depending on their recent history, and in natural minerals depending on their ancient history as well.

Sources of Boron-containing Samples

The major sources of natural boron compounds include: (1) borate deposits in dry lakes from saturated solutions; (2) H_3BO_3 and borax deposits around volcanoes and fumaroles; and (3) sea water. All these sources probably have similar geochemical backgrounds in which B_2O_3 is formed under oxidizing conditions at high temperatures, vaporized in the presence of water as gaseous H_3BO_3 or HBO_2, and deposited on cool ground where it may be redissolved by rain and carried into lakes and oceans. Borate deposits are known to exist in California, Tuscany, Germany, Asia Minor, Tibet and in South America.

Laboratory treatment of borates for determination of isotope ratios or the atomic weight of boron may involve several steps in each of which the nearly 10% difference in mass between B^{11} and B^{10} may make appreciable differences in equilibrium and rate constants through effects on zero point energies, vibrational frequencies and rotational constants which are reflected in intermolecular forces.

Mass Spectrographic Values for the B^{11}/B^{10} Ratio

Because the mass spectrograph is so useful for other isotope ratio determinations, one is surprised by the wide of values for $R = B^{11}/B^{10}$ found in Table II. For no other element is a range as wide as 3.3 to 4.5 observed on routine samples.

A detailed examination of these anomalies has been made by Melton, et al,[4] who conclude that there is an important "memory" effect for boron compounds from residual gaseous and previous samples; by von Ubisch, et al,[5] and by Osberghaus[6] who find no significant variations for a large number of natural boron minerals, except for a 0.2% increase of B^{11}/B^{10} for sea water; by Palmer, Dance and Aitken[7] who confirm the "memory" effect and suggest methods for handling samples to avoid it; by Schiuttse,[8] who has made an extensive study of BF_3, BCl_3, B_2O_3 and $Na_2B_4O_7$ for deter-

[4] C. E. Melton, L. O. Gilpatrick, R. Baldock and R. M. Healy, Anal. Chem. 28, 1049 (1956).

[5] A. Parwel, H. von Ubisch and F. E. Wickman, Geochimica et Cosmochimica Acta, 10, 185 (1956).

[6] O. Osberghaus, Z. Physik 128, 366 (1950).

[7] G. H. Palmer, D. F. Dance and K. L. Aitken, At. Energy Research Establishment Report AERE GP/R 1994, June, 1956.

[8] V. Schiuttse, J. Exp. Theor. Phys. U.S.S.R. 29, 486 (1955); translated in Soviet Physics JETP 2, 402 (1956).

TABLE I

THE ATOMIC WEIGHT OF BORON AS A FUNCTION OF R[a]

$R = B^{11}/B^{10}$	PHYSICAL ATOMIC WEIGHT	CHEMICAL ATOMIC WEIGHT
3.68386	10.80000	10.79704
3.91483	10.81000	10.80704
4.16978	10.82000	10.81704
4.45259	10.83000	10.82703
4.76818	10.84000	10.83703

[a]In this table, $B^{11} = 11.012789$ and $B^{10} = 10.016114$ as given by Li, Whaling, Fowler and Lauritsen, Phys. Rev. 83, 512 (1951) and the conversion factor for chemical to physical atomic weights is 1.000274.

TABLE II

MASS SPECTROGRAPHIC VALUES FOR THE B^{11}/B^{10} RATIO

COMPOUND	GEOGRAPHICAL SOURCE	$R = B^{11}/B^{10}$	REFERENCE
BF_3	Unknown	3.85	a
BF_3	Unknown	4.04	b
BF_3	Unknown	4.31 ± 0.17	c
$B(OCH_3)_3$			
BF_3	Various	4.270–4.442	d
B_2H_6	Unknown	3.99	e
B_2H_6	Unknown	3.99	f
BF_3	Various	4.07–4.13	g
BCl_3			
Decaboranes	Unknown	3.35–3.59	
Pentaboranes	Unknown	3.60–3.85	h
Diboranes and BX_3	Unknown	3.84–4.07	
BF_3, BCl_3, B_2O_3 and $Na_2B_4O_7$	Various	4.10–4.46	i
BH_3CO	Unknown	4.14	j
BF_3	Unknown	4.005	k_1
BF_3	Unknown	4.44 ± 0.05	k_2

(a) F. W. Aston, Proc. Roy. Soc. 132A, 487–98 (1931).
(b) F. W. Aston, "Mass Spectra and Isotopes", Arnold and Co. (London), 1933, pp. 124–5.
(c) M. G. Inghram, Phys. Rev. 70, 119, 653–60 (1946).
(d) H. G. Thode, J. Macnamara, F. P. Lossing, and C. B. Collins, J. Am. Chem. Soc. 70, 3008–11 (1948).
(e) V. H. Dibeler and F. L. Mohler, J. Am. Chem. Soc. 70, 987–9 (1948).
(f) F. J. Norton, J. Am. Chem. Soc. 71, 3488–91 (1949).
(g) O. Osberghaus, Z. Phys. 128, 366–77 (1950).
(h) Callery Chemical Company Mass Spectrographic Laboratory; work done under the supervision of R. W. Law.
(i) V. Schiuttse, J. Exp. Theor. Phys. U.S.S.R. 29, 486–9 (1955); translated in Soviet Physics 2, 402–5 (1956).
(j) I. Shapiro, Private Communication (1956).
(k_1) C. E. Melton, L. O. Gilpatrick, R. Baldock and R. M. Healy, Anal. Chem. 28, 1049–51 (1956).
(k_2) G. M. Panchenkov and V. D. Moiseev, Zhur. Fiz. Khim. 30, 1118 (1956).

mination of R; and by Panchenkov and Moiseev,[9] who have recently studied BF_3. The most interesting work is that of Schiuttse which indicates that there are systematic variations of R with time during (1) thermal decomposition of KBF_4 and (2) evaporation of $Na_2B_4O_7$ and B_2O_3 from a hot filament. These variations are in the direction which indicates more B^{11} than B^{10} containing molecules

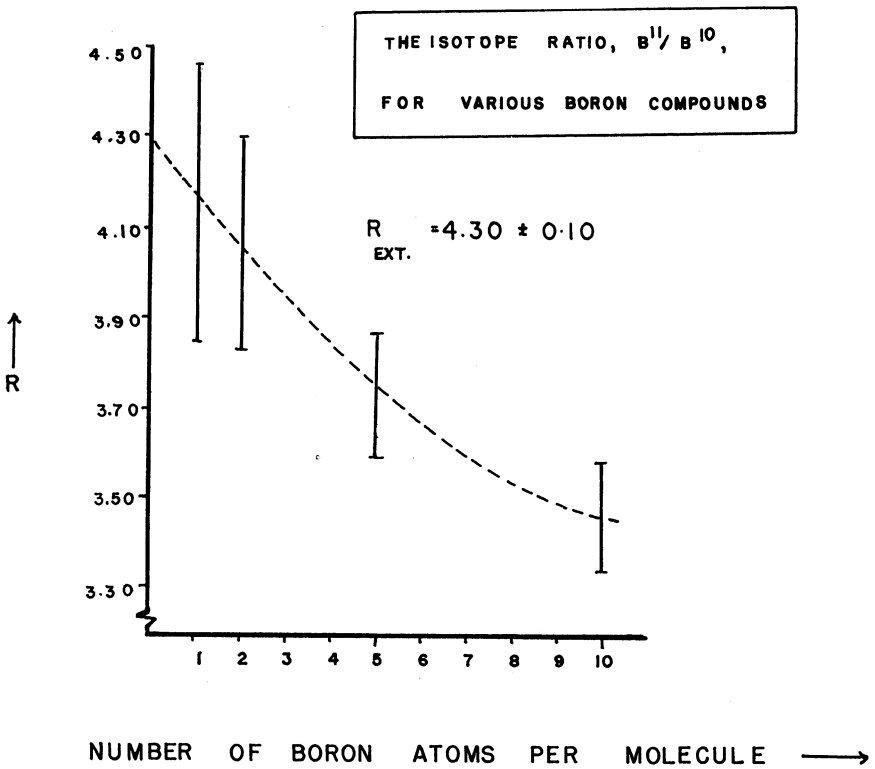


FIG. 1.

are being vaporized, contrary to the usually expected higher volatility of the lighter molecules. A similar report suggesting concentration of B^{11} in vapors has been given by Green and Martin[10] regarding the equilibrium between $B^{10}Cl_3$ and $B^{11}Cl_3$; by D'Hont and Lattre[11] for thermal decomposition of KBF_4; and the concentration of B^{11} in BF_3 etherate complexes has been widely applied.[12] Brad-

[9] G. M. Panchenkov and V. D. Moiseev, Zhur. Fiz. Khim. 30, 1118 (1956).
[10] M. Green and G. R. Martin, Trans. Far. Soc. 48, 416 (1952).
[11] M. D'Hont and A. D. Lattre, Nuc. Physics 2, 736 (1956).
[12] A. L. Conn and J. E. Wolf, Abstracts of 132nd Meeting, American Chemical Society, New York, September, 1957, page 25M.

ley[13] has pointed out that this behavior is not unexpected since in a mixture of light and heavy molecules (1) the greater entropy (because of mass) favors vaporization of the heavy molecules but (2) the stronger intermolecular forces between the heavy species tend to make their heat of vaporization higher.

Values of R have been deduced from peak heights at masses 10, 11, 12, 13 and 14 on mass spectrographic patterns of boron compounds available from routine analyses done in the Mass Spectrographic Laboratory of the Callery Chemical Company. An appearance potential study on heavy boron hydrides with 5 and 10 boron atoms per molecule also supports the low values of R for molecules with high boron content as indicated in Table II.[14] There appears to be a trend in R which is in the direction predicted for an isotope separation process which depends inversely on mass, with lighter molecules being concentrated in the vapor. Preferential reaction rates for B^{10}-containing molecules might also contribute to this separation.

The correlation of observed R with the number of borons in the molecule is shown in Figure I, and an extrapolation to zero boron content, which should eliminate isotope fractionation and separation effects, indicates $R = 4.30 \pm 0.10$.

Chemical Values for the Isotope Ratio

Chemical determinations of R involve a very accurate determination of the average molecular weight of a boron compound prepared in a series of reactions one of which includes some element whose atomic weight has already been very well established. For example, one could prepare high purity BCl_3, hydrolyze it and react the product HCl with standard $AgNO_3$. The final R in such a determination is usually obtained with the assumptions that no appreciable isotope separation occurs during the various reactions and that differences in reaction rates are not significant. Of course, a 100% conversion in each step of the determination assures the absence of isotope fractionation effects. Careful weighings, high purity materials and meticulous laboratory techniques are required.

Equally careful and reputable scientists have reported atomic weights for boron from 10.8055 to 10.896 by chemical means, as indicated in Table III. An R value between 3.5 and 6.0 is implied. It would appear that high precision values for R are not likely to be established by the chemical method.

---

[13] D. C. Bradley, Nature 173, 260 (1954).
[14] J. L. Margrave, Unpublished Work, 1956.

TABLE III

CHEMICAL VALUES FOR THE ATOMIC WEIGHT OF BORON

COMPOUND AND METHOD	GEOGRAPHICAL SOURCE	ATOMIC WEIGHT	REFERENCE
Fused Borax Reactions	Various	10.899–11.023	Various (1826–1918)
BBr_3:3AG	Unknown	10.800	l
$Na_2B_4O_7 \cdot 10H_2O$+HCl	Unknown	11.006	m
BBr_3:3AgBr	Unknown	11.016	n
BCl_3:3AgCl	Unknown	10.947	n
B_2S_3:3$BaSO_4$	Unknown	11.024	n
B_6C:6CO_2	Unknown	10.997	n
$Na_2B_4O_7$	Unknown	10.900	o
BCl_3:3Ag	Unknown	10.82–10.83	p
BBr_3:3Ag			
BCl_3:3AgCl	Unknown	10.818–10.840	q
B_2H_6:6H_2	Unknown	10.8055	r
Fused Borax+HCl	Unknown	10.920–11.087	s
	Unknown	10.829–10.889	
	Tuscany	10.821–10.862	
	Asia Minor	10.814–10.827	
BCl_3:3Ag	California	10.832–10.896	t
	Asia Minor	10.816–10.820	
	California	10.836–10.846	

(l) J. Hoskyns-Abrahall, J. Chem. Soc. 61, 650 (1892).
(m) E. Rimbach, Ber. 26, 164 (1893).
(n) Gautier, Ann. chim. phys. 18, 352 (1899).
(o) E. F. Smith and W. K. Van Hagen, Carnegie Inst. Pub. 267, 1–63 (1918).
(p) G. P. Baxter and A. F. Scott, Science 54, 524–5 (1921); Proc. Am. Acad. Arts Sci. 59, 21–48 (1923).
(q) O. Honigschmid and L. Birckenbach, Ber. 56B, 1467 (1923).
(r) A. Stock and E. Kuss, Ber. 56, 314 (1923).
(s) H. V. A. Briscoe, P. L. Robinson and G. E. Stephenson, J. Chem. Soc. 127, 150–62 (1925).
(t) H. V. A. Briscoe and P. L. Robinson, J. Chem. Soc. 127, 696–720 (1925).

NEUTRON ABSORPTION VALUES FOR THE ISOTOPE RATIO

Since the isotopes of boron show greatly different cross-sections for neutron capture ($\sigma = 4020$ barns for B^{10} and $\sigma < 0.05$ barns for B^{11}), one may analyze isotopic mixtures by neutron absorption techniques for B^{10} content. Typical procedures are outlined by Green and Martin[10], by DeFord and Braman[15] and by Hamlen and Koski.[16] The reaction used is

$$_5B^{10} + {}_0n^1 = {}_2He^4 + {}_3Li^7$$

and one may either count the α's produced or measure the attenuation of the neutron beam.

[15] R. S. Braman, Ph.D. Thesis, Northwestern University (1956); DeFord and Braman, Callery Chemical Company Report No. CCC–1024–TR–243, May 17, 1957.
[16] R. P. Hamlen and W. S. Koski, Mathieson Chemical Company Report No. MCC–1023–TR–117 (1956).

In all cases, it is customary to use a natural boron compound as a standard and a defined R to establish a scale for the B^{11}/B^{10} ratio.

Ideally, one would like to have a sample of 100% B^{10} for calibration purposes. In its absence, one must have some other source of data to put the neutron absorption method on an absolute basis. For relative B^{10} concentrations, however, the neutron absorption method is ideal.

Variations up to 1% are often observed in the B^{10} concentration in "normal" laboratory compounds. These are probably indicative of the isotope concentration or rate effects mentioned previously. The technique has not been applied to as wide a variety of compounds as the mass spectrographic method, but in no case has the value of R been below 4.0.

A comprehensive calibration of the method with "standard" boron compounds of various isotopic compositions is now being made for intercomparison with mass spectrographic and other isotope abundance data.[17]

Values for R from Optical Spectroscopy

The B^{11}/B^{10} ratio may be evaluated from intensity measurements on molecular or atomic spectral features. It is fundamental to assume for the particular transition that the transition probability does not depend on the particular isotope concerned. If this is true, then one may compare either photographically or photometrically the intensities of corresponding features of the $B^{11}O$ and $B^{10}O$ visible spectra, of $B_2{}^{11}H_6$, $B_2{}^{10}H_6$ and $B^{11}B^{10}H_6$ infrared spectra, etc. Calculation of R from relative intensities of molecular spectra and vice versa will be discussed by Margrave and Polansky.[18] Literature values for B^{11}/B^{10} ratios by optical spectroscopy are presented in Table IV. New studies on boron compounds of various isotopic composition are now in progress.[19]

Values of the Isotope Ratio from X-ray and Density Measurements

If one knows the density of a solid crystal, the number of molecules in the unit cell and the lattice constants, he can compute the formula weight of the substance. If more than one element is present but all the atomic weights are known except one, the data can yield extremely accurate atomic weights. This procedure has been applied for many elements.[20]

---

[17] R. S. Braman, Unpublished Work, Callery Chemical Company, 1957.
[18] J. L. Margrave and R. B. Polansky, to be published.
[19] W. Meyer and J. L. Margrave, University of Wisconsin, 1957.
[20] T. Batuecas, J. chim. phys. 54, 195 (1957).

TABLE IV

VALUES FOR THE B^{11}/B^{10} RATIO FROM OPTICAL SPECTROSCOPY

SPECTRUM OBSERVED	GEOGRAPHICAL SOURCE	$R = B^{11}/B^{10}$	REFERENCE
BO(β-system)	Chile	3.63 ± 0.02	u
BH(4332 A. system)	Unknown	4.86 ± 0.15	v
B($^2P_{\frac{3}{2}} - {}^2S_{\frac{1}{2}}$ line)	Unknown	4.43	w

(u) A. Elliott, Nature 126, 845–6 (1930); Z. Phys. 67, 75–88 (1931).
(v) R. F. Paton and G. M. Almy, Phys. Rev. 37, 1710 (1931).
(w) L. S. Ornstein and J. A. Vreeswijk, Z. Phys. 80, 57 (1933).

There are, however, fundamental sources of error which are difficult to eliminate: (1) lattice defects are often present which lead to apparent variations in atomic weights even under otherwise optimum conditions; (2) densities are hard to measure with great precision because of cracks, voids, etc., in crystals or chemically-bound impurities like water; and (3) Avogadro's Number is not known with particularly great accuracy.

A variety of boron compounds have been considered for calculation of the atomic weight of boron: H_3BO_3, HBO_2, decaborane, WB, MoB, CeB_6, MgB_2, and pure elementary boron. The apparent atomic weights range from 9.5 to 10.83 ± 0.02. This latter result was obtained from data on CeB_6 and is quite likely correct since all the expected errors tend to make the apparent atomic weight low, not high.

VALUES OF R FROM NUCLEAR MAGNETIC RESONANCE STUDIES

In nuclear magnetic resonance studies of boron compounds, independent signals are obtained for the B^{11} and B^{10} nuclei. If the transition probabilities for the transitions are the same or can be calculated, one can make a direct and absolute measurement of the isotope ratio. Alternatively, one can make an absolute determination of the isotope abundances in two measurements on two samples with different $B^{11/10}$ ratios.

Assume sample I contains concentrations x_1 and y_1 of B^{10} and B^{11} while sample II has concentrations x_2 and y_2 of B^{10} and B^{11}. Then, let

$a = x_1/x_2$ = ratio of B^{10} concentrations in samples I and II
$b = y_1/y_2$ = ratio of B^{11} concentrations in samples I and II.

Also, let

$x_1 + y_1 = c$ = total boron present in sample I
$x_2 + y_2 = d$ = total boron present in sample II.

Now, the quantities c and d may be determined by direct chemical analysis for total boron; a and b are determined from the ratios of the peak heights on the n–m–r trace, or a can be determined independently from neutron absorption studies. Thus, on solving for the unknowns x_1, y_1, x_2 and y_2:

$$x_1 = \frac{a(c - bd)}{a - b} \qquad y_1 = \frac{b(c - ad)}{b - a}$$

$$x_2 = \frac{(c - bd)}{a - b} \qquad y_2 = \frac{(c - ad)}{b - a}$$

Conclusions

The B^{11}/B^{10} ratio in a given sample may vary from 3.3 to 4.5 depending on the chemical history of the material. From mass spectrographic traces and an extrapolation to minimize isotope fractionation effects, the normal ratio, B^{11}/B^{10}, appears to be 4.30 ± 0.10. This implies a chemical atomic weight of 10.822 ± 0.004. Conflicting data do not enable one to decide absolutely if the isotope ratio varies widely in natural boron-containing minerals. Some of the observed variation probably results from isotope fractionation effects in chemical preparation and handling.

Further refinement of the atomic weight seems possible by a detailed comparison of the neutron absorption, nuclear magnetic resonance, optical and mass spectrographic data for various natural and synthetic boron compounds. Another approach was suggested by Dr. W. G. Berl of the Johns Hopkins Applied Physics Laboratory in 1955. The idea is to react a weighed B^{11}–B^{10} mixture in a nuclear pile with neutrons until all the B^{10} is converted to Li. One may then analyze for Li by normal quantitative methods, and also correct for the small amount of C^{12} formed by the B^{11}. Tests of this type are presently underway by the author and Mr. Wilfred Meyer, with the Argonne National Laboratory Pile as the neutron source.

Acknowledgement

This work was in part supported by the Callery Chemical Company under a contract from the Bureau of Aeronautics, Department of the Navy.

SOIL COLOR AS AN INDICATION OF NITROGEN CONTENT IN SOME WISCONSIN SOILS[1]

W. A. NOEL and F. D. HOLE[2]
Soils Department, University of Wisconsin, Madison

Professor A. R. Whitson reported thirty-one years ago (13) that dark prairie soils of Wisconsin were originally higher in content of organic matter, total nitrogen and phosphorus than lighter colored timbered soils. This paper reports a statistical study of the relationship between soil color and nitrogen content of some samples of Wisconsin soil profiles, including a number of Whitson's original soil samples.

Soil color has been reported to depend on many factors, including moisture, organic matter, iron, manganese, and elemental carbon (12). Gillam (2) found that the ratio between relative black pigment and humus contents of soil varied geographically from great soil group to great soil group. Wilde (14) recorded as high as 0.262 per cent of nitrogen in light colored surface horizons of Planosols in Indiana. Smirnoff (11) noted that soils of Morocco, which contained light colored organic matter, darkened in proportion to the content of organic matter, after being moistened with concentrated sulphuric acid. Jenny (5) reported that in grassland soils of the Great Plains of North America nitrogen content increases from south to north with decreasing annual temperature, and from west to east with increasing precipitation.

Brown and O'Neal (1) found that the relation of color designations, made by experienced soil scientists, to organic matter content was not clear. Their work was done before the development of modern soil color nomenclature and standards (3, 4, 6, 9, 10), of which the Munsell color system and notation (8) are now standard in the U.S.A. The Munsell Soil Color Charts were used in this investigation.

The Munsell system of color notations is based on three attributes: value, chroma and hue. The value notation indicates the relative darkness or gray scale, in which 0 represents black and 10, white. The chroma notation indicates the amount of color added

[1] Contribution from the Soils Department, and the Soil Survey Division, Wis. Geological and Nat. Hist. Survey, University of Wisconsin, Madison. Published wth the permission of the Director of the Wisconsin Agricultural Experiment Station. This work was supported in part by the Research Committee of the Graduate School with funds from the Wisconsin Alumni Research Foundation.

[2] Research Assistant in Soils, and Associate Professor of Soils, in charge of the Soil Survey Division, Wis. Geological and Nat. Hist. Survey, respectively.

to this gray scale, 0 representing no color added and 20, the maximum. The two scales are arranged on the ordinate and abscissa, respectively, meeting at a common point of origin, the black chip. The third attribute is hue, which is the particular color added. The color chips are arranged in equal visual steps.

In this study, a color factor of value times chroma is used, a factor which increases as the color of the soil becomes lighter (higher in value) or has more chroma.

Procedure. The senior author made a statistical study of data on nitrogen contents of surface soil and subsoil samples collected and analyzed by A. R. Whitson, the senior author (7) and others in the Soils Department at the University of Wisconsin at Madison. Munsell color notations were determined in each instance from original soil samples.

Before color determinations were made, the air-dry soil samples were put through a 30-mesh sieve. The wet color was taken at a moisture content just below that at which a free water film is present. The wet sample was placed in a small plastic container and compared to a Munsell soil color chart under a 3-tube daylight fluorescent fixture. The color was estimated to the nearest one-half interval for both value and chroma and to the nearest hue chart.

I.B.M. cards were punched and multiple correlations run[3] to compare the following categories of soil data: nitrogen content (Kjeldahl), horizon designation, great soil group, color designation, texture of sample, and textural class of the soil type. The last two were the same in the case of the A horizon. The data were put in a number of different mathematical forms to discover linear relationships between soil nitrogen content and the other categories listed. These multiple correlations indicated that the factors most closely related to content of nitrogen in soil are: (a) the color index expressed as value times chroma, and (b) the textural class of the soil. The fact that color value times chroma is more significant than color value in this correlation suggests that organic matter contributes not only value to soil color, but also enough chroma to produce indices as high as 35. It was found that a few samples were too dark or too red to display the nitrogen-color relationships normal to the majority of the samples. The study was, therefore, confined to simple correlations of soil nitrogen content with the two factors named above for 174 samples of 10YR Hue and with a color index of more than 5.0 for soil samples of medium textural classes (Group II: loams, silt loams, silty clay loams, clay loams, and sandy clay loams), and more than 3.75 for soil samples of sandy textural classes (Group I: sands, loamy sands, and sandy loams). In the

[3] Correlations were run at the Numerical Analysis Laboratory, University of Wisconsin at Madison.

simple correlations of color index with nitrogen, the data were obtained separately for each of the two textural groups. It is thought that differences in the meanings of textural designations used by Whitson and his coworkers, and by present-day soil scientists are small, and fall well within the two broad textural groups.

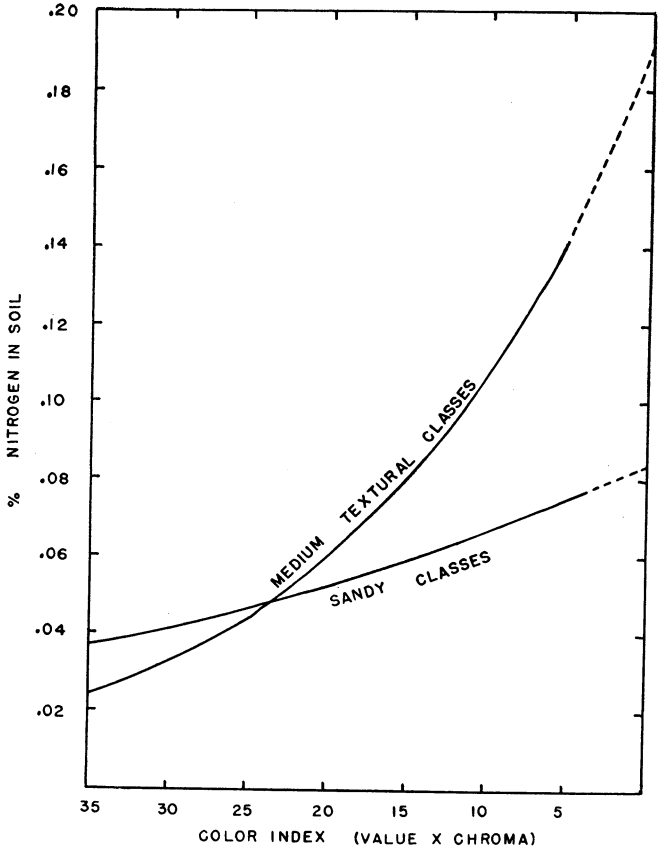


FIGURE 1. Curves for two textural groups of soil samples, showing the relationship between nitrogen contents determined by the Kjeldahl method, and nitrogen contents estimated on the basis of color (Value × Chroma). The dashed lines are simply extensions of the data curves. Darker soil colors (lower in value) lie to the right in the figure.

Results. Correlation coefficients (r) of nitrogen to color index (V × C) were obtained as follows: For textural Group I (17 samples), r = —0.516, (significant values for 15 degrees of freedom were 5% 0.482, 1% 0.606). For textural Group II (157 samples), r = —0.851, (significant values for 155 degrees of freedom were

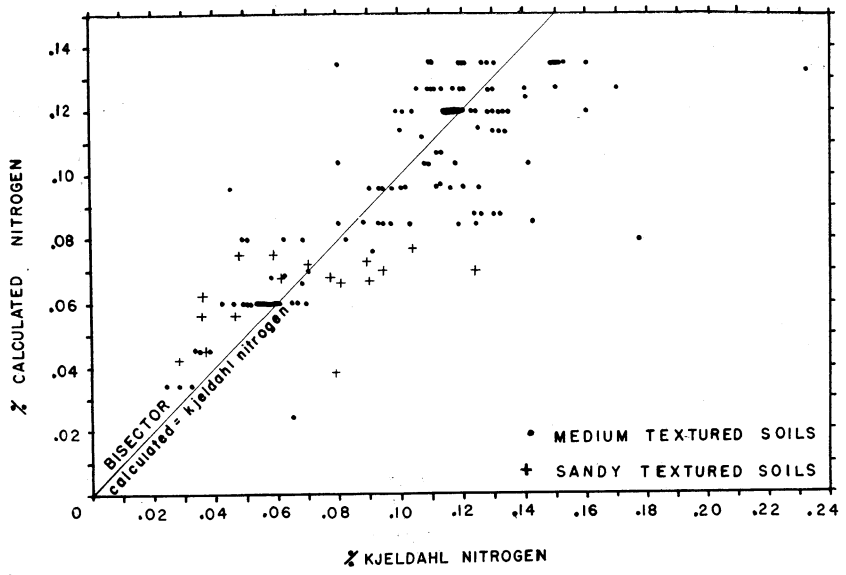


FIGURE 2. The distribution of the soil samples on the basis of Kjeldahl nitrogen content and nitrogen content calculated by means of color indices.

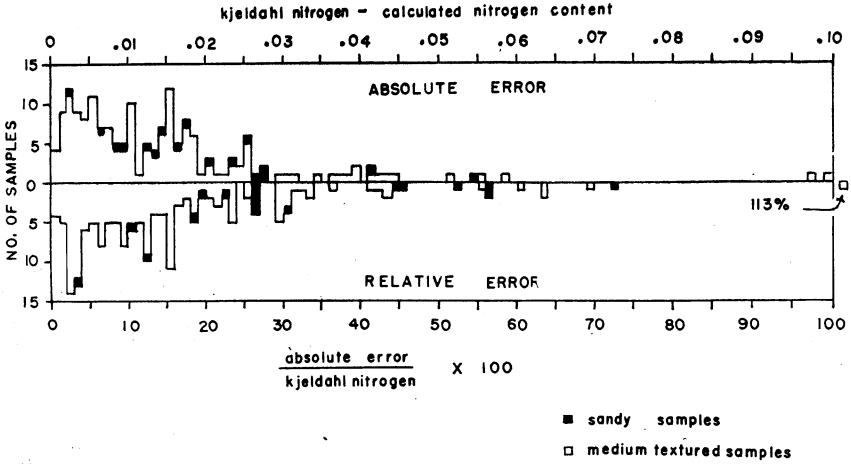


FIGURE 3. Error (discrepancy) in determining nitrogen by soil color, as compared with Kjeldahl nitrogen determinations.

5% 0.157, 1% 0.205). Correlation coefficients range from 0 (no correlation) to 1 (perfect correlation). A negative correlation means that as one factor increases, the other decreases.

The regression equations obtained were as follows: For textural Group I: %N = antilog (9.280–10 — .025VC) = $\frac{\text{antilog } (1.280 - .025VC)}{100}$, where VC = value times chroma. For textural Group II: %N = antilog (8.925–10 — .01VC) = $\frac{\text{antilog } (0.925 - .01VC)}{100}$, where VC = value times chroma.

Figure 1 shows graphically the relationships expressed in the regressive equations. The curve for medium textured soils (Group II) is steeper and therefore less sensitive with respect to color than the curve for sandy soils (Group I).

Figure 2 shows the distribution of the samples with respect to content of nitrogen as determined by the Kjeldahl method, and to content of nitrogen as calculated on the basis of color (V × C). The departure of points from the bisector is a measure of the discrepancies between the chemical determinations and color estimates of nitrogen contents. Points representing nitrogen contents in horizons of an undisturbed profile of a Gray-Brown Podzolic soil at Madison (7) follow the bisector closely, despite the presence of a light-colored A_2 horizon. The average absolute discrepancy or error was .014% N and the medium absolute error was .010% N (see Figure 3).

Summary

This study defines in statistical terms the correlation found between soil color and soil nitrogen content in some Wisconsin mineral soils. Excluded from the study were surface horizons of prairie (Brunizem) and marsh (Humic-Gley) soils which were so dark that increases in nitrogen content were not accompanied by visually detectable increases in black pigment content. The relationship between soil color and nitrogen content is found to be modified by texture of the soil. It is evident that there are still other factors yet to be investigated. For example, it is possible that light colored forms of organic matter, reported from areas outside Wisconsin, occur in small amounts in soils within the state. Further refinements of procedure for determining soil color are still needed.

Literature Cited

1. Brown, P. E. and O'Neal, A. M., The color of soils in relation to organic matter content. Iowa Agr Exp Sta Res Bul. 75:275 300, 1923.
2. Gillam, W. S., The geographical distribution of soil black pigment Jour. Am. Soc. Agron, Vol 31, pp 371–387, 1939

3. HUTTON, J. G., Report of the Committee on soil color standards. Am. Ass. of Soil Survey Workers, Bul. 3:1–10, 1922.
4. HUTTON, J. G., Report of the Committee on soil color standards. Am. Ass. of Soil Survey Workers, Bul. 4, Vol. 2:89–90, 1923.
5. JENNY, H., Factors of soil formation. McGraw-Hill, 1941.
6. MUNSELL COLOR CO., INC., Munsell soil color charts, Baltimore, Md., 1954.
7. NOEL, W. A., Carbon and nitrogen relationships in two profiles of the Parr and Miami soil families. M.S. thesis, U. of Wis., 1955.
8. PENDELTON, R. L. and NICKERSON, D., Soil colors and special Munsell soil color charts. Soil Science, Vol. 71:35–43, 1951.
9. RICE, J. D., NICKERSON, D., O'NEAL, A. M., and THORP, J., Preliminary color standards and color names for soils. U.S.D.A. Misc. Pub. 425, 1941.
10. SHAW, C. F., An improved method of measuring soil color. Soil Sci., Vol. 33:183–185, 1932.
11. SMIRNOFF, W., Methode colorscopique d'appreciation de la teneur en matieres organiques d'un sol par emploi de l'acide sulphurique concentre. Societe des Sciences Naturelles du Maroc, Travaux de la Section de Pedologie, Tomes 2 & 3:100–105, 1950.
12. U.S.D.A., Soil Survey Manual. Agr. Handbook No. 18, 1951.
13. WHITSON, A. R., Soils of Wisconsin. Bul. 68, Soil Series No. 49, Wis. Geological and Nat. Hist. Survey, 1927.
14. WILDE, S. A., Crypto-mull humus; its properties and growth effects. Soil Sci. Soc. Am. Proc., Vol. 15:360–362, 1950.

STANDARDIZATION OF SOIL TESTING IN WISCONSIN[1]

H. H. HULL AND J. R. LOVE[2]

ABSTRACT

The study reported here was undertaken for the purpose of comparing the results obtained in various soil testing laboratories in Wisconsin. Two standard soil samples were mailed to all County Agent and Commercial Soil Testing Laboratories and to 117 Vocational Agriculture Instructors. Each Cooperator was asked to analyze the two soil samples in triplicate for pH, available phosphorus, and available potassium.

The results reported by the Vocational Agriculture group showed the greatest amount of variation while those obtained by the State Soil Testing Laboratory varied the least. Comparable results were reported by the County Agent and Commercial Soil Testing Laboratories. For the most part the values obtained by these two groups averaged higher than those reported by the State Soil Testing Laboratory.

PURPOSE OF THE STUDY

Many of us who are concerned with soil testing have for a long time felt the need for a study in Wisconsin that would show how the results obtained at one laboratory compare with those of other laboratories testing the same soil. Such a study would serve two important functions. First, it would give assurance to those laboratories where agreement with the standard exists that the job of soil testing is being accurately performed. Second, it may help to narrow down the source(s) of error in those cases where the results are not in agreement.

EXPERIMENTAL PROCEDURE

Two standard soil samples were used in this study. They were prepared in the following manner: each soil was air-dried, sieved through a 20 mesh screen, thoroughly mixed, and quartered into samples weighing approximately 20 grams. Each sample was placed in a numbered packet and sealed. Samples marked number one were Parr silt loam and those labeled number two were Spencer silt loam.

---

[1] Contribution from the Soils Department, University of Wisconsin, Madison. Published with the approval of the Director, Wisconsin Agr. Exp. Sta.

[2] Assistant Professors of Soils.

The two standard soil samples were mailed to all County Agents testing soil, to all Commercial Laboratories known to be testing soil, and to 117 Vocational Agricultural Instructors. Each cooperator was asked to analyze the two soil samples for pH, available phosphorus, and available potassium and to indicate on his report the soil testing procedure (e.g., Hellige-Truog, LaMotte, Sudbury, Urbana, etc.) used in his laboratory. For purposes of this study only the results obtained with the Hellige-Truog procedure are compared. In addition all cooperating laboratories were asked to run the analyses in triplicate and to make a separate extraction for each replicate. The reason for the latter request, as was explained, is that in case an error is made in one extraction it will not affect the results of all of the tests. It should be emphasized in this regard that the two standard soil samples analyzed in the State Soil Testing Laboratory were replicated six times, and that on each occasion the two soils were included in a tray of regular soil samples so that at no time was their identity known to the analyst.

A set of directions on care of glassware and reagents and the procedure for testing glassware and reagents for contamination were sent to each cooperator with the recommendation that he check the cleanliness of his glassware and purity of reagents before beginning the testing of the standard soil samples.

Results and Discussion

In order to give each cooperator an opportunity to compare his results with those obtained in laboratories similar to his, the averages of the various tests for each of the four groups (County Agents, Commercial, Vo-Ag, and State) were calculated. It is important to note, however, that averages in themselves tell very little, unless some measurement of variation is also given. To illustrate this, consider the fact that 40 is the average of 10, 40, and 70 as well as the average of 39, 40, and 41. Now suppose these values represent the pounds of available phosphorus per acre as determined in triplicate by two laboratories testing the same soil sample. In both instances the average would be the same, but in the first laboratory the individual values range from a very low to a high reading. Since soil tests are not replicated in actual practice, the chances of the analyst in the first laboratory obtaining an accurate value for this test are no better than one in three. This would also mean that whoever is making the fertilizer recommendations based on these results is under-recommending or over-recommending phosphate fertilizer two-thirds of the time. Such practices would undermine the farmer's faith in soil testing. In the second laboratory, however, all of the values are so close to the average that it would make no difference which one was used in calculating the phosphate

needs of the soil, and the operator could feel fairly certain that his recommendations were based on accurate readings.

Thus, to give some idea of the amount of variation in the results obtained by each group, the average deviation was calculated for pH, available phosphorus, and available potassium and these together with the mean values are given in the following table. An important characteristic to keep in mind with respect to average deviation values is the fact that the spread includes approximately two-thirds of all of the samples. Furthermore, if the variation is small, a large share of the remaining one-third will not lie very far outside this range. However, the converse of this statement is also true, and unfortunately when a lime or fertilizer recommendation happens to be based on widely inaccurate soil test results and the crop for which the recommendation was made fails, the losses in time, money, or labor cannot be made up to a farmer.

TABLE I

SUMMARY OF ANALYSES FOR TWO STANDARD SOIL SAMPLES AS REPORTED BY COOPERATING LABORATORIES

Soil Testing Laboratory	Number Reporting	Sample 1			Sample 2		
		pH	Avail. P	Avail. K	pH	Avail. P	Avail. K
			(lbs./acre)			(lbs./acre)	
Commercial . .	7	5.2 ± .1	22 ± 9	160 ± 40	5.2 ± .1	21 ± 8	130 ± 25
Co. Agent	31	5.1 ± .2	19 ± 9	155 ± 33	5.6 ± .2	20 ± 8	124 ± 34
State	1	5.2 ± 0	15 ± 3	177 ± 11	5.4 ± 0	18 ± 3	108 ± 11
Vo-Ag	23	5.4 ± .4	47 ± 42	192 ± 54	5.9 ± .3	48 ± 41	152 ± 70

These data show that similar results for all tests were obtained in the County Agent and Commercial Soil Testing Laboratories. It will also be noted that the amount of variation associated with the average of the values reported by these two groups is greater for all tests than that obtained by the State Soil Testing Laboratory. This is especially evident in the potassium determination where the variation reported by the County Agent and Commercial Groups is 73 and 59 pounds per acre available potassium for soils 1 and 2, respectively. In the case of the State Soil Testing Laboratory, the amount of variation for the same test does not exceed 22 pounds of available potassium per acre in either soil. The differences in variation with regard to the pH and phosphorus tests is less serious, since much (about two-thirds) of the variation in the values obtained by these three groups lies within experimental error. However, the variation noted in the remaining one-third of the samples tested for pH and available phosphorus in the County

Agent and Commercial laboratories is serious and points out the need for further study. In addition it will be noted that the values reported by the Commercial and County Agent Laboratories have a tendency to be higher than those obtained by the State Soil Testing Laboratory. One possible explanation for this is contaminated glassware and/or reagents.

In view of the wide variation in the results obtained in the average Vo-Ag laboratory, it should be emphasized that soil testing in these laboratories is not done on a commercial basis, although Wiggelsworth[1] found that over two-thirds of the Vo-Ag. Instructors interviewed in a recent study indicated that they provided a soil testing service for farmers in their community. On the basis of the results reported in the above table, it would seem that this practice should be discouraged wherever possible. While it is true that accurate results should still be the goal even where soil testing is used as a teaching device, greater variation in tests from these laboratories is to be expected since the equipment is sometimes antiquated, the reagents old, and the job of analyzing performed by inexperienced students. Also, in spite of the fact that the average variation reported by the Vo-Ag group was considerably greater for all tests than that reported by any of the other cooperating groups, it should not be inferred that all Vo-Ag laboratories do a poor job of soil testing. On the contrary, the report from several high schools ranked near the top.

It is also important to note that in addition to the 23 Vo-Ag laboratories whose data were included in the summary table, 13 other Vo-Ag Instructors cooperated in this study. Unfortunately their results could not be compared with the rest since they used different testing procedures. Since all County Agent and Commercial Soil Testing Laboratories and the majority of Vo-Ag Instructors use the Hellige-Truog procedure, it is hoped that any high school contemplating a change in soil testing equipment will adopt the Hellige-Truog method. This procedure has served as the basis for all lime and fertilizer recommendations released by the College of Agriculture, Madison, as well as the basis of all benefit payments for lime and fertilizer made by the Agricultural Conservation Program (ACP) in Wisconsin. The Soils Department of the University is continually working to develop better testing methods and to improve its recommendations by laboratory, greenhouse, and field correlation studies.

---

[1] Wiggelsworth, Richard, "Values of Testing Soil Samples in the High School Vocational Agricuture Department." Senior Seminar, Dept. Agric. Ed., Univ. of Wis. (1957).

SUMMARY

The results of this study show that the measurements of pH, available phosphorus, and available potassium can be duplicated quite closely in the State Soil Testing Laboratory and in the majority of Commercial and County Soil Testing Laboratories. In approximately one-third of the samples tested by the Commercial and County Laboratories, however, serious variations in results were obtained. While it may be argued in most cases that the analyst knew that he was testing standard soil samples, and therefore, that the percentage of errors made are conservatively estimated, it does not necessarily follow that the analyst would use other than the same good technique on "run of the mill" soil samples.

To insure that equally good results are maintained, it is suggested that each soil testing laboratory obtain a supply of several standard soil samples (these can be obtained from the State Soil Testing Laboratory) and that the analyst makes it a policy to include one or more of these soils in each tray of regular soil samples. In this way a general check on analytical technique is easily obtained in everyday operations (a check on reagents and glassware by blank tests should also be made periodically). It should be emphasized in this connection that a soil test is only as good as the soil sample on which it was run. Therefore, as a means of promoting better soil sampling, it is hoped that everyone connected with soil testing will encourage farmers to use the recently prepared special circular entitled "Sampling Soils For Testing," available through all County Agent offices or by writing to the Soils Department, College of Agriculture, Madison.

WISCONSIN TABANIDAE[1]

RICHARD H. ROBERTS[2] and ROBERT J. DICKE
University of Wisconsin, Madison

Relatively little in the way of intense collecting of Tabanidae has been previously accomplished in Wisconsin. Specimens in the Public Museum of Milwaukee and in the collection of Professor W. S. Marshall were reported by Graenicher in 1912. Additional records of specimens collected over the years from the state have been reported by Brennan (1935), Stone (1938) and Philip (1947, 1950).

Graenicher reported 14 species of *Chrysops,* one species of *Pangonia* (= *Stonemyia*) and 17 species of *Tabanus.* All the species reported except for four were collected in Wisconsin during this investigation. The specimens Graenicher used in reporting these four species could not be located in the Milwaukee Museum collection. One of these species was found in the Marshall collection. This was the one he reported as *Tabanus flavipes* Wiedemann (= *aequetincta* Becker). However an examination of the specimen revealed that it was *Hybomitra zonalis* (Kirby). This confirms Fairchild's (1934) statement that he doubted Graenicher's report of its existence in Wisconsin. The other three species, unrecognized as occurring in the state, are *Tabanus carolinensis* Macquart, *Tabanus mexicanus* Linnaeus and *Chrysops obsoleta* Wiedemann.

Graenicher reported five males of *T. carolinensis* Macquart from Washington county. In the Milwaukee collection labeled as *carolinensis,* two males of *Hybomitra trispila* (Wiedemann) from Washington county were found. The other males in the collection were *carolinensis* but had been taken in Ohio.

The *T. mexicanus* L. which he reported from Buffalo county brings up a rather interesting point. Graenicher identified this species from the keys published by Osten Sacken (1876) and Hine (1907) and compared it favorably to identified specimens then in the Milwaukee collection. Knab in 1916 showed that the nearctic form identified as *mexicanus* L. was quite different from the neotropical form and renamed it *flavus.* Since that name was preoccupied, Bequaert in 1926 renamed it *crepuscularis.* (Stone, 1938) This species, now in the genus *Chlorotabanus,* is common in the costal

[1] Approved for publication by the Director of the Wisconsin Agricultural Experiment Station. Supported in part by the Research Committee of the Graduate School with funds from the Wisconsin Alumni Research Foundation.

[2] The research on which this paper is based is from a dissertation presented by the senior author in partial fulfillment of the degree of Doctor of Philosophy at the University of Wisconsin. Now with U. S. Department of Agriculture, Kerrvile, Texas.

states from New Jersey southward and in the states bordering the Gulf of Mexico west to Texas. As stated above the specimen was not located, nor have any since been reported from that section of the state or by Philip (1931) from the adjacent regions in Minnesota. It is doubtful that this species is a native of Wisconsin. Where the specimen Graenicher saw came from is a matter for conjecture. Since it was taken at Fountain City on the Mississippi River there is a possibility that it was carried up the river on board a ship.

The fourth unrecognized species is *Chrysops obsoleta* Wiedemann. This species is found along the Atlantic Coast. The species name was misapplied for years until Krober erected *wiedemanni* in 1926. (Brennan, 1935) These two species are quite similar except for the hyaline first basal cell of *wiedemanni.* It is very probable that this is the species Graenicher had before him when he reported *obsoleta.*

Brennan (1935), Stone (1938) and especially Philip (1947, 1950) list the states from which each species has been reported. Although many new state records were established in this study, there are some species reported from Wisconsin by these authors which have not as yet been seen or collected in this investigation. Stone lists six species from Wisconsin: *Dicladocera scita* Walker, *Tabanus actaeon* Osten Sacken, *Tabanus fulvicallus* Philip, *Tabanus longiglossus* Philip, *Atylotus pemeticus* (Johnson) and *Tabanus aequetincta* Becker. Philip lists *Chrysops furcata* Walker, *Hamatabanus scita* (Walker), *Tabanus actaeon* Osten Sacken and *Hybomitra aequetincta* (Becker). Brennan did not report any species in addition to those taken in this study.

The classification in this paper is based on that proposed by Philip in his 1947 catalog which separated the Pangoniinae from the Tabaninae on the basis of the presence or absence of the hind tibial spurs.

The Pangoniinae are represented in Wisconsin by the genera *Chrysops* and *Stonemyia* and the Tabaninae by *Tabanus, Hybomitra* and *Atylotus.* The tabanid fauna of Wisconsin is at present composed of 64 species and four subspecies distributed as follows: *Tabanus,* 15 species, 1 subspecies; *Atylotus,* 3 species; *Hybomitra,* 20 species, 1 subspecies; *Chrysops,* 24 species, 2 subspecies; *Stonemyia,* 2 species. In addition to this record there is a possibility that the two genera *Silvius* and *Chrysozona,* each with one species, eight species of *Tabanus,* two species of *Hybomitra* and one species of *Chrysops* may occur in the state. This is based on records from Illinois, Iowa, Minnesota and the Upper Peninsula of Michigan.

There are 28 tabanids being reported from Wisconsin for the first time. These are as follows: *Chrysops aestuans abaestuans, C. cuclux, C. frigida xanthus, C. geminata, C. nigra, C. pikei,*

C. sequax, C. shermani; *Tabanus calens, T. catenatus, T. lineola lineola, T. nigripes, T. quinquevittatus, T. sparus, T. vivax*; *Hybomitra astuta, H. criddlei, H. frontalis frontalis, H. frontalis septentrionalis, H. hinei, H. itasca, H. liorhina, H. metabola, H. microcephala, H. nuda, H. sonomensis, H. typha*; *Atylotus ohioensis.*

The following is a check list of the species found in Wisconsin. Names preceded by an asterisk are those which have not been recorded from the state. These species are found in the neighboring states and it is quite possible that they also occur in Wisconsin. Keys to the imago will follow the check list, but since all the species listed have been amply described elsewhere, the descriptions will be omitted.

TABANIDAE

PANGONIINAE Loew

Pangoniini Enderlein

Stonemyia Brennan

rasa (Loew)

tranquilla (Osten Sacken)

Chrysopini Enderlein

Chrysops Meigen

aberrans Philip

aestuans van der Wulp

aestuans abaestuans Philip

**brunnea* Hine

callida Osten Sacken

carbonaria Walker

celeris Osten sacken

cuclux Whitney

excitans Walker

frigida Osten Sacken

frigida xanthas Philip

geminata Wiedemann

inda Osten Sacken

mitis Osten Sacken

moecha Osten Sacken

montana Osten Sacken

nigra Macquart

pikei Whitney

pudica Osten Sacken

sackeni Hine

sequax Williston

shermani Hine

striata Osten Sacken

univittata Macquart

venus Philip
vittata Wiedemann
wiedemanni Kröber
**Silvius* Meigen
**quadrivittatus* (Say)

TABANINAE Loew

Chrysozonini Philip
**Chrysozona* Meigen
**americana* (Osten Sacken)

Tabanini Enderlein
Atylotus Osten Sacken
bicolor Wiedemann
ohioensis (Hine)
thoracicus (Hine)
Hybomitra Enderlein
affinis (Kirby)
astuta (Osten Sacken)
cincta (Fabricius)
criddlei (Brooks)
epistates (Osten Sacken)
frontalis (Walker)
frontalis septentrionalis (Loew)
gracilipalpus (Hine)
hinei (Johnson)
illota (Osten Sacken)
itasca (Philip)
lasiophthalma (Macquart)
liorhina (Philip)
metabola (McDunnough)
microcephala (Osten Sacken)
minuscula (Hine)
nuda (McDunnough)
**rhombica* (Osten Sacken)
sonomensis (Osten Sacken)
trepida (McDunnough)
trispila (Wiedemann)
typha (Whitney)
zonalis (Kirby)
Tabanus Linneaus
**actaeon* Osten Sacken
atratus Fabricius
calens Linnaeus
catenatus Walker
fairchildi Stone

**gladiator* Stone
kesseli Philip
lineola Fabricius
lineola scutellaris Walker
**melanocerus* Wiedemann
**molestus* Stone
**nigrescens* Palisot de Beauvois
nigripes Wiedemann
nivosus Osten Sacken
**pumilus* Macquart
quinquevittatus Wiedemann
reinwardtii Wiedemann
**sagax* Osten Sacken
sparus Whitney
stygius Say
sulcifrons Macquart
trimaculatus Palisot de Beauvois
**venustus* Osten Sacken
vivax Osten Sacken

KEYS TO THE IMAGO

KEY TO THE GENERA

1. Hind tibiae with two apical spurs similar to those on the middle tibiae (Pangoniinae) ---------- 2
   Hind tibiae without apical spurs (Tabaninae) ---------- 4
2. Flagellum twice the combined length of the scape and pedicel ---------- *Stonemyia*
   Flagellum equal to or only slightly longer, never twice the combined length of the scape and pedicel ---------- 3
3. Scape more than twice the length of the pedicel ----- **Silvius*
   Scape and pedicel subequal in length ---------- *Chrysops*
4. Frontal callus absent ---------- *Atylotus*
   Frontal callus present ---------- 5
5. Width between eyes considerably more than the distance from the antennae to the vertex ---------- **Chrysozona*
   Height at least several times the width ---------- 6
6. Vertex with a distinct ocellar tubercle ---------- *Hybomitra*
   Vertex without an ocellar tubercle ---------- *Tabanus*

KEYS TO THE SPECIES

Key to the species of *Stonemyia* Brennan

1. Pedicel and scape black,
   femora black ---------- *tranquilla* (Osten Sacken)
   Pedicel and scape reddish-orange,
   femora orange-brown ---------- *rasa* (Loew)

Key to the species of *Atylotus* Osten Sacken

1. Vestiture of thorax yellow ---------- *bicolor* (Wiedemann)
   Vestiture of thorax gray ---------- 2
2. Pile of abdomen white ---------- *ohioensis* (Hine)
   Pile of abdomen yellow ---------- *thoracicus* (Hine)

Key to the species of *Chrysops* Meigen

1. Apex of the wing, distal to the crossband, hyaline ---------- 2
   Apex of wing infuscated at least along costal margin ------ 7
2. Dorsum of abdomen with yellow laterally on first two segments ---------- 3
   Dorsum of abdomen black in these areas ---------- 4
3. Pleurae of thorax yellow pilose, median yellow triangle present on at least the second tergite of the abdomen ---------- *excitans* Walker
   Pleurae grayish pilose, no median triangles; yellow on abdomen limited to dorsolateral areas of segments one and two ---------- *cuclux* Whitney
4. Second basal cell hyaline ---------- *nigra* Macquart
   At least half of second basal cell infuscated ---------- 5
5. Lateral margins of mesonotum and dorsal portion of the pleurae anterior to wing base orange pilose ---------- *celeris* Osten Sacken
   These portions gray pilose ---------- 6
6. Wing crossband not reaching posterior edge of wing but fading out before edge leaving a hyaline area next to the hind margin of the wing; cell Cu_1 infuscated basally ---------- *mitis* Osten Sacken
   Crossband reaching edge of wing, sometimes faintly, but there is not a hyaline area along the edge; cell Cu_1 with a hyaline lunule at base ---------- *carbonaria* Walker
7. Scape and pedicel swollen, dorsum of abdomen reddish brown with little or no indication of a pattern ------- **brunnae* Hine
   Abdomen distinctly patterned in black and yellow or orange, scape and pedicel with very little if any swelling ---------- 8
8. Abdominal dorsum with longitudinal stripes, with a median yellow stripe that is continuous over at least three segments 9
   Abdominal dorsum transversely banded, median yellow triangles not continuous to form a median stripe over three or more segments ---------- 17
9. Hyaline triangle small, confined to cells M_1 and M_2 ---------- *moecha* Osten Sacken
   Hyaline triangle not limited by vein M_1 ---------- 10

10. Wing infuscation diluted by hyaline areas next to the veins ---------- *shermani* Hine
    Wing infuscation even, if diluted, it is in the centers of the cells ---------- 11
11. Dorsum of abdomen with four more or less complete longitudinal stripes ---------- 12
    Two longitudinal stripes at most ---------- 22
12. Apex of hyaline triangle extending well past furcation ---- 13
    Apex of hyaline triangle just enveloping furcation ---------- 15
13. First basal cell completely infuscated ---------- 14
    First basal cell not completely infuscated, at least half is hyaline ---------- *montana* Osten Sacken
14. Lateral abdominal stripes not present on first and second tergites ---------- *pikei* Whitney
    Lateral stripes extending onto first tergite --- *sequax* Williston
15. Scutellum completely yellow ---------- *vittata* Wiedemann
    Scutellum dark, at least on the disc ---------- 16
16. Frontal callus completely black, facial calli with a black spot on both sides of suture ---------- *striata* Osten Sacken
    Frontal callus with yellow on at least the disc, black spots on facial calli limited to median side of suture --- *aberrans* Philip
17. Apical spot of wing but little wider than cell R_1, reaching at most into the extreme tip of cell R_4 ---------- 18
    Apical spot broad, at least half of cell R_4 infuscated ------ 20
18. Median femora yellow or orange except for a small black area at extreme base; frontal callus yellow to black with yellow disc ---------- *sackeni* Hine
    Medain femora black on basal third or more; frontal callus black ---------- 19
19. Second abdominal tergite with a small black triangle on each side of median figure ---------- *aestuans* van der Wulp
    Second abdominal tergite without sublateral triangles although median figure may have lateral extensions along the posterior border ---------- *callida* Osten Sacken
20. Frontoclypeus completely black except for the median yellow pollinose stripe ---------- 21
    Frontoclypeus yellow, with black shadings over facial calli and above oral margin ---------- *frigida xanthus* Philip
21. Dorsolateral edges of thorax with a broad bright orange pilose stripe, yellow pollinosity of pleurae with a rich orange pilosity; legs black except for apex of median tibiae ---------- *venus* Philip
    Legs with reddish-orange ground color; yellow pollinosity of pleurae with concolorous pile ---------- *frigida* Osten Sacken

22. Apex of hyaline triangle extending towards the costal margin and crossing vein R_{2+3} ---------- 24
Apex reaching but little way past furcation ---------- 23

23. Cell Cu_1 hyaline in the center; yellow median stripe of abdomen extends anteriorly onto the first tergite ---------- *univittata* Macquart
Center of cell Cu_1 infuscated; yellow median stripe ends anteriorly in center of second tergite ---------- *inda* Osten Sacken

24. Second tergite with submedian black lines reaching the full length of the tergite ---------- *wiedemanni* Krober
Second tergite with submedian black lines very short, not touching either edge ---------- *geminata* Wiedemann

Key to the species of *Tabanus* Linneaus

1. Abdomen above with a continuous median stripe which may widen at the posterior edge of each tergite ---------- 2
Abdomen above without a continuous stripe; median triangles, if present, do not form a parallel sided stripe ---------- 5

2. Abdominal stripes regularly widening at the posterior margin of each tergite; abdomen yellowish brown outside of the median stripe; eyes with three diagonal bands ---------- **sagax* Osten Sacken
Median stripes not widening perceptibly at posterior margins; eyes with one or two bands ---------- 3

3. Second palpal segment yellowish brown, vestiture of body, especially thorax, yellow; eye with one band ---------- *quinquevittatus* Osten Sacken
Second palpal segment whitish; vestiture gray; eye with two bands ---------- 4

4. Scutellum completely dark ---------- *lineola* Fabricius
Scutellum with a reddish brown to reddish tip ---------- *lineola scutellaris* Walker

5. Abdominal dorsum with both median and sublateral pale spots ---------- 6
Dorsum does not have both, although median triangles may expand laterally along posterior margins ---------- 12

6. Furcation distinctly infuscated ---------- 7
Furcation without a distinct spot ---------- 8

7. Hind tibial fringe white; infuscation confined to crossveins ---------- *reinwardtii* Wiedemann
Hind tibial fringe black; wing with large infuscated areas not confined to crossveins ---------- **venustus* Osten Sacken

8. Sublateral abdominal spots very much larger than the median triangles which are not longer than one-fourth the length of the tergite ---------- *nivosus* Osten Sacken
   Median triangles extend nearly the length of the tergite, sublateral areas not much larger ---------- 9
9. Abdomen brownish above ---------- 11
   Abdomen black above ---------- 10
10. Pedicel height twice that of scape ---------- *fairchildi* Stone
    Pedicel and scape subequal in height ---------- *sparus* Whitney
11. Vestiture of mesonotum gray; third antennal segment black ---------- *vivax* Osten Sacken
    Vestiture reddish-brown; third antennal segment orange except for darker annulate portion ---------- **pumilus* Macquart
12. Dorsum of abdomen with conspicuous median triangles ---- 13
    Abdomen unicolorous or evanescent triangles present medially ---------- 18
13. Fore tibiae distinctly bicolored ---------- 14
    Fore tibiae unicolorous, at most, vestiture is pale ---------- 16
14. Second abdominal tergite without a median triangle or a small white triangle is present that is smaller than that of the third tergite, or second tergite has a pair of small white submedian areas; venter of abdomen white with a median brown stripe ---------- *trimaculatus* Palisot de Beauvois
    Triangle of second tergite as large or larger than those of following tergites ---------- 15
15. Second palpal segment dark brown ------ *sulcifrons* Macquart
    Second palpal segment white to yellowish-white ---------- **melanoceras* Wiedemann
16. Dorsal triangles of abdomen large, continued along posterior edge of tergites to expand laterally into rather large white areas ---------- **molestus* Say
    Triangles not produced along posterior edge ---------- 17
17. Third antennal segment with a prominent dorsal excision; antennae mainly reddish; second palpal segment dark reddish-brown ---------- *catenatus* Walker
    Antennae with little excision, black except for a small reddish spot at extreme base of third segment; second palpal segment whitish ---------- *nigripes* Wiedemann
18. Entirely black bodied; wings infuscated ---- *atratus* Fabricius
    Body not entirely black; wings with hyaline or faded areas 19
19. Antennae entirely orange; second palpal segment brownish-orange ---------- *calens* Linnaeus
    Antennae black, reddish-brown basally or palpi dark brown to black ---------- 20

20. Dorsum of thorax white pollinose ---------- 22
White pollinosity not present ---------- 21
21. Crossveins and furcation distinctly infuscated ---------- **nigrescens* Palisot de Beauvois
Spotting not obvious, faint; if a spot is at furcation, it does not extend into cell R_5 ---------- 23
22. Palpi black, not slender; hind tibiae dark reddish-brown to black ---------- *stygius* Say
Palpi reddish-brown, very slender, apex truncated; hind tibiae reddish-orange ---------- **gladiator* Stone
23. Palpi black; femora black ---------- *kesseli* Philip
Palpi reddish-orange; femora orange-brown ---------- **actaeon* Osten Sacken

Key to the species of *Hybomitra* Enderlein

1. Dorsum of abdomen with first three tergites and first four sternites orange, rest of the segments black ---------- 2
Color not so restricted, not orange ---------- 3
2. Third antennal segment orange except for the black annuli; palpi black with black pile; no median black marking on third tergite ---------- **cinctus* (Fabricius)
Base of third antennal segment with black; palpi brown with black pile; third tergite with a median black mark ---------- *criddlei* (Brooks)
3. Posterior margin of each black abdominal tergite with a golden transverse band ---------- *zonalis* (Kirby)
Not so ---------- 4
4. Abdominal tergites black with a single median row of white triangles; venter with a median black stripe and lateral white stripes ---------- *trispila* (Wiedemann)
Sublateral pale spots present on abdomen not black ---------- 5
5. Face shiny black, no pollen; a cloud in stigma region of wing; very slender, dark palpi ---------- *hinei* (Johnson
Disagreeing with at least one character ---------- 6
6. Subcallus denuded ---------- 7
Subcallus pollinose ---------- 11
7. Frontal callus rugose ---------- 8
Frontal callus smooth ---------- 9
8. Abdomen broadly reddish-brown, color reaching anterior edge of first tergite; the median black stripe extends over at least the first five tergites and has a concave border, narrowest on tergite three ---------- *nuda* (McDunnough)
Reddish-brown, if present, restricted to the posterior edge of tergite one; black stripe on third tergite about one-third width of abdomen ---------- *metabola* (McDunnough)

9. Abdomen broadly reddish-brown, wing crossveins and furcation heavily infuscated; third antennal segment with black annuli and orange base ---------- *lasiophthalma* (Macquart)
Base of third antennal segment with considerable black; wing crossveins not darkly spotted; reddish-brown areas confined to each tergite, not joined to cover lateral areas of tergites ---------- 10

10. Prealar callus concolorous with mesonotum ---------- **rhombicus* (Osten Sacken)
Prealar callus not concolorous ---------- *liorhina* (Philip)

11. Median black stripe of abdomen with concave borders, narrowest on third tergite where the reddish-brown of the sides of the abdomen may join in a rather narrow band along the posterior edge ---------- 12
Median black stripe with parallel borders, or abdomen black or brown and white, or black of median stripe is produced along posterior margin of each tergite giving a serrated picture, or abdominal pattern indistinct due to grayish-yellow pollen over ground pattern ---------- 15

12. Palpi whitish to yellowish-white, swollen basally; height of frons about five times width of a rugose frontal callus ---------- *epistates* (Osten Sacken)
Palpi yellowish-brown, frontal callus smooth ---------- 13

13. Third antennal segment either with a prominent dorsal angle but with scarcely any excision or no angle ---------- 14
Third antennal segment with a prominent dorsal angle and a deep excision ---------- *affinis* (Kirby)

14. Palpi unusually slender; prominent dorsal angle ---------- *trepida* (McDunnough)
Palpi swollen basally; dorsal angle very low ---------- *sonomensis* (Osten Sacken)

15. Second palpal segment whitish ---------- 16
Second palpal segment not whitish ---------- 18

16. Furcation infuscation ---------- *illota* (Osten Sacken)
No infuscation present ---------- 17

17. Abdomen with median and sublateral pale spots on a black background, very little, if any orange-brown around them ---------- *frontalis septentrionalis* (Loew)
Sublateral pale spots evanescent, on an orange-brown background on tergite two; antealar calli reddish-brown ---------- *sonomensis* (Osten Sacken)

18. Antealar calli black ---------- 19
Not black ---------- 21

19. Abdomen broadly orange-brown laterally, median black stripe with parallel sides ---------- *gracilipalpis* (Hine)
    Orange-brown, if present, is confined to individual tergites 20
20. Ocellar tubercle reduced, located in a denuded black area one-third width of frons; second palpal segment with black pile at tip ---------- *microcephala* (Osten Sacken)
    Ocellar tubercle distinct, not located in a denuded region; second palpal segment with black pile fairly evenly distributed ---------- *astuta* (Osten Sacken)
21. Femora reddish-brown to orange ---------- 22
    Femora black ---------- 23
22. Hind tibial fringe black ---------- *minuscula* (Hine)
    Hind tibial fringe mostly white ---------- *itasca* (Philip)
23. Second palpal segment brownish, very slender, scarcely at all swollen basally; third antennal segment with a prominent angle and excision ---------- *typha* (Whitney)
    Second palpal segment swollen basally, pale yellowish; third antennal segment with hardly any angle and little if any excision ---------- *frontalis* (Walker)

Distribution

Chrysops Meigen

1. *aberrans* Philip, 1941, Proc. ent. Soc. Wash., 43:122
   Burnett, Dane, Door, Florence, Grant, Kenosha, Marinette, Outagamie, Polk, Price, Richland, Rusk, Sauk, Vilas, Washburn, Waukesha and Wood counties. June 28 to September 5
   Specimens examined: 477 females, 1 male.
2. *aestuans* van der Wulp, 1867, Tijdschr. Ent. 10:135
   C. moerans Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:172
   Bayfield, Brown, Burnett, Dane, Milwaukee, Outagamie, Rusk, Walworth, Washburn and Waukesha counties. June 1 to August 25
   Specimens examined: 13 females, 1 male.

2a. subsp. *abaestuans* Philip, 1941, Proc. ent. Soc. Wash. 43:121
   Dane county
   Specimens examined: 1 male.

3. *callida* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:379
   C. callidus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:171
   Burnett, Dane, Douglas, Grant, Milwaukee, Richland, Rusk, St. Croix, Vernon and Walworth counties. June 1 to August 13
   Specimens examined: 61 females, 7 males.

4. *carbonaria* Walker, 1848, List, Dipt. Brit. Mus. Part I, p. 203
C. carbonarius Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:171
Burnett, Dane, Florence, Langlade, Oneida, Rusk, Sawyer, Vernon, Vilas, Washburn and Waukesha counties. May 22 to August 19
Specimens examined: 137 females.

5. *celeris* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:376
C. celer Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:172
Bayfield, Burnett, Dane, Florence, Iron, Milwaukee, Rusk, Vilas, Washburn and Waukesha counties. June 3 to July 19
Specimens examined: 24 females, 1 male.

6. *cuclux* Whitney, 1879, Canad. Ent. 11:36
Bayfield, Crawford, Price, Rusk and Sawyer counties. June 2 to July 8
Specimens examined: 20 females.

7. *excitans* Walker, 1850, Dipt. Saund. 1:72
C. excitans Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:171
Ashland, Bayfield, Burnett, Door, Douglas, Florence, Marinette, Price, Rusk, Sawyer, Vilas, Washburn, Waupaca and Wood counties. June 18 to July 28
Specimens examined: 409 females.

8. *frigida* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:384
C. frigidus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:172
Bayfield, Burnett, Columbia, Dane, Door, Douglas, Florence, Forest, Langlade, Marinette, Milwaukee, Oneida, Price, Rusk, Sawyer, Shawano, Vilas, Washburn and Washington counties. June 10 to August 10
Specimens examined: 378 females, 47 males.

8a. subsp. *xanthas* Philip, 1949, Ann. ent. Soc. Amer. 42:453
Langlade, Rusk, Sawyer and Washburn counties. June 17 to July 4
Specimens examined: 4 females.

9. *geminata* Wiedemann, 1828, Auss. zweifl. Ins. 1:205
Wood county. August 20
Specimens examined: 3 females.

10. *inda* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:383
C. indus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:172
Bayfield, Burnett, Dane, Door, Douglas, Florence, Forest, Kenosha, Marinette, Milwaukee, Ozaukee, Price, Richland, Rusk, Sawyer, Vilas, Walworth, Washburn, Washington, Waukesha, Waupaca and Wood counties. May 6 to August 20
Specimens examined: 548 females.

11. *mitis* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:374
C. mitis Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:172
Dane, Door, Douglas, Florence, Iron, Manitowoc, Oneida, Price, Rusk, Sawyer, Vilas, Washburn, Waukesha, Waupaca and Wood counties. May 13 to August 3
Specimens examined: 284 females, 2 males.

12. *moecha* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:315
Florence, Grant, Iowa, Langlade, Rusk, Vernon and Washburn counties. June 26 to August 6
Specimens examined: 35 females, 13 males.

13. *montana* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:382
Douglas, Florence, Kenosha, Milwaukee, Oconto, Price, Rusk, Vilas, Walworth, Washburn, Washington, Waukesha and Waupaca counties. June 23 to August 18
Specimens examined: 73 females.

14. *nigra* Macquart, 1838, Dipt. exot. nouv. peu connus I, 1:161
C. niger Graenicher, 1812, Bull. Wis. nat. Hist. Soc. 10:172
Ashland, Crawford, Dane, Door, Douglas, Florence, Lafayette, Langlade, Milwaukee, Outagamie, Price, Richland, Rusk, Sawyer, Vernon, Vilas, Walworth, Washburn and Waukesha counties. May 19 to July 8
Specimens examined: 124 females, 1 male.

15. *pikei* Whitney, 1904, Canad. Ent. 36:205
Dane, Iowa, Jefferson, Kenosha and Richland counties. June 27 to July 14
Specimens examined: 14 females, 1 male.

16. *pudica* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:381
Walworth county, July 27
Specimens examined: 1 female.

17. *sackeni* Hine, 1903, Spec. pap. Ohio Acad. Sci. #5, p. 42
C. sackeni Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:173
Adams, Dane, Door, Florence, Manitowoc, Marinette, Marquette, Rusk, Sawyer, Walworth, Washburn, Waukesha and Wood counties. May 5 to August 20
Specimens examined: 236 females, 5 males.

18. *sequax* Williston, 1887, Trans. Kans. Acad. Sci. 10:133
Washburn county, July 27
Specimens examined: 1 female.

19. *shermani* Hine, 1907, Ohio. Nat. 8:229
Bayfield, Dane, Florence, Langlade, Marinette, Oneida, Price, Rusk and Wood counties. June 22 to August 20
Specimens examined: 108 females.

20. *striata* Osten Sacken, 1875, Mem. Boston Soc. nat. Hist. 2:391
C. striatus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:173
Adams, Burnett, Crawford, Dane, Door, Douglas, Florence, Forest, Manitowoc, Marinette, Marquette, Oneida, Outagamie, Price, Richland, Rusk, Sawyer, Vilas, Walworth, Washburn, Washington, Waukesha, Waupaca and Wood counties. May 30 to August 24
Specimens examined: 1047 females, 2 males.
21. *univittata* Macquart, 1855, Dipt. exot. nouv. peu connus, Sup. V, p. 36
C. univittatus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:173
Adams, Burnett, Jefferson, Marinette, Rusk, Sawyer, Waushara and Wood counties. June 28 to August 15
Specimens examined: 16 females.
22. *venus* Philip, 1949, Ann. ent. Soc. Amer. 42:457
Bayfield, Florence and Rusk counties. July 1 to July 10
Specimens examined: 11 females.
23. *vittata* Wiedemann, 1821, Dip. exot. nouv. peu connus I, p. 106
C. vittatus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:173
Adams, Bayfield, Buffalo, Burnett, Columbia, Crawford, Dane, Door, Douglas, Florence, Fond du Lac, Forest, Grant, Marathon, Marinette, Marquette, Milwaukee, Oneida, Polk, Price, Racine, Richland, Rusk, Sauk, Sawyer, Sheboygan, Vernon, Vilas, Walworth, Washburn, Washington, Waukesha, Waupaca, Waushara and Wood counties. June 18 to September 1
Specimens examined: 576 females, 2 males.
24. *wiedemanni* Kröber, 1926, Stettin ent. Ztg. 87:267
Adams, Bayfield, Burnett, Columbia, Dane, Door, Douglas, Florence, Grant, Marinette, Milwaukee, Richland, Rusk, Washburn and Wood counties. June 21 to August 24
Specimens examined: 118 females, 1 male.

Stonemyia Brennan

1. *rasa* (Loew), 1869, Dipt. Amer. Sept. Ind. II, p. 119 (Pangonia)
Pangonia rasa Graenicher, 1912, Bull. Wis. nat, Hist. Soc. 10:173
Dane, Door, Fond du Lac, Kenosha and Washburn counties. June 26 to August 14
Specimens examined: 5 females, 2 males.
2. *tranquilla* (Osten Sacken), 1875, Mem. Boston Soc. nat. Hist. 2:367 (Pangonia)
Rusk and Vilas counties. August 3 to August 14
Specimens examined: 3 females.

Tabanus Linnaeus

1. *atratus* Fabricius. 1775, Ent. Syst. p. 79
   T. atratus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
   Chippewa, Columbia, Dane, Kenosha, Milwaukee, Pierce, Racine, Shawano, Vernon, Washburn and Winnebago counties. June 20 to September 1
   Specimens examined: 13 females, 3 males.
2. *calens* Linnaeus, 1767, Systema Naturae, ed. 12, 1:1000
   T. giganteus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
   Adams and Sauk counties. August 20 to August 24
   Specimens examined: 3 females.
3. *catenatus* Walker, 1848, List Dipt. Brit. Mus. I, p. 148
   Bayfield, Rusk and Wood counties. July 16 to July 27
   Specimens examined: 4 females.
4. *fairchildi* Stone, 1938, Misc. Publ., U. S. Dept. Agric. No. 305, p. 63
   Burnett, Douglas and Rusk counties. July 22 to August 1
   Specimens examined: 3 females.
5. *kesseli* Philip, 1950, Ann. ent. Soc. America 43:117
   Door county. June 25
   Specimens examined: 1 female.
6. *lineola* Fabricius, 1794, Ent. Syst. 4:369
   T. lineola Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
   Dane, Door, Rusk and Waukesha counties. June 28 to July 29
   Specimens examined: 10 females.

6a. subsp. *scutellaris* Walker, 1850, Ins. Saund. Dipt. 1:27
   Bayfield, Columbia, Dane, Door, Grant, Jefferson, La Crosse, Outagamie, Racine, Rusk, Vernon, Washburn, Waukesha, Winnebago and Wood counties. May 19 to July 28
   Specimens examined: 1248 females, 11 males.

7. *nigripes* Wiedemann, 1821, Dipt. exot. nouv. peu connus 1:75
   Oconto and Vilas counties. May 30 to July 18
   Specimens examined: 2 females.
8. *nivosus* Osten Sacken, 1876, Mem. Boston Soc. nat. Hist. 2:445
   T. nivosus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:175
   Bayfield, Burnett, Dane, Douglas, Florence, Marinette, Rusk, Sawyer and Vilas counties. June 12 to August 5
   Specimens examined: 26 females, 1 male.
9. *quinquevittatus* Wiedemann, 1821, Dipt. exot. nouv. peu connus 1:84
   T. costalis Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
   Crawford, Dane, Fond du Lac, Jefferson, Kenosha, Lafayette, Milwaukee, Outagamie, Ozaukee, Racine, Vernon, Walworth, Waukesha and Winnebago counties. May 13 to August 16
   Specimens examined: 130 females, 8 males.

10. *reinwardtii* Wiedemann, 1828, Auss. zweifl. Ins. 1:130
T. reinwardtii Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:175
Bayfield, Dane, Florence, Milwaukee, Racine, Rusk, Sauk, Sawyer, Vilas and Walworth counties. June 25 to September 8
Specimens examined: 15 females.

11. *sparus* Whitney, 1879, Canad. Ent. 11:38
Adams county. July 23
Specimens examined: 1 female.

12. *stygius* Say, 1823, Jour. Acad. nat. Sci. Philad. 3:33
T. stygius Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:175
Dane, Milwaukee, Racine, Washburn and Waukesha counties. June 20 to July 24
Specimens examined: 8 females, 2 males.

13. *sulcifrons* Macquart, 1855, Dipt. exot. nouv. peu connus Sup. V, p. 33
Kenosha county. July 28
Specimens examined: 1 male.

14. *trimaculatus* Palisot de Beauvois, 1807, Ins. rec. en Afr. et en Amer., p. 56
T. trimaculatus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:175
Columbia, Dane, Green Lake, Jefferson, Richland, Sheboygan, Walworth and Winnebago counties. June 8 to July 27
Specimens examined: 20 females, 6 males.

15. *vivax* Osten Sacken, 1876, Mem. Boston Soc. nat. Hist. 2:446
T. vivax Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:175
Burnett, Dane, Douglas, Rusk and Vilas counties. June 30 to July 21
Specimens examined: 6 females.

Hybomitra Enderlein

1. *affinis* (Kirby), 1837, Fauna Bor. Amer. 4:313 (*Tabanus*)
T. affinis Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:173
Ashland, Burnett, Dane, Door, Douglas, Florence, Forest, Lincoln, Manitowoc, Marinette, Oneida, Price, Rusk, Sawyer, Shawano, Vilas and Washburn counties. May 30 to July 12
Specimens examined: 456 females, 1 male.

2. *astuta* (Osten Sacken), 1876, Mem. Boston Soc. nat. Hist. 2:471 (*Tabanus*)
T. astutus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
Florence and Vilas counties. August 6 to August 18
Specimens examined: 3 females, 1 male

3. *criddlei* (Brooks), 1946, Canad. Ent. 77:234 (*Tabanus*)
Florence, Sawyer and Shawano counties. June 17 to July 5
Specimens examined: 7 females, 1 male.

4. *epistates* (Osten Sacken), 1878, Mem. Boston Soc. nat. Hist. 2 (sup.) : 555 (*Tabanus*)
T. epistates Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
Bayfield, Burnett, Dane, Dodge, Florence, Forest, Iron, Langlade, Marquette, Milwaukee, Oneida, Polk, Price, Richland, Rusk, Sawyer, Shawano, Vilas, Washburn, Waukesha, Waupaca, Waushara, Winnebago and Wood counties. June 1 to August 20
Specimens examined: 1530 females, 6 males.

5. *frontalis* (Walker), 1848, List Dipt. Brit. Mus. I, p. 172 (*Tabanus*)
Bayfield, Dane and Rusk counties. June 30 to August 28
Specimens examined: 26 females.

5a. subsp. *septentrionalis* (Loew), 1858, Verh. zool.-bot. Ges. Wien. 8:592 (*Tabanus*)
Vilas county. August
Specimens examined: 1 female.

6. *gracilipalpus* (Hine), 1923, Canad. Ent. 55:143 (*Tabanus*)
Price and Vilas counties. June 20 to June 24
Specimens examined: 23 females.

7. *hinei* (Johnson), 1904, Psyche 11:15 (*Tabanus*)
Florence and Washburn counties. June 26 to July 26
Specimens examined: 13 females, 2 males.

8. *illota* (Osten Sacken), 1876, Mem. Boston Soc. nat. Hist. 2:469 (*Tabanus*)
Columbia, Dane, Door, Florence, Marinette, Oneida, Price, Rusk, Sawyer, St. Croix, Washburn, Waupaca and Wood counties. May 22 to August 10
Specimens examined: 532 females, 41 males.

9. *itasca* (Philip), 1936, Canad. Ent. 68:149 (*Tabanus*)
Rusk county. July 16
Specimens examined: 1 female.

10. *lasiophthalma* (Macquart), 1838, Dipt. exot. nouv. peu connus 1:1, 143 (*Tabanus*)
T. lasiophthalmus Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
Ashland, Bayfield, Burnett, Chippewa, Crawford, Dane, Door, Florence, Forest, Iron, Jefferson, Juneau, Kewaunee, Langlade, Manitowoc, Marinette, Milwaukee, Oneida, Outagamie, Price, Richland, Rusk, Sawyer, Shawano, St. Croix, Vernon, Vilas,

Walworth, Washburn, Washington, Waukesha, Waupaca, Winnebago and Wood counties. May 3 to August 25
Specimens examined: 2295 females, 15 males.

11. *liorhina* (Philip), 1936, Canad. Ent. 68:151 (*Tabanus*)
Bayfield county. July 19
Specimens examined: 1 female.
12. *metabola* (McDunnough), 1922, Canad. Ent. 54:239 (*Tabanus*)
Dane, Florence, Marinette, Price and Rusk counties. May 30 to August 1
Specimens examined: 32 females, 1 male.
13. *microcephala* (Osten Sacken), 1876, Mem. Boston Soc. nat. Hist. 2:470 (*Tabanus*)
Door and Florence counties. July 4 to July 7
Specimens examined: females.
14. *minuscula* (Hine), 1907, Ohio Nat. 8:226 (*Tabanus*)
Rusk and Washburn counties. June 27 to July 27
Specimens examined: 2 females.
15. *nuda* (McDunnough), 1921, Canad. Ent. 53:143 (*Tabanus*)
Dane, Door, Florence, Forest, Oneida, Outagamie, Price, Rusk, Sawyer, Vilas, Washburn and Wood counties. May 18 to July 19
Specimens examined: 468 females, 2 males.
16. *sonomensis* (Osten Sacken), 1877, West. Dipt., U. S. Geog. Surv. III, p. 216 (*Tabanus*)
Florence county. July 5
Specimens examined: 1 female.
17. *trepida* (McDunnough), 1921, Canad. Ent. 53:142 (*Tabanus*)
Adams, Ashland, Bayfield, Burnett, Dane, Door, Florence, La Crosse, Langlade, Marinette, Oneida, Price, Rusk, Sawyer, Shawano, Vilas and Washburn counties. April 7 to August 27
Specimens examined: 303 females, 2 males.
18. *trispila* (Wiedemann), 1828, Auss. zweifl. Ins. 1:150 (*Tabanus*)
Bayfield, Dane, Door, Dunn, Florence, Marinette, Rusk, Sawyer, Washburn and Washington counties. May 14 to September 2
Specimens examined: 173 females, 4 males.
19. *typha* (Whitney), 1904, Canad. Ent. 36:206 (*Tabanus*)
Florence, Forest, La Crosse, Marinette, Oneida, Outagamie, Price, Rusk, Sawyer, Vilas and Washburn counties. April 19 to August 6
Specimens examined: 603 females.
20. *zonalis* (Kirby), 1837, Fauna Bor. Amer. 4:314 (*Tabanus*)
T. zonalis Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:175
T. flavipes Graenicher, 1912, Bull. Wis. nat. Hist. Soc. 10:174
Florence, La Crosse, Marinette, Oneida, Price, Rusk, Sawyer, Shawano, Vilas and Washburn counties. April 19 to July 20
Specimens examined: 37 females.

Atylotus Osten Sacken

1. *bicolor* (Wiedemann), 1821, Dipt. exot. nouv. peu connus 1:96 (*Tabanus*)
   Dane and Grant counties. May 7 to July 30
   Specimens examined: 3 females, 3 males.
2. *ohioensis* (Hine), 1901, Canad. Ent. 33:28 (*Tabanus*)
   Dane county. July
   Specimens examined: 2 females.
3. *thoracicus* (Hine), 1900, Canad. Ent. 32:248 (*Tabanus*)
   Dane and Door counties. June 7 to August 9
   Specimens examined: 2 females, 7 males.

ACKNOWLEDGEMENTS

The identifications of the species reported in this paper have been confirmed by Dr. C. B. Philip of the National Microbiological Institute at Hamilton, Montana. The Illinois records of Wisconsin species were obtained from the collection of the Illinois Natural History Survey through Dr. H. H. Ross. Mr. Kirby Hays of the University of Michigan supplied the records for the upper peninsula of Michigan. The Iowa records came from an examination of the Iowa State College collection sent by Dr. J. L. Laffoon and from a check list supplied by Dr. H. E. Jacques of Mt. Pleasant, Iowa. Minnesota records were taken from Philip's 1931 paper. Additional Wisconsin records were obtained from the Milwaukee Public Museum through Mr. Kenneth MacArthur, from the Marshall collection and from collections made by Mr. R. A. Buchstaff of the Oshkosh Public Museum.

LITERATURE CITED

BRENNAN, J. M. 1935. The Pangoniinae of Nearctic America (Tabanidae, Diptera). Kans. Univ. Sci. Bull. 22:239–401.

FAIRCHILD, C. B. 1934. Notes on Tabanidae Occ. Pap. Boston Soc. nat. Hist. 8:139–144.

GRAENICHER, S. 1912. Records of Wisconsin Diptera. Bull. Wis. nat. Hist. Soc. 10:171–185.

HINE, J. S. 1907. Descriptions of new North American Tabanidae. Ohio Nat. 8:221–230.

OSTEN SACKEN, C. R. 1875–76. Prodrome of a Monograph of the Tabanidae of the United States. Mem. Boston Soc. nat. Hist. 2:365–397, 421–479, 555–560.

PHILIP, C. B. 1931. The Tabanidae (Horseflies) of Minnesota with Special Reference to Their Biologies and Taxonomy. Tech. Bull. Minn. agric. Exp. Sta. No. 80, 132 pp.

———. 1947. A catalog of the Blood-sucking Fly Family Tabanidae (Horseflies and Deerflies) of the Nearctic Region North of Mexico. Amer. Midl. Nat. 37:257–324.

———. 1950. Corrections and Addenda to a Catalog of Nearctic Tabanidae. *Ibid.* 43:430–437.

STONE, A. 1938. The Horseflies of the Subfamily Tabanidae of the Nearctic Region. Misc. Publ. U. S. Dep. Agric. No. 305, 171 pp.

HARVESTMEN AND SPIDERS OF WISCONSIN; ADDITIONAL SPECIES AND NOTES

HERBERT W. LEVI, LORNA R. LEVI AND JOHN L. KASPAR
Museum of Comparative Zoology, Harvard University and Department of Zoology, University of Wisconsin

Two previous papers (1952, 1954) have listed harvestmen and spiders found in Wisconsin. Since the publication of these, large additional collections have become available. Although the smaller spiders, particularly the micryphantids, have not been completely sorted out because of difficulties in determining them, it is worthwhile to present a list of additional records with habitat notes at the present time. Species not heretofore collected in the state have been marked with an asterisk.

Most of this work was done while the senior author was on the faculty of the University of Wisconsin, at the Wausau Extension Center and with the Department of Zoology in Madison. The paper was completed at the Rocky Mountain Biological Laboratory, Crested Butte, Colorado. We want to thank Dr. R. Chew of the University of Southern California for spiders collected while he was on the staff of Lawrence College, and the graduate students of the department of zoology for help in obtaining additional records.

To this date 15 species of harvestmen and 438 species of spiders are known from Wisconsin.

CLASS ARACHNIDA

ORDER PHALANGIDA (Harvestmen)

SUBORDER PALPATORES

Nemastomatidae

Crosbycus dasycnemus (Crosby). Found by sifting hardwood litter. Columbia Co.: 3 mi. north of Portage. Iron Co.: nr. Powell, Sandy Beach Lake. La Crosse Co.: 3 mi. northeast of Coon Valley. Sauk Co.: 6 mi. southwest of Sauk City. Vernon Co.: Wildcat Mtn.: State Pk.: 5 mi. north of Viola.

Ischyropsalidae

**Caddo boopis* Crosby. One specimen found in mixed hardwood litter. Vernon Co.: 5 mi. north of Viola.

ORDER ARANEAE

SUBORDER ORTHOGNATHA

Atypidae (Purse-web spiders)

Atypus niger Hentz. Dane Co.: University Arboretum, Madison; Shorewood quarry, Madison (R. Nero).

SUBORDER LABIDOGNATHA

Pholcidae (Cellar spiders)

Pholcus phalangioides (Fuesslin). Columbia Co. (J. Kaspar).

Theridiidae (Comb-footed spiders)

As a result of recent revisions in this family and of Opinion 517 of the International Commission on Zoological Nomenclature to continue established usage of generic names, a number of names as given in the 1954 paper must be changed. Given here is a complete list of theridiid spiders found in Wisconsin.

Achaearanea globosa (Hentz), (=*Hentziectypus globosum,* Levi and Field, 1954) Winnebago Co.: Zittau; Point Comfort.
A. rupicola (Emerton), (=*Cryptachaea rupicola*)
A. tepidariorum (C. L. Koch), (=*Parasteatoda tepidariorum*)
Argyrodes trigona (Hentz) (=*Conopistha trigona*)
Coressa stridula (Crosby), (=*Theonoe stridula*)
Crustulina altera Gertsch and Archer. Sauk Co.: Ferry Bluff.
**C. sticta* (O. P. Cambridge). Winnebago Co.: Point Comfort (J. Kaspar).
Ctenium banksi Kaston
C. eremophilus (Chamberlin)
**C. fuscus* (Emerton). Found in pine litter. Sauk Co.: Devil's Lake State Pk.; East Bluff.
**C. laticeps* (Keyserling). Clark Co.: 12 mi. east of Neillsville.
C. longipalpus Kaston
C. riparius (Keyserling)
C. spiniferus (Emerton). Rusk Co.: Bruce.
Dipoena nigra (Emerton)
Enoplognatha marmorata (Hentz), (=*Theridion marmoratum*). Sauk Co.; Ferry Bluff.
E. rugosa (Emerton), (=*Theridion rugosum*)
E. tecta (Keyserling), (=*Theridion puritanum*)
Euryopis argentea Emerton
E. limbata (Walckenaer)
E. pepini Levi (=E. *californica,* err. det.)
E. saukea Levi

Latrodectus curacaviensis (Müll.). Black-widow spider. Grant Co.: Wyalusing State Pk., under log (S. Wellso). Waushara Co.: Twin Lake Boy Scout Camp (S. Wellso). (=*L. mactans* Levi and Field, 1954). This is not the southern black spider, *L. mactans*, which occurs as far north as central Illinois, but has not been found resident in Wisconsin.

Pholcomma hirsuta Emerton (=*Ancylorrhanis hirsutum*)

Sphyrotinus unimaculatus (Emerton), (=*Tholocco unimaculata*) Jefferson Co.: Hope Lake Bog.

Steatoda albomaculata (De Geer), (=*Lithyphantes albomaculatus*). Juneau Co.: Camp Douglas.

S. americana (Emerton), (=*Asagena americana*)

S. borealis (Hentz)

S. triangulosa (Walckenaer), (=*Teutana triangulosa*)

Theridion alabamense Gertsch and Archer, (=*Allotheridion alabamense*)

T. albidum Banks, (=*Allotheridion albidum*)

T. aurantium Emerton

T. berkeleyi Emerton, (=*Allotheridion fieldi*). Winnebago Co.: Point Comfort; Zittau.

T. differens Emerton, (=*Allotheridion differens*)

T. frondeum Emerton, (=*Allotheridion frondeum*)

T. glaucescens Becker, (=*Allotheridion glaucescens*)

T. lyricum Walckenaer, =(*Allotheridion lyricum*)

T. murarium Emerton, (=*Allotheridion murarium*)

T. pictum (Walckenaer), (=*Allotheridion zelotypum*). Oneida Co. (D. Wills).

T. sexpunctatum Emerton

Theridula emertoni Levi, (=*Theridula sphaerula*, err. det.).

Linyphiidae (Sheet-web weavers)

Bathyphantes pallidus (Banks). Iron Co.: Manitowish, in white pine litter.

**B. pullatus* (O. P. Cambridge). Douglas Co.: Cedar Isl., Brule. Iron Co.: Manitowish, in white pine litter.

**B. weyeri* (Emerton). Found in caves. Richland Co.: Eagle Cave.

**Centromerus cornupalpis* (O. P. Cambridge). Dane Co.: Madison (T. K. Hagene).

**Lepthyphantes* sp., ♀ nr. *washingtoni*. Florence Co.: Long Lake, in sphagnum.

L. zebra (Emerton). Florence Co.: 2 mi. northwest of Tipler, in aspen litter: Sheboygan Co.: Cedar Grove.

**Macrargus multesimus* (O. P. Cambridge). Found in deciduous forest litter. Clark Co.: nr. Stanley. Florence Co.: 2 mi. northwest

of Tipler. Jackson Co.: Castle Mound Park. Marathon Co.: Eau Claire Dells. Sheboygan Co.: Cedar Grove. Vilas Co.: 4 mi. east of Eagle River.

**Meioneta unimaculata* (Banks). Winnebago Co.: Point Comfort (J. Kaspar).

Microneta viaria (Blackwall). Found in leaf litter. Barron Co.; Columbia Co.; Forest Co.; Jackson Co.; Manitowoc Co.; Marathon Co.; Monroe Co.; Price Co.; Sauk Co.; Waushara Co.; Winnebago Co.

Pusillia mandibulata (Emerton), Door Co.: Peninsula State Park. (=*Linyphia maculata* Levi and Field, 1954, err. det.).

Tapinopa bilineata Banks. Manitowoc Co.: Point Beach State Pk., in fallen pine log. (R. Chew).

Tennesseellum formicum (Emerton). Dane Co.: Madison (J. Kaspar).

Micryphantidae (Dwarf spiders)

Catabrithorax plumosus (Emerton). Crawford Co.: Prairie du Chien (M. Melanie). Winnebago Co.: Point Comfort (J. Kaspar).

Ceraticelus atriceps (O. P. Cambridge). Marathon Co.: Eau Pleine Flowage.

C. laetabilis (O. P. Cambridge). Found in leaf litter. Barron Co.: east of Cameron. Manitowoc Co.: Point Beach State Pk. (R. Chew). Vernon Co.: Wildcat Mtn. State Pk.

C. laetus (O. P. Cambridge). Found in sphagnum moss. Jackson Co.: nr. Alma Center. Langlade Co.: 2 mi. north of Parrish. Lincoln Co.: Jeffris.

C. minutus (Emerton). Found in herbs in forests and in litter. Adams Co.: 2 mi. south of Adams. Grant Co.: Wyalusing State Pk. La Crosse Co.: 3 mi. northeast of Coon Valley. Manitowoc Co.: Point Beach State Pk. (R. Chew). Marathon Co.: Eau Pleine Flowage. Sauk Co.: Baxter's Hollow; Ferry Bluff; Leopold Memorial. Taylor Co.: Chequamegon Natl. For., west of Medford. Vilas Co.: east of Eagle River.

**C. similis* Banks. Sauk Co.: Ferry Bluff (J. Kaspar). Winnebago Co.: Point Comfort (J. Kaspar).

**C.* sp. ♀. Marathon Co.: Hogarty, in sphagnum.

Ceratinella brunnea Emerton. Found in leaf litter. Door Co.: Peninsula State Pk. Marathon Co.: Maine. Sauk Co.: Leopold Memorial. Sawyer Co.: Flambeau State For. Winnebago Co.: Zittau.

**Ceratinops crenata* Emerton. Dane Co.: Mud Lake (D. Wills).

C. rugosa (Emerton). Winnebago Co.: Zittau (J. Kaspar).

**Chocorua cuneata* Emerton. Found in leaf litter. Manitowoc Co.: Point Beach State For. (R. Chew).

**Cornicularia brevicornus* Emerton. Iowa Co.: 7 mi. northwest of Dodgeville, dry oak litter.

C. communis Emerton. Florence Co.: Long Lake, in sphagnum.

C. minuta Emerton. Iowa Co.: 7 mi. northwest of Dodgeville, dry oak litter. Sauk Co.: Ferry Bluff. Winnebago Co.: Zittau (J. Kaspar).

C. pallida Emerton. Vernon Co.: Wildcat Mtn. State Pk., mixed hardwood litter.

Dismodicus decemoculatus (Emerton). Oneida Co.: Rhinelander (T. France).

**Eperigone augustalis* Crosby and Bishop. Waushara Co.: east of Red Granite, forest litter.

E. index (Emerton). Found in sphagnum moss. Jackson Co.: 3 m. east of Millston.

**E. tridentata* (Emerton). Lincoln Co.: Jeffris, in sphagnum.

**E.* sp. Dane Co.: Madison. Marathon Co.: Wausau. Taylor Co.: Chequamegon Natl. For., west of Medford.

**Erigone alsaida* Crosby and Bishop. Abundant in decaying aquatic vegetation on the shore of some lakes. Rock Co.: Lake Koshkonong nr. Edgerton (H. S. Dybas). Vilas Co.: north shore of Fence Lake.

E. atra Blackwall. Door Co.: Peninsula State Pk., on gravel beach. Manitowoc Co.: Point Beach State Pk., sweeping sand dune grass (R. Chew). Winnebago Co.: Point Comfort (J. Kaspar).

E. blaesa Crosby and Bishop. Vilas Co.: Anvil Lake, in shore drift.

Gonatium rubens Blackwall. Buffalo Co.: 10 mi. east of Fountain City, in oak litter. Crawford Co.: Prairie du Chien. Monroe Co.: nr. Coon Valley in maple-basswood forest. Winnebago Co.: Zittau.

**Grammonota spinimana* Emerton. Winnebago Co.: Point Comfort (J. Kaspar).

Hybocoptus cymbadentatus Crosby and Bishop. Found in sphagnum. Jackson Co.: 3 mi. east of Hillston. Marathon Co.: Hogarty.

**Maso sundevallii* (Westring). Dane Co.: Wingra Marsh in University Arboretum (R. Nero). Door Co.: Potawatomi State Pk. Grant Co.: Wyalusing State Pk., in maple-basswood forest. Iowa Co.: 7 mi. northwest of Dodgeville.

Oedothorax trilobatus (Banks). Vilas Co.: Fence Lake, in shore drift.

Origanates rostratus (Emerton). Found in forest litter. Columbia Co.: Gibraltar Rock, nr. Okee.; 7 mi. west of Lodi. Dane Co.: nr. Madison. Portage Co.: 10 mi. south of Stevens Point, in oak litter. Sauk Co.: Eagle Bluff 5 mi. southwest of Sauk City; Ferry Bluff.

**Pocadicnemis pumila* (Blackwall). Taylor Co.: nr. Westboro (J. Kaspar).

Sciastes terrestris (Emerton). Iowa Co.: 7 mi. northwest of Dodgeville.

**S. truncatus* (Emerton). Iron Co.: Sandy Beach Lake, Powell. Manitowoc Co.: Point Beach State Pk., in soil (R. Chew). Oneida Co.: 2 mi. north of Rhinelander in sphagnum.

**Scirites pectinatus* (Emerton). Winnebago Co.: Zittau (J. Kaspar).

Scylaceus pallidus (Emerton). Found in leaf litter. Columbia Co.: Gibraltar Rock, Blackhawk Lookout. Crawford Co.: Wauzeka. Dane Co.: 7 mi. northeast of Mazomanie. Grant Co.: Wyalusing State Pk. Iowa Co.: 7 mi. northwest of Dodgeville. Jackson Co.: Merrillan. Sauk Co.: Leopold Memorial.

Sisicus penifusiferus Bishop and Crosby. Taylor Co.: Chequamegon Natl. For., west of Medford, in sphagnum.

Soulgas corticarius (Emerton). Manitowoc Co.: Point Beach State Pk., sweeping low herbs (R. Chew). Outagamie Co.: Appleton (R. Chew).

**Tapinocyba minuta* (Emerton), Florence Co.: 2 mi. northwest of Tipler, in aspen litter.

T. simplex (Emerton). Found in litter, sometimes in sphagnum. Door Co.: Peninsula State Pk. Iron Co.: Sandy Beach Lake, Powell. Jackson Co.: 3 mi. south of Hatfield. Marathon Co.: Rib Mtn. State Pk. Oneida Co.: 2 mi. north of Rhinelander, Gilmore Lake nr. Lake Tomahawk. Sawyer Co.: Flambeau State For., scientific area. Taylor Co.: Chequamegon Natl. For., west of Medford. Vilas Co.: 4 mi. east of Eagle River.

Walckenaera vigilax (Blackwall). Dane Co.: Madison. Marathon Co.: Rib Mtn. State Pk. (not Tipler, Florence Co.; Herbster, Bayfield Co., err. det.)

Argiopidae (Orb Weavers)

**Araneus bicentenarius* (McCook). Walworth Co.: Lake Geneva, Wynchwood (D. C. Lowrie).

A. thaddeus (Hentz). Marathon Co.: Wausau, found in automobile. Winnebago Co.: Zittau.

Conepeira glyphica Archer. Grant Co.: Wyalusing State Pk. (J. T. Medler).

Larinia borealis Banks. Dodge Co. (S. Wellso).

**Singa campestris* Emerton. Vilas Co.: Anvil Lake. (*S. variabilis*, Levi and Field, 1954, err. det.)

**?S. keyserlingi*, juv. Price Co.: Chequamegon Natl. For. (*S. variabilis, ibid.*, 1954).

S. variabilis Emerton. Door Co.: nr. Bailey's Harbor.

Tetragnathidae

Leucauge venusta (Walckenaer). Manitowoc Co.: Point Beach State Pk. (R. Chew).

Pachygnatha kuratai Levi. Sauk Co.: Ferry Bluff (J. Kaspar).

**P. tristriata* C. L. Koch. Dane Co.: Picnic Point, Madison (W. Eustance). Winnebago Co.: Point Comfort.

Tetragnatha harrodi Levi. Winnebago Co.: Point Comfort (J. Kaspar).

Mimetidae

**Ero canionis* Chamberlin and Ivie. Dane Co.: Madison (J. Kaspar).

Mimetus notius Chamberlin. Grant Co.: Wyalusing State Pk. (J. T. Medler).

Agelenidae (Funnel-web weavers)

Circurina arcuata Keyserling. Sauk Co.: Ferry Bluff. Winnebago Co.: Zittau (J. Kaspar).

**C. robusta* Simon. Washburn Co.: 14 mi. north of Spooner, in forest litter.

Hahniidae

**Antistea brunnea* (Emerton). Oneida Co.: Hazelhurst, in sphagnum.

Hahnia cinerea Emerton. Found in dry oak litter. Jefferson Co.: 6 mi. south of Cambridge. Manitowoc Co.: Point Beach State Pk. (R. Chew). Portage Co.: 10 mi. south of Stevens Point. Sauk Co.: Eagle Bluff, 5 mi. southwest of Sauk City.

Neoantistea agilis (Keyserling). Dodge Co.: Lowell Twnshp. (G. H. Orians).

Lycosidae (Wolf spiders)

Arctosa emertoni Gertsch. Dane Co.: Madison. Winnebago Co.: Point Comfort (J. Kaspar).

A. littoralis (Hentz). Sheboygan Co.: Cedar Grove (J. Kaspar).

A. rubicunda (Keyserling). Crawford Co.: Prairie du Chien (M. Melanie).

Geolycosa missouriensis (Banks). Dane Co.: Madison. Marathon Co.: Wausau. Sauk Co.: Ferry Bluff.

**G. wrightii* (Emerton). Builds vertical burrows, as much as three feet in depth in sand. Columbia Co.: Rio (J. Kaspar). Dane Co.: Arboretum Ponds, Madison (D. Kranendonk). Iowa Co.: Spring Green. Sauk Co.: T9NRSE, Sec. 36, Troy Township. Sheboygan Co.: Cedar Grove (D. Berger).

Pardosa fuscula (Thorell). Jefferson Co.: Hope Lake Bog (J. Kaspar). Winnebago Co.: Long Point Island (J. Kaspar).

P. lapidicina Emerton. Winnebago Co.: Point Comfort (J. Kaspar).

Oxyopidae (Lynx spiders)

**Oxyopes scalaris* Hentz. Dane Co.: Madison. Marathon Co.: Wausau. Immature *Oxyopes* of this species or of *O. salticus* were found to feed in large numbers on sawfly larvae on conifers in the University Arboretum, Madison, by J. Kapler.

Gnaphosidae (Running spiders)

Cesonia bilineata (Hentz). Sauk Co.: Ferry Bluff (J. Kaspar).

Drassodes auriculoides Barrows. Sauk Co.: Ferry Bluff (J. Kaspar).

**Drassyllus eremitus* Chamberlin. Marathon Co.: Bevent, in sphagnum moss.

**D. femoralis* (Banks). Dane Co.: Madison, in building (H. C. Mueller).

D. niger (Banks). Bayfield Co.: T46N, R7W, Highway H. Sauk Co.: Ferry Bluff (J. Kaspar).

D. rufulus (Banks). Dane Co.: Madison (D. Wills).

Gnaphosa fontinalis Keyserling. Sauk Co.: Ferry Bluff.

Haplodrassus hiemalis Emerton. Ashland Co.: Copper Falls State Pk. (J. Kaspar).

Nodocion melanie Levi. Dane Co.: Madison (D. Wills). Washburn Co.: Spooner, in wasp nest provision (J. T. Medler).

Sosticus insularis (Banks). Grant Co.: Glen Haven (Breuer).

Clubionidae (Sack spiders)

Agroeca pratensis Emerton. Florence Co.: Long Lake, in sphagnum.

Clubiona canadensis Emerton. Winnebago Co.: Point Comfort (J. Kaspar).

**C. kastoni* Gertsch. Polk Co.: St. Croix Falls (N. Banks).

C. mixta Emerton. Sheboygan Co.: Cedar Grove (J. Kaspar).

**C. trivialis* Koch. Manitowoc Co.: Point Beach State For.

Micaria longipes Emerton. La Crosse Co.: T17N, R7W, Sec. 12 (J. Kaspar).

M. montana Emerton. Dodge Co.: S. of Beaver Dam (J. Kaspar).

Phrurotimpus borealis (Emerton). Price Co.: 8 mi. west of Prentice, in litter.

Scotinella madisonia Levi. Dane Co.: Shorewood quarry, Madison, on ant hill.

S. minnetonka (Chamberlin and Gertsch). Found in forest litter. Columbia Co.: Gibraltar Rock, nr. Okee. Jefferson Co.: Hope Lake Bog. Kewaunee Co.: Kewaunee (A. Ziemer). La Crosse Co.: 8 mi. southeast of La Crosse. Marathon Co.: Eau Pleine Flowage, Eau Claire Dells. Portage Co.: Bancroft. Washburn Co.: 14 mi. north of Spooner. Wood Co.: 3 mi. south of Wisconsin Rapids.

Anyphaenidae

Anyphaena celer (Hentz). Sauk Co.: Ferry Bluff (J. Kaspar). Richland Co. (D. Wills).

Thomisidae (Crab spiders)

**Ebo latithorax* Keyserling. Columbia Co.: Rio, on tree trunk (G. H. Orians).

Oxyptila americana Banks. Manitowoc Co.: Point Beach State Pk., sweeping in hemlock forest (R. Chew). Marathon Co.: Eau Pleine Flowage.

**O. monroensis* Keyserling. Found in leaf litter. Grant Co.: Wyalusing State Pk., in maple-basswood forest. Sauk Co.: Eagle Bluff, 5 mi. southwest of Sauk City.

**O. nevadensis* Keyserling. Waushara Co.: 2 mi. north of Coloma, in pine litter.

Philodromus infuscatus Keyserling. Grant Co.: Wyalusing State Pk. (J. T. Medler). Sauk Co.: Ferry Bluff.

P. satullus Keyserling. Lafayette Co.: Darlington. Winnebago Co.: Point Comfort. (=*P. placidus,* Levi and Field, 1954, err. det.).

Xysticus bicuspis Keyserling. Sauk Co.: Ferry Bluff (J. Kaspar).

X. lutulentus Gertsch. Manitowoc Co.: Point Beach State Pk. (R. Chew).

X. punctatus Keyserling. Oneida Co.: Camp Tesomas nr. Rhinelander (T. France).

Salticidae (Jumping spiders)

**Euophrys monadnock* Emerton. Juneau Co.: Camp Douglas (D. Wills).

**Habrocestum parvulum* Banks. Shawano Co.: nr. Neopit, maple-basswood litter.

Habronattus decorus (Blackwall). Winnebago Co.: Point Comfort (J. Kaspar).

Icius elegans (Hentz). Dane Co.: Sunset Point quarry, Madison.

Phidippus apacheanus Chamberlin and Gertsch. Waushara Co.: Plainfield (J. Kaspar).

P. whitmanii Peckham. Sauk Co.: Ferry Bluff (J. Kaspar).

Phlegra fasciata (Hahn). Dane Co.: Shorewood quarry, Madison. Juneau Co.: Camp Douglas (D. Wills).

Zygoballus bettini Peckham. Fond du Lac Co.: Camp Long Lake. Winnebago Co.: Zittau (J. Kaspar).

Z. nervosus (Peckham). Sauk Co.: Ferry Bluff (J. Kaspar). Winnebago Co.: Long Point Island (J. Kaspar).

Dictynidae (Hackled-band weavers)

Dictyna bostoniensis Emerton. Grant Co.: Glen Haven (Breuer). Winnebago Co.: Point Comfort, County Road Z at Highway 41.

D. hentzi Kaston. Dane Co.: Sun Prairie. Walworth Co.: T4N, P18E. Sec. 16 (J. Kaspar).

D. minuta Emerton. Rusk Co.: Ladysmith. Winnebago Co.: Point Comfort (J. Kaspar).

Lathys foxii (Marx). Wood Co.: 3 mi. south of Wisconsin Rapids.

Scotolathys pallidus (Marx). Manitowoc Co.: Point Beach State Pk., in leaf litter (R. Chew). Outagamie Co.: Appleton, sweeping herbs (R. Chew). Portage Co.: Bancroft, oak litter.

Uloboridae (Hackled band orb weavers)

Hyptiotes cavatus (Hentz). Richland Co.: Rockbridge.

Amaurobiidae (Hackled band weavers)

Walmus borealis (Emerton). Douglas Co.: north of Solon Springs. Price Co.: 8 mi. west of Prentice, in forest litter.

ERRONEOUS RECORDS

Ceraticelus limnologicus, Levi and Field, 1954, not this species.

Hyptiotes gertschi Chamberlin and Ivie, 1935, Bull. Univ. of Utah, biol. ser., vol. 2, no. 4, p. 12. Longmire, Wisconsin should read Longmire, Washington.

LITERATURE CITED

LEVI, H. W. and H. M. FIELD, 1954, The spiders of Wisconsin. Amer. Midland Nat. 51:440–467.

LEVI, L. R. and H. W. LEVI, 1952, Preliminary list of harvestmen of Wisconsin. Trans. Wisc. Acad. Sci. 41:163–167.

A TRAP-NEST SURVEY OF SOLITARY BEES AND WASPS IN WISCONSIN, WITH BIOLOGICAL NOTES

T. W. KOERBER[1] and J. T. MEDLER[2]
University of Wisconsin, Madison

Many species of solitary bees and wasps nest in hollow stems, holes in logs, and similar natural locations. Among the previous students of bee and wasp biology, only a few workers in Europe and North America have provided different types of artificial nesting holes and have recorded the acceptance of such holes by various species. Since 1951, artificial nesting holes or "trap-nests" have been used in northern Wisconsin in connection with research on the pollinators of legume seed crops. The success experienced in attracting not only Megachilidae, but eumenid, sphecid, and pompilid wasps with a relatively few trap-nests, and in a limited area, suggested that a similar study on a state-wide scale would add to our knowledge regarding these insects. Accordingly, a trap-nest survey was made in order to learn more about the distribution and nesting biology of solitary bees and wasps in Wisconsin. This is a report on the data obtained during the 1956 season.

METHODS

The trap-nest used in this survey was a section of sumac stem about eight inches long with a six inch hole bored in the center. The diameter of the hole was either ¼-inch or $\frac{5}{16}$-inch.

Twenty locations (Figure 1) were selected to represent different major habitats and to give a state-wide distribution. In the spring of 1956, bundles of trap-nests were placed at trapping sites at each location. Each bundle contained three sticks with ¼-inch holes and three sticks with $\frac{5}{16}$-inch holes. The bundle of trap-nests was held together with a ½-inch rubber band cut from old automobile tire inner tube. Each bundle also contained a solid stick of wood about one inch square and six to eight inches long. This stick had two hooks by which the bundle was attached to a wire around a tree

---

[1] Research Assistant, Department of Entomology, University of Wisconsin. Now with The Division of Forest Insect Research, U. S. Forest Service, California Forest and Range Experiment Station, Berkeley, California. Information given in this paper was submitted in partial fulfillment of the requirements for the degree of Master of Science in Entomology at the University of Wisconsin.

[2] Associate Professor, Departments of Agronomy and Entomology, University of Wisconsin, Madison. This work was supported in part by the Research Committee of the Graduate School of the University of Wisconsin from funds supplied by the Wisconsin Alumni Research Foundation.

or to a fence wire. The solid stick carried the serial number of the bundle written in indelible pencil.

Two bundles of trap-nests were placed at each site. A high bundle was placed four to seven feet above the ground and a low bundle between the ground and the two foot level, usually directly below the high bundle. The bundles were inspected at four to six week intervals during the summer. Each sumac stick was examined and those which contained nests were brought back to the laboratory for study. The occupied trap-nests were immediately replaced with empty ones, so that each bundle of trap-nests contained the same number of sticks with the same size holes throughout the summer.

The trap-nests which were brought back to the laboratory were split carefully so that damage to the contents was kept to a minimum. A diagram was made and notes were taken on the contents of each nest. Photographs were made of many of the nests and of representative specimens. The immature insects were transferred to individual vials for rearing and observation. A coding system was devised to indicate location, site, nest, and cell. Every specimen could be associated with its nest by means of the code designations, and also with all notes, pictures and diagrams.

Results

The number of nests built by each of the important species at the twenty locations is given in Table 1. There were different numbers of trapping sites and trap-nests used at the various locations. Of the 1647 trap-nests placed at the 94 trapping sites, 778 or 47.2% were accepted by bees and wasps.

Considerable data were obtained on the distribution, abundance and habitat preferences of the various species of bees and wasps that used the trap-nests. All of these insects built a linear series of cells which they provisioned with food for their larvae. An egg was deposited in each provisioned cell and the resulting larva grew to maturity, pupated and finally emerged as an adult bee or wasp. The various species differed widely in the materials used to construct the cells, the size and number of cells per nest, and the cell provisions. The information obtained on nest construction, biology of the progeny, and the parasites, is not given in this report. These data have been consolidated with data obtained during a period of several years and will be published in a series of reports on the biologies of the various species.

Because of similar nesting habits, it might be expected that the species utilizing the trap-nests would compete for the limited number of nesting holes. It was not possible to measure exactly the interspecific competion. However, it appeared that intraspecific competion was more important than interspecific competion, because

TABLE I

THE NUMBER OF NESTS OF EACH OF THE PRINCIPLE SPECIES TAKEN AT EACH OF THE TRAPPING AREAS

	Number of Trapping Sites	Total Trap-Nests Put Out	Total Accepted	*Megachile relativa* Cress.	*Megachile mendica* Cress.	*Megachile inermis* Prov.	*Ancistrocerus antilope* (Panz.)	*Rygchium foramination* (Sauss.)	*Dipogon sayi* Banks	*Chlorion harrisi* Fern.	Miscellaneous[3]
Council Grounds State Forest, Lincoln Co.	4	80	42	16	.....	4	9	.....	12	.....	1
Cave Point, Door Co.	3	41	10	.....	.....	.....	4	.....	5	.....	1
Devils Lake State Park, Sauk Co.	4	72	31	1	1	.....	8	3	9	.....	9
Dietz Farm. Bayfield Co.	4	48	48	10	.....	6	16	9	6	.....	1
Gurney, Iron Co.	3	56	26	6	.....	1	14	.....	5	.....	.....
Highbridge, Ashland Co.	5	150	65	42	.....	3	5	3	5	3	4
Interstate Park, Polk Co.	5	85	45	18	.....	1	7	12	6	.....	1
Kitchak Farm, Bayfield Co.	5	83	27	.....	.....	2	19	2	4	.....	.....
Kettle Morain State Forest, Waukesha Co.	4	53	39	.....	1	.....	3	10	15	.....	10
Lucerne Farm, Waushara Co.	4	48	16	5	.....	.....	.....	4	4	.....	3
Madison Area, Dane Co.	12	258	139	1	11	.....	3	51	4	23	46
Mauthe Lake, Fond du Lac Co.	7	113	39	1	1	.....	5	14	9	.....	9
Oconto Lake Cathryn, Oconto Co.	3	36	3	.....	.....	.....	1	.....	2	.....	.....
Platteville Prairie, Lafayette Co.	3	24	15	.....	.....	.....	.....	5	.....	7	3
Peninsula State Park, Door Co.	5	71	15	.....	.....	.....	6	.....	8	.....	1
Point Beach, Manitowoc Co.	4	69	24	.....	.....	.....	9	5	5	.....	5
Spooner Branch Station, Washburn Co.	4	100	50	18	.....	.....	8	3	14	.....	7
Wildcat Mt. State Park, Vernon Co.	5	75	42	3	1	.....	7	15	12	.....	4
Wyalusing State Park, Grant Co.	6	104	56	.....	3	.....	8	12	7	.....	26
Zander Farm, Manitowoc Co.	4	81	46	1	.....	.....	4	12	6	3	20
TOTAL	94	1647	778	122	18	17	136	160	138	36	151

[3] *Osmia albiventris* Cress., *O. coerulescens* Linn., *O. tersula* Ckll., *O. lignaria* Say, *O. proxima* Cress.; *Megachile brevis* Say, *M. centuncularis* (Linn.); *Ancistrocerus tigris* (Sauss.); *Symmorphus cristatus* (Sauss.); *Trypoxylon striatum* Prov., *T. frigidum* Sm., *T. rubro-cinctum* Pack., *Pemphredon inornatus* Say, *P. tenax* Fox; *Auplopus* sp.

the various species showed differences in distribution, hole size preference, and food requirements for provisioning cells. The availability of food may have been related to the distribution and abundance of the species, but food was plentiful and, therefore, not considered to be a major factor in the selection of the nesting site.

Three species of megachilid bees, *Megachile inermis* Prov., *M. relativa* Cress., and *M. mendica* Cress., occurred in considerable numbers in the trap-nests. All used pollen and nectar to provision their cells. *M. inermis* was found in the northern part of the state and *M. mendica* in the southern part only. Nests of *M. relativa* were common in northern locations, but became less abundant in southern Wisconsin, and none were taken at two of the southernmost locations. Nests taken in the southern part of the state generally produced smaller specimens of *M. relativa* than those obtained from locations farther north. *M. mendica* preferred to nest in dry open locations where few *M. relativa* nests were built. The habitats in which *M. relativa* and *M. inermis* built their nests were similar except that *M. relativa* built many nests in fence rows, whereas *M. inermis* was apparently restricted to woodland habitats. *M. inermis* is a large bee and was unable to use holes having a diameter of a ¼-inch. *M. relativa* and *M. mendica,* which are smaller bees, were able to use both ¼-inch and $\frac{5}{16}$-inch holes. The distribution of these three species is shown in Figure 2.

Two species of eumenid wasps, *Rygchium foraminatum* (Sauss.) and *Ancistrocerus antilope* (Panz.), were found commonly throughout Wisconsin. Both species provisioned their cells with caterpillars and used both size holes. However, the two species differed in their habitat preference. *R. foraminatum* showed a strong preference for open areas and fence rows. *A. antilope* preferred woodland locations, although its preference was not so strongly defined as that of *R. foraminatum.* The habitat preferences of these two species were much more strongly indicated at the extreme northern and southern locations. In the north *A. antilope* nested in nearly all habitats whereas *R. foraminatum* was found only in the most open locations. In the south *R. foraminatum* was found under a variety of conditions and *A. antilope* nested only in heavily wooded locations. It seemed that the relative abundance of *R. foraminatum* and *A. antilope* was strongly influenced by the proportion of wooded land to open land in any given area. A high proportion of wooded land such as exists in northern Wisconsin could produce conditions favorable for *A. antilope.* Some members of the resulting large population of *A. antilope* would be forced to nest in the less favored open areas. A high proportion of open land with fence rows such as exists in the southern part of the state would favor a large population of *R. foraminatum.* The combination of a high *R. forami-*

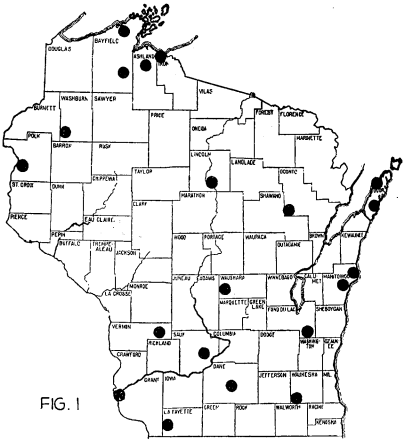


FIG. 1

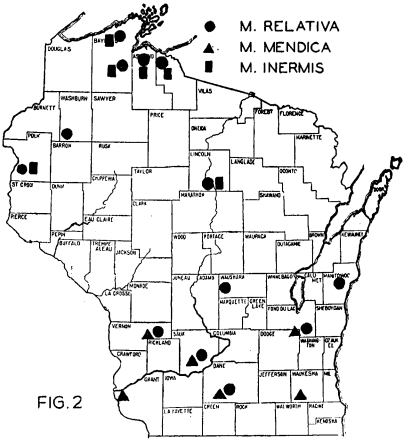


FIG. 2

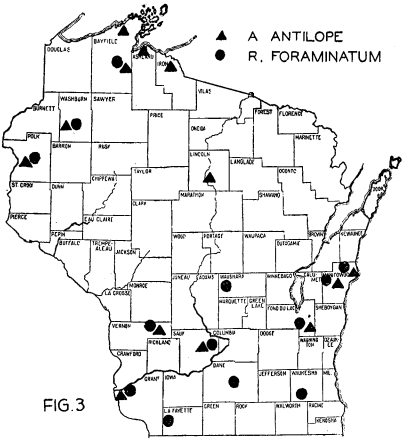


FIG. 3

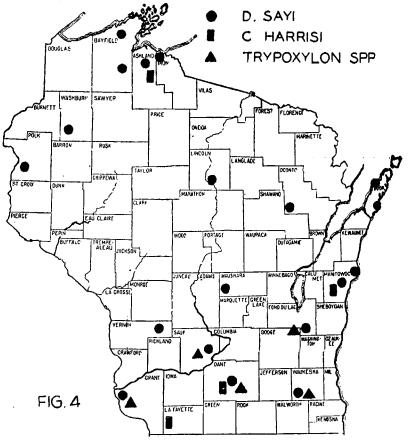


FIG. 4

FIGURE 1. Locations of twenty trap-nest sites in Wisconsin, 1956.
FIGURE 2. Distribution of three species of *Megachile* at trap-nest sites.
FIGURE 3. Distribution of two species of *Eumeninae* at trap-nest sites.
FIGURE 4. Distribution of *Trypoxyloninae*, *Sphecinae*, and *Pepsinae* at trap-nest sites.

natum population and a reduced area of favorable habitat would tend to limit *A. antilope* to small populations in the areas of favorable habitat. The distribution of the two species is shown in Figure 3.

A pepsid spider wasp, *Dipogon sayi* Banks, occurred throughout the state, and appeared to be equally abundant at all the locations. It showed a strong preference for woodland habitats, including the edges of wooded areas. Relatively few trap-nests were utilized in dry and wet open habitats such as upland fields and pastures or marshes and wet meadows.

Only those trap-nests in the southern part of Wisconsin were utilized by sphecid wasps in the genus *Trypoxylon,* the most common species being *T. striatum* Prov. Also collected was *T. rubrocinctum* Pack., but as this species is only about half the size of *T. striatum,* it probably preferred to use smaller holes than the ones in the trap-nests. We do not have enough data on *Trypoxylon* to evaluate habitat preferences.

Although *D. sayi* and *Trypoxylon* spp. provisioned their nests with spiders, they were not in competition for food, as the spiders used by *D. sayi* were mainly Thomisidae, whereas those used by *Trypoxylon* were mainly Argiopidae.

Another sphecid, *Chlorion harrisi* Fern., was collected at 4 widely distributed sites, but showed a very limited habitat requirement. The species was found only in the trap-nests located in large, well-drained open fields. Nests were provisioned with nymphs and adults of saltatorial orthoptera, mostly in the genus *Oecanthus.* Host species sampled from nests included *Oecanthus quadripunctatus* Beut., *O. augustipennis* Fitch, *O. niveus* (DeG.) *Neoxabea bipunctata* (DeG.), and *Conocephalus fasciatus* (DeG.). The distribution of the pepsid and sphecid wasps is shown in Figure 4.

Isopods, spiders, caterpillars and ants competed with the bees and wasps for the trap-nests. The isopods invaded trap-nests placed near the ground or in wet locations, but were probably not very important competitors, using the holes only for shelter.

Small spiders in the family Gnaphosidae constructed an oval silken case, open at one end, in which to live. The ¼- or $\frac{5}{16}$-inch hole in the end of the trap-nest seemed to be an ideal place to construct the case. The number of trap-nests used this way was not very large but the spiders were apparently permanent residents, using the same stick all summer. Spiders in the family Agelenidae built a large sheet-like web at the end of the bundle of trap-nests, blocking the holes. The spider spent most of its time in a tubular retreat between the sticks. These spiders probably do not compete with the bees and wasps in nature, since they do not get into the nesting holes. It was interesting to find these spiders preventing wasps

from using a trap-nest, while other spiders were being used as food by wasps in other trap-nests in the same bundle.

In some locations in the northern part of the state, forest tent caterpillars, *Malacosoma disstria* Hbn., entered the trap-nests to spin cocoons and pupate. The competition from these caterpillars was not extensive and probably was coincidental with a local caterpillar outbreak. The lepidopterous larva, *Chamyris cerintha* Treitschke, entered some of the sticks. This species was widely distributed, but was not particularly abundant in any one place. The larvae enter holes in the late summer, pupate, and emerge as adult moths in the spring; so the occupied holes are again available to bees. At one trapping area, Lucerne Farm, Waushara County, cutworms were very abundant and used the holes of the trap-nests as resting shelters during the day. All of the trap-nests located at three places in the infested area, including those six feet from the ground, were taken over by the cutworms, up to three or four cutworms occupying each trap-nest. Presumably, any natural holes suitable for nesting by bees or wasps would be similarly occupied by cutworms. If high populations of cutworms existed over any extensive area, the solitary bees and wasps might have considerable difficulty finding suitable holes for nesting.

Ants[4] were the most important of all the competitors and occupied trap-nests in all parts of the state. Carpenter ants, of which four species, *Camponotus pennsylvanicus* (Degeer), *C. nearcticus* Emery, *C. noveboracensis* (Fitch), and *C. caryae* (Fitch), were identified, used only one trap-nest at a given time and place. A dealate female entered a trap-nest, constructed a plug of pith to close the hole and reared a brood of workers. Except for *C. nearcticus,* this process was rather slow, so that the ant populations in the nests never amounted to more than a few individuals at the end of four to six weeks when the occupied nests were collected. However, the trap-nests seemed to be well suited to *C. narcticus,* and several colonies in excess of 500 individuals were taken; possibly as the result of the migration of existing colonies into the sticks.

Crematogaster cerasi (Fitch) invaded the trap-nests early in the summer. They excavated almost all of the pith, except for a thin layer at one end of the stick. At the other end of the stick a thin plug was constructed with a hole just large enough to admit a single ant. It is not known whether established colonies moved into the trap-nests, or whether the ants had a high rate of reproduction, but sticks which had been at a trapping site for five or six weeks contained 20 to 50 adult ants and almost enough eggs, larvae and

[4] The authors express appreciation to Dr. W. L. Brown, Jr. and Dr. M. R. Smith who determined the species of ants. We wish to gratefully acknowledge the generous help by T. B. Mitchell in the determination of bees, and K. V. Krombein in the determination of wasps.

pupae to fill a 20 ml. vial. Several or all of the trap-nests in a bundle were used. In cases where several trap-nests were used, it was not possible to determine if more than one colony of ants was involved. Many of the colonies apparently failed to maintain themselves or moved. For example, trap-nests were placed at four locations on May 20. Two weeks later the traps were inspected and ant invasion was found at three of the four locations. At the end of three more weeks ants were found at only one location. A strong colony was maintained at this location through the entire summer in spite of efforts to eradicate the ants on two occasions by pouring chloroform into the holes. Another colony which invaded an entire bundle of trap-nests in Vernon County was left undisturbed. A strong colony was present when the site was inspected in August. Five weeks later the ants were no longer present and several of the trap-nests had been used by *D. sayi.*

Tapinoma sessile (Say) used the trap-nests in much the same way as *Crematogaster.* This species appeared in large numbers and invariably invaded all of the trap-nests in a bundle. The pith was excavated and thin plugs with small entry holes were constructed at either end of the sticks. In addition to rearing their brood in the bore of the trap-nests these ants closed the interstices between the sticks with a dark fibrous material and used the resulting chambers for brood rearing. These ants were very aggressive in spite of their extreme small size. When the nests were disturbed the ants rushed out in large numbers, attempted to bite, and produced drops of strong-smelling acid from the ends of their abdomens.

At a single location in Door County, a nest of *Leptothorax canadensis* Prov. was found, which contained 6 workers, 40 eggs, 12 small larvae and 15 large larvae.

Although the various ant species compete with the bees and wasps for nesting holes they probably make more nesting sites available. The excavation of pith from the trap-nest added two inches to the length of the nesting hole. Under natural conditions these ants would excavate even deeper holes which would later be available to solitary bees and wasps for nesting sites. Colonies of ants were found nesting in dead sumac stems where they excavated the pith from the center of the stems.

In those bundles where ants did not occupy all of the trap-nests, the bees and wasps were not prevented from using those remaining. Some ant colonies disappeared during the summer and the enlarged holes were used by bees and wasps. The reasons for ant abandonment are not understood, as attempts to eradicate the ants by removing the occupied sticks or pouring chloroform into the holes were to no avail. It would seem that some interesting studies on ant biology could be made using this trap-nesting technique.

Discussion

Although artificial nests or trap-nests have been used previously in small numbers or in restricted areas to obtain data on the biology and ecology of various solitary bees and wasps (Krombein, 1955), they have never been used before in a survey over a wide area. The trap-nest technique is especially valuable as a means of obtaining data on the biology of insects. If the trap-nests are properly placed, much information can be gathered in a relatively short period of time on the distribution and abundance of species which ordinarily are rarely encountered.

By using trap-nests, large numbers of the immature stages of solitary bees and wasps may be obtained for studies of their life cycles. Observations made on a large sample of larvae from many nests yield very reliable data.

The sumac stick trap-nests have several advantages over most of the other types that have been used. They closely approximate hollow sumac stems which are natural nest sites. Sumac grows abundantly along roadsides and in waste land, so that a practically unlimited supply is available free of charge. The sumac stems have a pith center which is very easily drilled out to form the nesting hole. The sticks are straight-grained, which facilitates splitting with a pocket knife without injury to the nests. Using a power-driven saw and drill, one man can make upwards of 300 sumac trap sticks per day.

The general life histories of bees and wasps have been fairly well worked out. However, for many species there is little detailed information known about their biology and ecology. While some of the species have been studied in other areas, very little information is available on any of the species under Wisconsin conditions.

The nesting habits of *Dipogon sayi* were described briefly by Peckham and Peckham (1898). The biology of this insect given by Medler and Koerber (1957) is based on information obtained from trap-nests.

The Megachilinae have been more extensively studied because of their importance as pollinators of legume seed crops. Peck and Bolton (1946) gave considerable information on the nesting habits, habitat preferences, and parasites of *M. relativa* and *M. inermis*. Their study was conducted in northern Saskatchewan using artificial nesting holes bored into logs and stumps. In most respects, the data presented by Peck and Bolton are in agreement with that found in Wisconsin. However, they list (in Table 6) *Chrysis* as a parasite of Megachilinae. *Chrysis* was never found to parasitize Megachilinae in Wisconsin. All of the chrysidids which were taken in this survey occurred as parasites in the nests of *A. antilope, R. foraminatum* and *Trypoxylon* spp.

Hobbs and Lilly (1954) studied the distribution, abundance, and habitat preferences of Megachilinae in Alberta but gave no information on nesting biology. *M. brevis* Say, *M. relativa*, and *M. inermis* were reported as being rare in Alberta. In Wisconsin, *M. relativa* is abundant except in the southern part of the state. *M. inermis* is fairly common in the north but does not occur in the south. Manuscripts on the biology of *M. relativa* and *M. inermis* in Wisconsin are now in preparation.

Michener (1953) presented a very detailed account of the biology and ecology of *M. brevis* Say which is the most common Megachile in Kansas. Only two nests of *M. brevis* were taken in Wisconsin.

Practically no information is available on *M. mendica* which is the most abundant species in the trap-nests in southern Wisconsin.

Ancistrocerus antilope was reported by Cooper (1953) in New York and Medler and Fye (1956) in northern Wisconsin. Both authors used trap-nests to collect data on the nesting biology of this wasp, but neither gave information on habitat preferences or distribution of *A. antilope*.

Rau and Rau (1918) described the nest and nesting activity of *Rygchium foraminatum* in natural holes in logs and hollow stems. Apparently little is known on the distribution, abundance, or habitat preferences of this species.

Chlorion harrisi is fairly well known. Its nesting habits were described by Rau (1935). It is recorded as nesting in hollow sticks and holes in logs and using various saltatorial orthoptera for provisioning its nests. *C. harrisi* has not previously been studied in Wisconsin, and some new host records were obtained.

Peckham and Peckham (1898) described the nesting habits of *Trypoxylon rubro-cinctum* and *T. striatum*. They record *T. rubro-cinctum* as nesting in hollow straws and *T. striatum* from beetle galleries in logs and posts. Our trap-nest data agree very well with the accounts given by the Peckhams. Krombein (1954, 1956) recorded *T. rubro-cinctum* and *T. striatum* in wooden block trap-nests.

Data that were obtained on the other species of insects listed in the footnote of Table 1 were fragmentary, and further studies should be made before details of biology, distribution, and habitat preference are discussed.

SUMMARY

The trap-nest method was used to determine the distribution and abundance of bees and wasps in Wisconsin. The insects used the hole of the trap-nest to build a linear series of cells and provision the cells with food for their progeny.

The most common species found in the trap-nests were:

Megachilinae—*Megachile relativa* Cress., *M. inermis* Prov., and *M. mendica* Cress.
Eumeninae—*Rygchium foraminatum* (Sauss.) and *Ancistrocerus antilope* (Panz.)
Pepsinae—*Dipogon sayi* Banks
Trypoxyloninae—*Trypoxylon striatum* Prov., *T. rubro-cinctum* Pack.
Sphecinae—*Chlorion harrisi* Fern.

The species were found to have certain preferences for habitats and hole size. The distribution and abundance of some of the species was associated with habitats at the various trapping sites.

The trap-nest technique affords many as yet uninvestigated opportunities for studying the biology, ecology, and distribution of solitary bees and wasps. There are many species which would probably use trap-nests made from different materials or with smaller or larger holes. Intensive investigations are required in order to provide needed information on species rarely encountered in nature, and the trap-nest technique would be a valuable aid to this research.

References Cited

Cooper, K. W. 1953. The ecology, predation, nesting and competition of *Ancistrocerus antilope* (Panzer). Trans. Amer. Ent. Soc. 79:13–35.

Hobbs, G. A. and Lilly, C. E. 1954. Ecology of species of *Megachile* Latreille in the mixed prairie region of southern Alberta with special reference to pollination of alfalfa. Ecology 35:453–462.

Krombein, K. V. 1954. Wasps collect at Lost River State Park, West Virginia, in 1953. Bul. Bklyn. Ent. Soc. 49:1–7.

———. 1955. Some notes on the wasps of Kill Devil Hills, North Carolina, 1954. Proc. Ent. Soc. Wash. 57:145–160.

———. 1956. Biological and taxonomic notes on the wasps of Lost River State Park, West Virginia, with additions to the faunal list. Proc. Ent. Soc. Wash. 58:153–161.

Medler, J. T. and Fye, R. E. 1956. The biology of *Ancistrocerus antilope* (Panzer) in trap-nests in Wisconsin. Ann. Ent. Soc. Amer. 49:97–102.

Medler, J. T. and Koerber, T. 1957. Biology of *Dipogon sayi* Banks in Trap-nests in Wisconsin. Ann. Ent. Soc. Amer. 50:621–625.

Michener, C. D. 1953. The biology of a leafcutter bee (*Megachile brevis*) and its associates. Univ. Kans. Sci. Bul. 35:1659–1745.

Peck, O. and Bolton, J. L. 1946. Alfalfa seed production in northern Saskatchewan as affected by bees, with a report on means of increasing the population of native bees. Sci. Agr. 26:387–415.

Peckham, G. W. and Peckham, E. G. 1898. The instincts and habits of the solitary wasps. Wis. Geological and Natural History Survey Bul. No. 2.

Rau, P. and Rau, N. 1918. Wasp Studies Afield. Princeton University Press.

Rau, P., 1935. The nesting habits of solitary wasps. Bul. Bklyn. Ent. Soc. 30:65–68.

PRELIMINARY REPORTS ON THE FLORA OF WISCONSIN. NO. 42—ROSACEAE I—ROSE FAMILY I

HARRIET GALE MASON and HUGH H. ILTIS
Herbarium of the University of Wisconsin

This is the first half of a treatment of the Wisconsin species of the family Rosaceae. In this portion, certain extremely complex genera are not treated, namely *Crataegus, Rosa, Rubus,* and *Amelanchier.* It is hoped that these four genera will be discussed in the not too distant future by specialists in each of these groups.

The distribution maps of species in Wisconsin are based on collections in the herbaria of the Universities of Wisconsin and Minnesota, the Milwaukee Public Museum, and Northland College, Wisconsin. Small dots in Iowa County represent sight records from an unpublished work by Iverson (1955). Other sources of information are cited in the text. Dots indicate specific location, triangles county records without specific locality. Numbers within the enclosures in the lower left-hand corner of each map represent the specimens used in this study that were flowering or fruiting in respective months. These numbers do not include specimens in bud, very young fruit, or in vegetative condition. While, therefore, a small percentage of collections was not counted, the total numbers give a rough estimate of the amount of study material available for this study, with the monthly figures giving an indication of when a species is apt to flower or fruit in Wisconsin. Nomenclature, phyletic sequence, and general descriptions follow generally "The New Britton and Brown Illustrated Flora" (Gleason, 1952) and "Gray's Manual of Botany, ed. 8" (Fernald, 1950).

Grateful acknowledgment is due to Gerald B. Ownbey, University of Minnesota, Albert M. Fuller, Milwaukee Public Museum, Frank C. Lane, Ashland College, and Henry C. Greene, curator, Cryptogamic Herbarium, University of Wisconsin, who were kind enough to provide the use of their herbarium facilities for this study; to John W. Thomson whose constructive criticism of the final draft was exceedingly helpful; and to Mrs. Katherine S. Snell, herbarium assistant, for untold favors and a cheerful disposition in the face of much adversity.

This work was supported during the school year 1957–58 and summer session 1958 by the Research Committee of the University of Wisconsin on funds from the Wisconsin Alumni Research Foundation. Their support is gratefully acknowledged.

ROSACEAE OF WISCONSIN

Annual or perennial herbs, shrubs, or trees with alternate, stipulate leaves; stipules sometimes caducous, rarely minute or wanting; flowers regular, perfect, perigynous or epigynous; sepals and petals 5, stamens few to numerous, usually in multiples of 5, all inserted at or near the margin of the hypanthium; pistils 1–many, distinct to united, superior to inferior; fruits pomes, achenes, follicles, or drupes, with or without enlarged hypanthium and/or receptacle, often subtended by a persistent calyx; embryo straight, with large and thick cotyledons.

KEY TO GENERA

1. Trees, shrubs, or woody vines.
   2. Ovary or ovaries inferior or apparently so, in flower concealed within the hypanthium with only the styles or the summit of the ovary protruding; in fruit, the achenes or seeds enclosed within the enlarged hypanthium, which usually bears the sepals, or traces of them, at its summit.
      3. Styles 2–5; ovary one, inferior, or ovaries 1–5, half inferior and free at apex; fruit a pome; flowers white or pinkish; trees or shrubs, with simple leaves (compound in *Sorbus* which can be distinguished from *Rosa* by absence of thorns); stipules deciduous.
         4. Branches almost invariably thorny, the thorns long stout modified twigs.
            5. Carpels in fruit very hard and bony, seed-like, enclosing the seeds; styles in flower distinct; ovule 1 in each cell; spines usually polished; bud scales fleshy, glabrous ---------- 15. *Crataegus.*
            5. Carpels in fruit cartilaginous and papery, easy to open and to expose the seeds within; styles in flower connate at base; ovules 2 in each cell; spines usually dull; bud scales not fleshy, pubescent ---- 12. *Pyrus.*
         4. Branches not thorny.
            6. Leaves odd-pinnate (deeply and irregularly lobed in hybrid with *Aronia*); inflorescence a large flat-topped compound cyme, 6–20 cm. across. 14. *Sorbus.*
            6. Leaves simple, serrate, or merely lobulate; flowers and fruits few, in sub-umbellate or racemose inflorescences, or in small irregular cymes which are usually less than 5 cm. broad.
               7. Leaves glandular along mid-rib on upper side; flowers 0.7–1.4 cm. broad, in irregular cymes, panicular or corymbose in arrangement ---------- 13. *Aronia.*

7. Leaves not glandular along the mid-rib; flowers 1.5–4.0 cm. broad, in racemes or umbel-like clusters.
   8. Ovary 2–5-celled; ovules 2 in each cell; flowers in small umbellate clusters (never racemose) frequently on spur branches; visible bud scales many, woolly; leaves with coarse serration ---------- 12. *Pyrus.*
   8. Ovary 6–10-celled by intrusion of a false septum; ovule 1 in each cell; flowers usually in racemes (clusters only in 1 species) at end of seasons growth; visible bud scales only 2, glabrous; leaves with fine serration ---------- 16. *Amelanchier.*

3. Styles numerous; ovaries apparently inferior, numerous, inserted on the bottom and sides of hypanthium; fruit of bony achenes inside a fleshy hypanthium; flowers white, yellow or pink; usually thorny shrubs with pinnate leaves; stipules usually adnate to the petiole for more than half their length, persistent ---------- 10. *Rosa.*

2. Ovary or ovaries (carpels) superior or apparently so; hypanthium in flower saucer-shaped to hemispheric, in fruit commonly subtended by remnants of calyx and in some genera more or less concealed by the incurved persistent calyx-lobes.
   9. Ovary 1; fruit a single, juicy, indehiscent drupe, 5–25 mm. in diam.; calyx deciduous, or in one species persistent; leaves simple, usually with glands on petiole 11. *Prunus.*
   9. Ovaries 2–many; fruit achenes, druplets or follicles, dehiscent or indehiscent, 2–5 mm. in diam.; calyx persistent in fruit; leaves simple or compound, without petiolar glands.
      10. Ovaries 2–5; fruit a dehiscent, nearly free follicle; leaves simple.
         11. Stipules or stipular scars present; leaves more or less lobed, palmately veined; mature carpels inflated, bladdery, splitting into 2 separate valves; seeds plump with crustaceous testa; stamineal disk wanting ---------- 1. *Physocarpus.*
         11. Stipules none; leaves entire or serrate, pinnately-veined; carpels not inflated, splitting on one side; seeds slender, with loose tests; staminal disk present ---------- 2. *Spiraea.*
      10. Ovaries many; fruits indehiscent drupes or achenes, inserted on convex to conic receptacle; leaves compound (except in some species of *Rubus*).

12. Bractlets 5, alternating with the calyx-lobes; calyx-lobes accrescent and enclosing fruits; achenes dry, on a mostly pubescent or hairy receptacle; flowers white, yellow or dark purple; plants never with prickles ---------- 6. *Potentilla.*

12. Bractlets none; calyx-lobes neither accrescent nor enclosing fruits; fruits fleshy druplets falling as a unit with or without spongy receptacle; flowers white, pinkish or rose-purple; plants often with straight or hooked prickles ---------- 8. *Rubus.*

1. Herbaceous plants (a few species, otherwise herbaceous, may have the basal leaves borne on a woody caudex).

13. Ovaries 2–6; fruits follicles, or achenes enclosed by an hypanthium (covered with hooked bristles in *Agrimonia*).

14. Leaves 3-foliolate, basal; fruit achenes enclosed within a membranous hypanthium; flowers yellow. ---------- 5. *Waldsteinia.*

14. Leaves pinnate, 5–13-foliolate, cauline and basal; fruit bristly or a thin-walled follicle; flowers white or yellow.

15. Shrubby herbs, 1–2 m. tall; flowers in a large panicle 1–3 dm. long; bracts or bractlets none; petals white; calyx-lobes soon reflexed; fruit a thin-walled follicle, dehiscent on both the ventral and dorsal sutures ---------- 3. *Sorbaria.*

15. Perennial herbs to 1.5 m. tall; flowers in long interrupted spike-like racemes, the short peduncles subtended by laciniate bracts, the very short pedicels by a pair of 3-lobed bractlets; petals yellow; hypanthium indurate and 10-grooved at maturity, armed with hooked bristles; calyx-lobes connivent toward the summit forming a beak on the fruit; fruits achenes ---------- 9. *Agrimonia.*

13. Ovaries numerous; in fruit achenes or drupes in a head or inserted on a convex to conic receptacle (sometimes fleshy).

16. Leaves simple, or palmately 3–5-foliolate.

17. Plants usually prickly; fruit a head of pulpy juicy drupes; flowers without bractlets; leaves simple or usually palmate ---------- 8. *Rubus.*

17. Plants not prickly; fruits dry achenes (on pulpy receptacle in *Fragaria*); leaves compound.

18. Receptacle enlarged in fruit and conical, becoming pulpy and usually scarlet; leaves 3-foliolate, all basal; plants rarely more than 20–25 cm. tall, spreading by runners ------ 4. *Fragaria.*

18. Receptacle dry and pubescent in fruit; leaves 3–5-foliolate, basal and/or cauline; plants rarely less than 3 dm. tall, if so, leaflets with only 3 teeth at apex or white-tomentose beneath; only a few species spreading by runners 6. *Potentilla.*

16. Leaves pinnate, with up to 20 leaflets.

19. Styles filiform, at maturity either greatly elongating and conspicuously hooked after terminal joint has fallen, or plumose; calyx-lobes commonly reflexed at maturity; leaflets very irregular in size and shape ---------- 7. *Geum.*

19. Styles short and inconspicuous, at maturity not greatly elongated, often deciduous; calyx-lobes ascending and enclosing head of achenes; leaflets uniform in shape ---------- 6. *Potentilla.*

1. PHYSOCARPUS Maxim. Ninebark.

1. P. OPULIFOLIUS (L.) Maxim. Maps 1, 2.

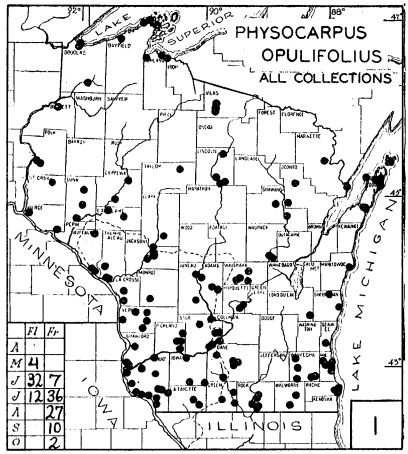
Shrub 1–3 m. high, the old bark loose and separating into numerous thin layers; leaves simple, ovate to obovate, 3-lobed, irregularly serrate; flowers in umbel-like corymbs; hypanthium shallowly cup-shaped; calyx 5-lobed, glabrous to tomentose, persistent in fruit; petals 5, white; stamens 30–40; pistils 1–5, inflated into 2-valved follicles in fruit; follicles pale brown, glabrous, or in var. *intermedius* (Rydb.) Robins. permanently pubescent; ovules 2–4; seeds shiny, hard, with endosperm.

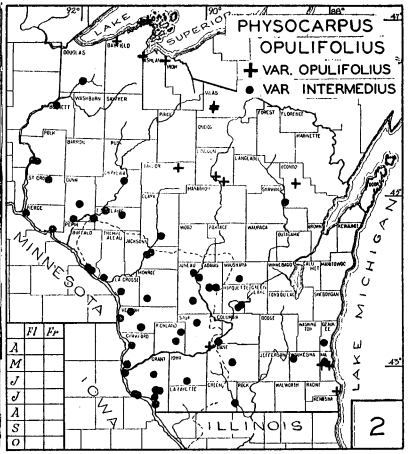
Common over the state from very dry to very wet, usually open habitats, in woods of maple or oak, limestone bluffs, sandstone cliffs, prairies with limestone out-crops, rocky goat prairies, roadsides, river banks, sandy shores, sedge meadows, bogs and marshes. Flowers last of May through July.

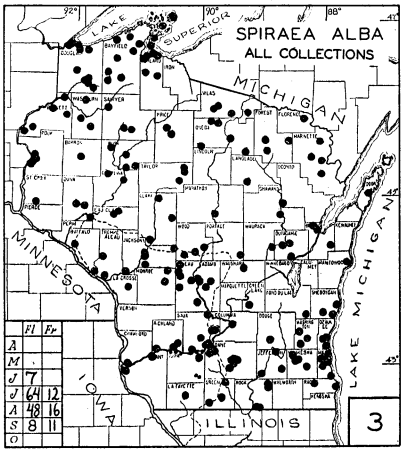
Map 1 shows the distribution of all collections, map 2 the distribution of all specimens that had mature fruits and that could be scored as to pubescence extremes. It is evident that completely glabrous fruited plants (map 2) are more common in the northern part of Wisconsin than those with sparsely to densely pubescent fruits.

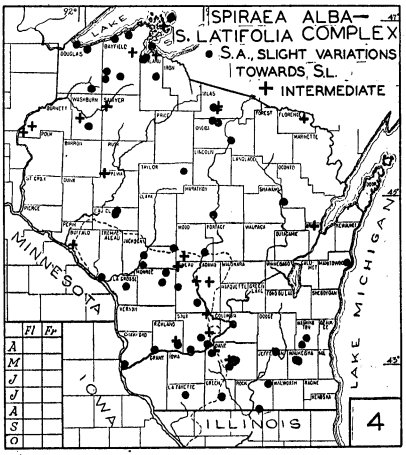
2. SPIRAEA L. Spiraea.

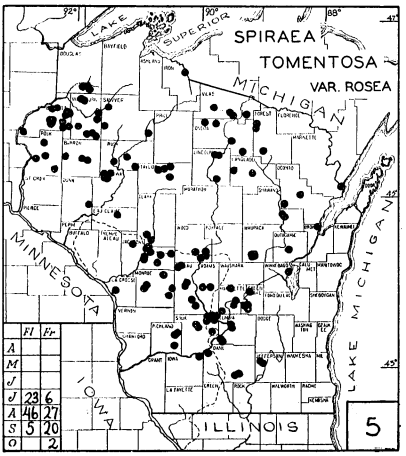
Shrubs with simple leaves; flowers white, rose, or dark pink, in elongate panicles (corymbs in introduced species); hypanthium cup-shaped; calyx 5-cleft, persistent; petals 5; stamens 10–50; pistils commonly 5, alternate with calyx-lobes; follicles 3–5, firm in texture, dehiscent along 1 suture; seeds linear, with a thin or loose coat.

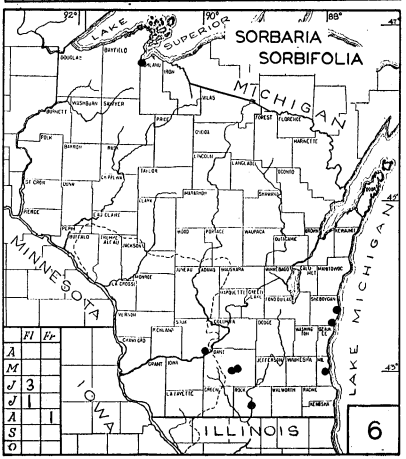

PHYSOCARPUS
OPULIFOLIUS
ALL COLLECTIONS
LAKE SUPERIOR
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 4
J 32 7
J 12 36
A 27
S 10
O 2
1


PHYSOCARPUS
OPULIFOLIUS
+ VAR. OPULIFOLIUS
• VAR. INTERMEDIUS
LAKE SUPERIOR
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J
J
A
S
O
2


SPIRAEA ALBA
ALL COLLECTIONS
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J 7
J 64 12
A 48 16
S 8 11
O
3


SPIRAEA ALBA—
S. LATIFOLIA COMPLEX
• S.A., SLIGHT VARIATIONS
TOWARDS S.L.
+ INTERMEDIATE
LAKE SUPERIOR
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J
J
A
S
O
4


SPIRAEA
TOMENTOSA
VAR. ROSEA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J
J 23 6
A 46 27
S 5 20
O 2
5


SORBARIA
SORBIFOLIA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J 3
J 1
A 1
S
O
6

1. Leaves green on both sides; flowers white, 5–8 mm. wide; follicles glabrous; calyx-lobes spreading; hypanthium finely pubescent to glabrous ---------- 1. *S. alba.*
1. Leaves densely white to brown tomentose beneath; flowers pink or rose, rarely white, 2–4 mm. wide; follicles pubescent; calyx-lobes reflexed; hypanthium densly tomentose--- 2. *S. tomentose.*

1. S. ALBA DuRoi. Meadow-sweet. Map 3, 4.

Erect shrub, with slender brown twigs; leaves narrowly to broadly oblanceolate, 3–6 cm. long, finely and sharply serrate, glabrous or nearly so; inflorescence, hypanthium and calyx-lobes finely pubescent; flowers 5–8 mm. wide, white; follicles glabrous.

Common over the state in wet habitats: sandy and boggy shores, low meadows, sedge marshes, bogs, swamps, woods, roadsides, as well as sand barrens, prairies, and along railroads. Flowering mid-June through September.

Agnes Kugel, University of Michigan (personal communication), found that, while true *S. latifolia* (Ait.) Borkh. does not occur in Wisconsin, many of the Wisconsin collections did show indication of introgression by *S. latifolia*; namely, they have leaves that are broader and more obovate, and with deeper more irregular serrations than typical *S. alba*, and have reddish to purplish-brown twigs. Map 4 shows those plants of the *S. alba-S. latifolia* complex varying only slightly towards *S. latifolia* (dots), as well as those that are intermediate in one to several characters (crosses).

S. VANHOUTTEI (Briot) Zab. Bridal Wreath.

Of hybrid origin, commonly planted in southern Wisconsin and an occasional escape. It has white flowers in umbellate corymbs, densely arranged on the branches.

2. S. TOMENTOSA L. var. ROSEA (Raf.) Fern. Hardhack; Steeplebush. See Salamun (1951). Map 5.

Shrub; leaves ovate, oblong to lanceolate, 3–5 cm. long, irregularly serrate, densely tomentose and pronouncedly veined beneath; inflorescence, hypanthium, and sepals tomentose; flowers 2–4 mm. wide, pink or rose, rarely white; follicles pubescent to glabrate.

Common over the state on sandy, grassy and rocky shores, low and sedge meadows, heath marshes, swampy ground, abandoned fields and roadsides. Flowering all summer.

3. SORBARIA R. Br. False Spiraea.

1. S. SORBIFOLIA (L.) A. Br. Map 6.

Nearly herbaceous shrub, the younger parts covered with a flocculent, deciduous stellate tomentum; leaves stipulate, 1–4 dm. long, pinnate, 13–21-foliolate, the leaflets lance-oblong, sessile, sharply

serrate; inflorescence a pyramidal terminal panicle with small flowers; petals 5, 2–3 mm. long, white; pistils 5, opposite sepals; fruit a thin-walled follicle, dehiscent on both dorsal and ventral sutures.

Native of Asia, cultivated and occasionally escaped. Flowering June and July.

4. FRAGARIA L. Strawberry.

Perennial herbs, usually spreading by runners; leaves basal, 3-foliolate, serrate; peduncles scape-like, bearing few to several flowers; hypanthium saucer-shaped; sepals 5, with 5 alternating bracts; petals 5, white; stamens numerous, sometimes abortive, the filaments short, dialated at base; pistils numerous, the styles slender, inserted laterally on the ovary; receptacle in fruit much enlarged, becoming pulpy, usually scarlet, bearing the minute dry achenes scattered over or slightly imbedded in its surface.

1. Leaf-teeth ascending, the terminal one commonly smaller than the lateral ones; inflorescence with (1–)3–18 flowers, umbelliform or a rounded to flattish cyme with subequal primary branches, usually shorter than the leaves even at maturity; calyx-lobes appressed or connivent about the young fruit; achenes set in pits on mature receptacle; petals 4–10 mm. long ---------- 1. *F. virginiana.*

1. Leaf-teeth sharply divergent, the terminal one commonly projecting beyond the adjacent lateral ones; inflorescence with 1–4 (–7) flowers, soon racemose or irregularly racemiform, the primary branches of cyme quite unequal, the leading one prolonged as the axis of a raceme, at maturity usually rising above the leaves; calyx-lobes loosely spreading or reflexed about the young fruit; achenes superficial on the mature receptacle; petals 3–7 mm. long ---------- 2. *F. vesca.*

1. F. VIRGINIANA Duchesne. Strawberry. Map 7.

Leaflets thin, with more or less ascending, less divergent teeth than those in *F. vesca*; flowers on pedicels of approximately uniform length, forming a corymbiform cluster usually shorter than the leaves at maturity; calyx-lobes appressed about young fruit; petals 3–10 mm. long, white or pink (forma *maliflora* Haynie); fruit subglobose to ovoid, juicy; achenes in pits.

According to Gleason there are 5 varieties, 2 of which grow in Wisconsin. "Var. *virginiana.* Pubescence of the peduncle spreading; inflorescence 1–2 m. tall; fruit broadly ovoid to subglobose. Dry upland woods, rarely on prairies," and var. *illinoensis* (Prince) Gray. "Pubescence of the pedicels copious, widely spreading. . . . Dry upland woods and prairies . . . intergrading with var. *vir-*

giniana. . . ." These, as the varieties of *F. vesca,* are difficult to tell, and have not been mapped separately.

Very common in Wisconsin in oak, poplar, maple, basswood, beech, hemlock, elm, spruce, red and white pine woods, also wooded riverbanks, meadows, roadsides, railroads, sphagnum bog with *Larix,* black spruce, balsam fir, white cedar, sand beaches, limestone cliffs, "goat prairies", old fields, and marshes. Flowers end of April through June.

2. F. VESCA L. Woodland Strawberry. Map 8.

Leaflets nearly or quite sessile, ovate to obovate, the teeth sharp and rather divergent; peduncles at anthesis usually shorter than the leaves, exceeding them at maturity; calyx-lobes spreading, reflexed about fruit; petals 3–7 mm. long, white or pink in forma *rosea* Rostrup; fruit red, or yellowish-white in forma *alba* (Ehrh.) Rydb., rather dry; achenes superficial.

Gleason recognizes two varieties, both growing in Wisconsin: "var. *vesca.* Petioles and peduncles more or less villous with spreading or somewhat reflexed hairs; fruit commonly ovoid to subglobose. Along roadsides in fields and upland woods," "var. *americana* Porter. Petiole and peduncles thinly pubescent with ascending hairs; fruit commonly slenderly ovoid or ellipsoid. Cool woods," These varieties are difficult to tell and have not been mapped separately.

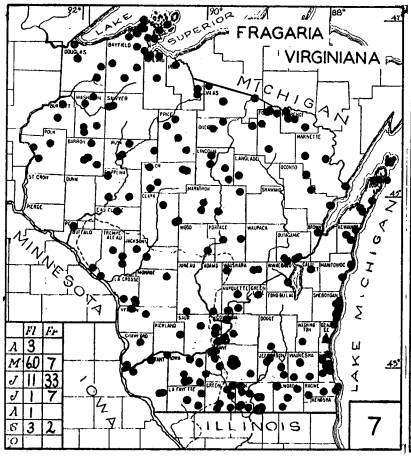
Found over the state in a great variety of woods of oak, pine, juniper, hemlock-maple-elm, birch, basswood-maple-elm-birch, beech-hemlock-pine-aspen, also pastures, rock ledges and wet meadows. Flowers May and June.

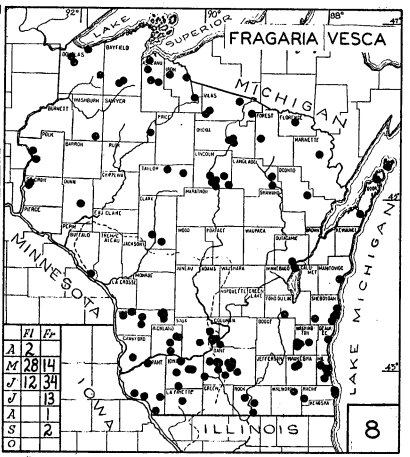
5. WALDSTEINIA Willd. Barren Strawberry.

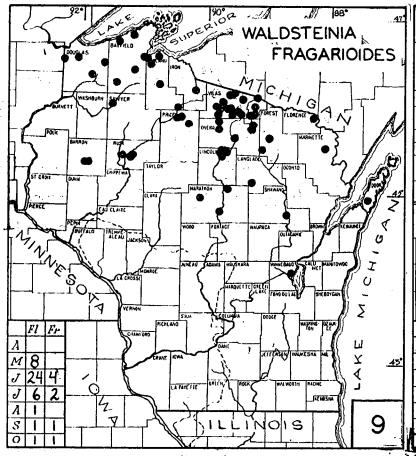
1. W. FRAGARIOIDES (Michx.) Tratt. Map 9.

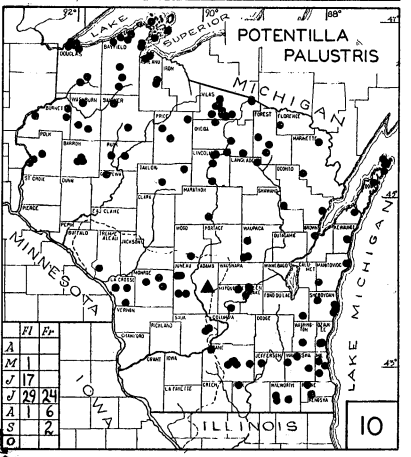
Perennial rhizomatous herb, with the aspect of *Fragaria,* but with the 3 leaflets broadly cuneate-obovate, serrate with numerous broad teeth and commonly shallowly and irregularly lobed, the lateral leaflets asymmetrical; scapes several-flowered, the cyme-axis often elongating after anthesis and the cluster becoming racemiform; hypanthium obconic with mouth contracted by a conspicuous disk; calyx-lobes 5, the minute bractlets deciduous; petals 5, yellow, 5–10 mm. long; stamens numerous, persistent after anthesis; pistils 2–6, inserted on a hairy receptacle; styles terminal, soon deciduous; ovule 1; fruit an achene.

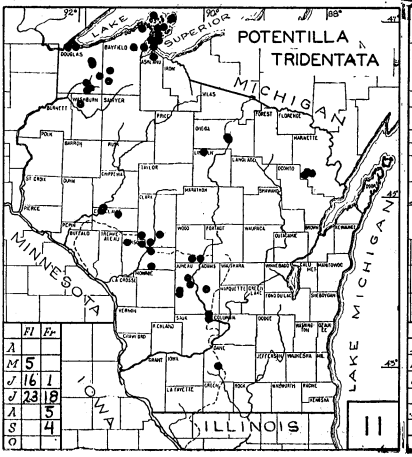
Rare, found only in the northern part of state, in coniferous, dry or moist wooded habitats as jack, white, or red pine, hemlock-sugar maple, birch, poplar. Flowers May through July.

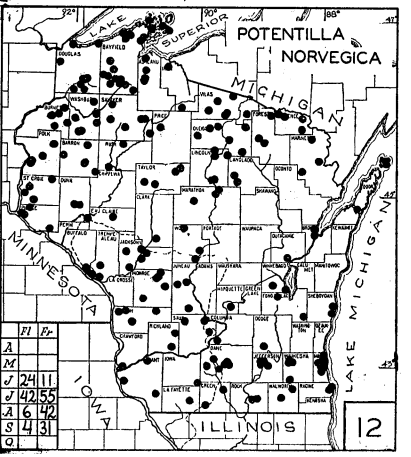

FRAGARIA
VIRGINIANA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A 3
M 60 7
J 11 33
J 1 7
A 1
S 3 2
O
7


FRAGARIA VESCA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A 2
M 28 14
J 12 34
J 13
A 1
S 2
O
8


WALDSTEINIA
FRAGARIOIDES
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 8
J 24 4
J 6 2
A 1
S 1 1
O 1
9


POTENTILLA
PALUSTRIS
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 1
J 17
J 29 24
A 1 6
S 2
O
10


POTENTILLA
TRIDENTATA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 5
J 16 1
J 23 18
A 5
S 4
O
11


POTENTILLA
NORVEGICA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J 24 11
J 42 55
A 6 42
S 4 31
O
12

6. POTENTILLA L. Cinquefoil; Five-Finger.

Herbs or small shrubs; leaves compound, stipulate; hypanthium saucer-shaped to hemispheric; calyx-lobes 5, alternating with 5 bractlets; petals 5, white, yellow or purple; stamens 5–many, commonly 20, inserted on margin or inner surface of the hypanthium; pistils commonly numerous, rarely as few as 10; styles slender, terminal to nearly basal, articulated with the ovary and easily detached at maturity; fruit (achenes) usually enclosed by calyx.

1. Corolla dark reddish-purple, 10–25 mm. wide; calyx-lobes twice as long as petals; leaves pinnate; leaflets 5–7, sharply serrate, 3–9 cm. long; wet boggy habitats ---------- 1. *P. palustris.*
1. Corolla white to yellow.
   2. Principal leaves below inflorescence 3-foliolate.
      3. Flowers white, 6–10 mm. wide; leaflets narrow, cuneate, 3-toothed at apex, otherwise entire; low suffrutescent perennials, usually less than 3 dm. tall --- 2. *P. tridentata.*
      3. Flowers yellow, 5–15(–20) mm. wide; leaflets oblanceolate to obovate, crenately toothed nearly to base; erect annuals, often more than 3 dm. tall ---------- 3. *P. norvegica.*
   2. Principal leaves below inflorescence 5–20-foliolate; perennials.
      4. Leaves digitately (palmately) compound, leaflets 5–7; flowers yellow.
         5. Plants weak, with long, slender stolons, these often rooting at the nodes; flowers 10–15 mm. wide, solitary on naked peduncles from stem-nodes; leaflets sparsely strigose or sericeous, green beneath ---- 4. *P. simplex.*
         5. Plants erect, not rooting at the nodes; flowers several to many, in terminal cymose inflorescences.
            6. Leaflets white-tomentose beneath, 1–3 cm. long; flowers 6–10 mm. wide ---------- 5. *P. argentea.*
            6. Leaflets green on both sides, 4–9 cm. long; flowers 10–25 mm. wide ---------- 6. *P. recta.*
      4. Leaves pinnately compound, leaflets 5–20; flowers white to yellow.
         7. Small, woody, twiggy shrubs; flowers yellow, 10–22 mm. wide; leaflets 5–7, entire, about 1–2 cm. long ---------- 7. *P. fruticosa.*
         7. Herbaceous perennials, rarely woody at base; leaflets toothed.
            8. Leaflets 15–20, densely white-tomentose beneath; flowers 15–25(–30) mm. wide; low plants with long stolons, of moist, sandy habitats ---- 8. *P. anserina.*

8. Leaflets 5–11, densely glandular-villous, but green on both sides; flowers white to pale yellow, 12–20 (–25) mm. wide; erect, strict plants of dry prairies ---------- 9. *P. arguta.*

1. P. PALUSTRIS (L.) Scop. Marsh-five-finger. Map 10.

Comarum palustre L.

Rather robust ascending or decumbent perennial from semi-woody reddish-brown rhizomes 2–6 dm. long; leaves pinnate; leaflets 5–7, glabrous to densely sericeous; inflorescence leafy; flowers red-purple, 10–20 mm. wide, the calyx-lobes twice as long as petals; achenes smooth; upper part of stem strigose and obscurely glandular to villous and densely glandular; the latter, when coupled with sericeous leaves, has been called var. *villosa* (Pers.) Lehm.

Locally over the state except in the extreme southwest, in wet ground or shallow standing water, along lakes and rivers, sandy or muddy shores, swamps, marshes, and in sphagnum bogs. Flowering June and July, fruiting July to October.

2. P. TRIDENTATA Soland. Three-toothed Cinquefoil Map 11.

Perennial, with long prostrate stems woody at base; leaves mostly basal, digitate; leaflets 3, cuneate, 3-toothed at summit; flowers white, 6–10 mm. across, several in a flattened cyme; achenes villous.

A northern species, reaching its southern limit in Wisconsin, where rather rare on open sandy ground as shores and beaches, roadsides, prairies, woods (jack pine), railroads, and sandstone ledges. The distribution of the species (map 11) is similar to that shown on any map showing sandy soil in Wisconsin. Flowering May through June.

3. P. NORVEGICA L. Map 12.

Slender to stout, leafy and commonly much branched stems with hirsute and spreading hairs; leaves 3-foliolate, the leaflets up to 8 cm. long, coarsely serrate; flowers yellow, 5–15 mm. wide, the petals shorter than calyx-lobes; mature achenes flattened, with curved longitudinal ridges.

Var. *hirsuta* (Michx.) T. & G. has been used to designate native plants. All those in Wisconsin seem to be of this variety which, when recognized as a distinct species, has been called *P. monspeliensis* L.

Very common throughout, in a variety of waste or disturbed habitats, as roadsides, railroad embankments, pastures, hillsides, woods, dry fields, creek banks, sand bars, lake shores, sedge meadows and edges of bogs; flowers June through September.

P. intermedia L. can be distinguished from *P. norvegica* by its primary leaves with 5 instead of 3 leaflets (cf. notes under *P. recta*).

P. rivalis Nutt. is reported for Wisconsin by Fernald, though no specimens were seen by the author. Mature achenes are smooth rather than ridged as in *P. norvegica*.

4. P. SIMPLEX Michx. Old-field Cinquefoil. Map 13.

Stems erect or ascending, soon becoming prostrate; leaves palmate, leaflets 5; flowers yellow, solitary from most well-developed internodes, 10–16 mm. wide. Plants with stem, petioles, etc. glabrous or appressed-strigose have been called var. *calvescens* Fern., and occur scattered throughout Wisconsin.

Common over the state, especially in the southern half, on prairies, roadsides, railroad right-of-ways, open abandoned sandy fields, pine, oak and maple woods, hills and bluffs. Flowering May through June, fruiting June through August.

The eastern *P. canadensis* L., with which this species is often confused, does not grow in Wisconsin, though Rydberg (1908) reports it from here.

5. P. ARGENTEA L. Silvery Cinquefoil. Map 14.

Perennial, woody at base with several to many depressed or ascending stems; leaves digitate, with 5–6 leaflets, white-tomentose beneath, cuneate, with 2–4 deeply incised linear teeth above the middle, margins revolute; flowers yellow to pale yellow, 7–10 mm. wide; petals shorter and often hidden by calyx; achenes nearly smooth.

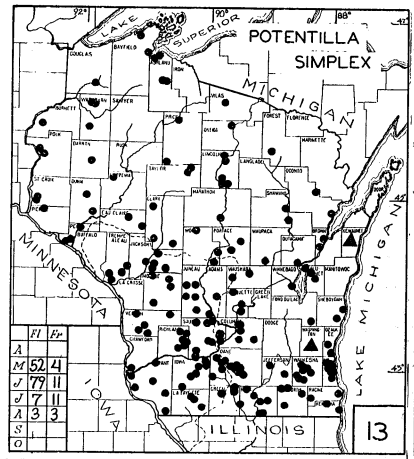
Introduced from Europe and now common in dry disturbed habitats: roadsides, stream banks, lake shores, open, abandoned fields, pastures, dry sandy prairies, and thinly wooded areas. Flowers and fruits all summer.

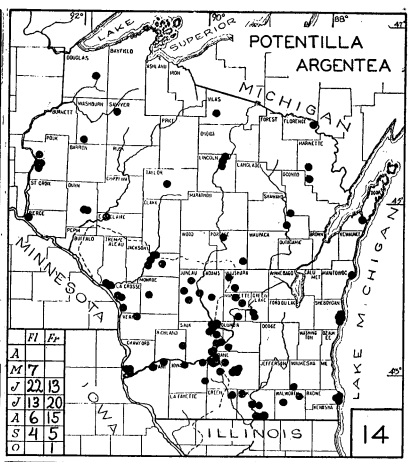
6. P. RECTA L. Map 15.

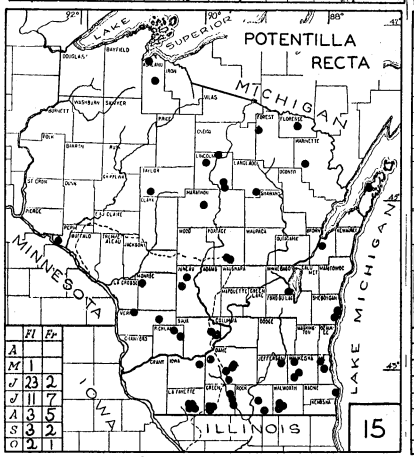
Perennial with erect stems, simple to inflorescence; leaves palmate; leaflets 5–7, hirsute on both sides; inflorescence flattened, the many showy yellow flowers 10–25 mm. across; mature calyx 0.8–1.5 cm. high, with long stiff divergent hairs; mature achenes with curved ridges.

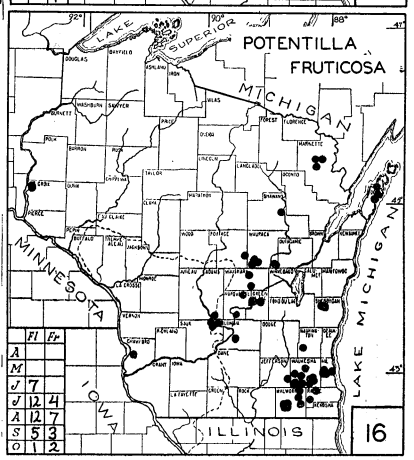
Native of Europe, in Wisconsin in the southern ⅔ of the state, in dry and sterile soil of roadsides, railroad yards, field, wooded and grassy areas; flowers from June to October.

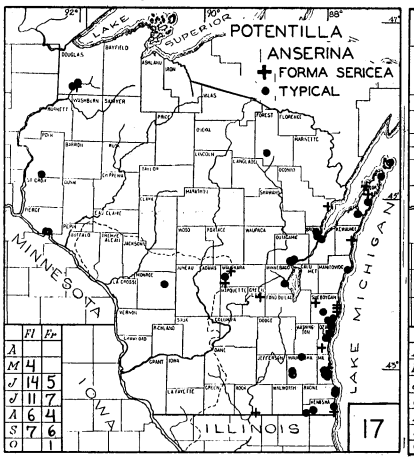
P. flabelliformis Lehm. is similar to *P. recta* but has smooth achenes and appressed or strongly ascending finer petiole hairs. Native farther west, occasionally in Minnesota and Keweenaw

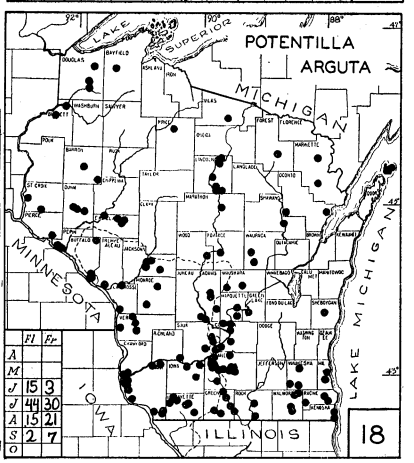

POTENTILLA
SIMPLEX
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 52 4
J 79 11
J 7 11
A 3 3
S
O
13


POTENTILLA
ARGENTEA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 7
J 22 13
J 13 20
A 6 15
S 4 5
O 1
14


POTENTILLA
RECTA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 1
J 23 2
J 11 7
A 3 5
S 3 2
O 2 1
15


POTENTILLA
FRUTICOSA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J 7
J 12 4
A 12 7
S 5 3
O 1 2
16


POTENTILLA
ANSERINA
+ FORMA SERICEA
• TYPICAL
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 4
J 14 5
J 11 7
A 6 4
S 7 6
O 1
17


POTENTILLA
ARGUTA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M
J 15 3
J 49 30
A 15 21
S 2 7
O
18

Point, Michigan, in Wisconsin collected by C. Goessl: "Sept. 27, 1915 Rib Lake, Taylor Co., along a R. R." (WIS) and "Aug. 2, 1915 Prentice, Price Co., a colony on R. R. land, from 1–3 tall" (MIL). Both collections were identified by D. D. Keck (1958).

P. intermedia L. is similar to *P. recta* but with a much branched inflorescence; smaller flowers (8–10 mm. broad); finely appressed-villous mature calyx only 5–8 mm. high, and 5, rarely 7, leaflets gray villous to minutely tomentose beneath. Introduced from Europe, and reported as far west as Michigan, it has been collected once in Wisconsin by C. Goessl, "Sandy waste place, large colony, Aug. 26 and Aug. 30, 1916, Marinette, Marinette Co."

7. P. FRUTICOSA L. Shrubby Cinquefoil; Golden Hardhack. Map 16.

Low shrub with shredding brown bark; leaves pinnate; leaflets 5–7, usually less than 5 mm. wide, entire, the terminal 3 often confluent at the base; flowers solitary or few, bright yellow, 10–25 mm. wide; achenes villous. Variable, especially in pubescence; our only truly woody species.

Locally in southeast ¼ of state, rare elsewhere, in wet places as sedge meadows, bogs, swamps, marshes, along creeks, lakes, and on edges of cliffs; flowering June to September.

8. P. ANSERINA L. Silverweed; Argentine. Map 17.

Perennial with long slender stolons, rooting at the nodes; leaves from a basal rosette, pinnate; leaflets 11–23 white-silky tomentose beneath; flowers yellow, 15–25 mm. wide, solitary on long naked peduncles; achenes furrowed.

The upper side of the leaflets may vary from glabrous to more or less sericeous (in forma *sericea* (Hayne) Hayek). According to Gleason (1952) pubescence is apparently correlated with dry environment. In Wisconsin both forms are about equally common often occurring together and with intermediate types. Even on the same plant the mature leaves may be glabrous while the young ones, especially those on the stolons, may be strongly sericeous.

On moist to wet sandy and pebbly lake or river shores, especially common on Lake Michigan, occasionally in waste places, railroad embankments, and in damp woods; flowering and fruiting June through September.

9. P. ARGUTA Pursh. Tall Cinquefoil. Map 18.

Coarse, visid-pubescent perennial with stout rhizome; stem usually one, erect, strict, unbranced to inflorescence; leaves pinnate; leaflets 5–11, oblanceolate to obovate, serrate; flowers white to pale yellow, 10–20(–25) mm. wide, the inflorescence crowded; calyx-lobes as long as or shorter than the petals; achenes finely striate.

Common on dry, open ground, in low, mesic, and sand prairies, especially common on the high lime "goat prairies" (Curtis and Greene, 1949), pastures, and often on bluffs (granite or limestone outcrops), open woods, and along roadsides and R. R. right-of-ways. Flowers June through August.

FILIPENDULA Adans.

1. F. RUBRA (Hill) Robins. Queen-of-the-Prairie.

Has been collected once by an unknown collector (J. T. Hale?) in August 1865, at Mazomanie, Dane County (Wisconsin). Whether this specimen was cultivated or native is not known. Since this is an exceedingly well collected area, the lack of further collections would seem to indicate that this plant was cultivated.

7. GEUM L. Avens.

Perennial rhizomatous herbs; foliage variable, the lower leaves pinnate, the cauline smaller, commonly trifoliolate, the upper often simple; bractlets present in most species, linear-oblong; petals elliptic to obovate, shorter or longer than calyx-lobes, white, yellow sometimes suffused with red; stamens 10–many; ovaries numerous on an elongate cylindric receptacle; styles filiform; fruit an achene; upper portion of the long, usually jointed, persistent style often deciduous.

1. Fruiting style essentially straight, not obviously jointed or hooked, 4–9 cm. long, conspicuously plumose, the achenes dispersed by wind; bractlets linear 10–15 mm. long, the shorter calyx-lobes 7–10 mm. long; petals yellow, sometimes purplish; plants usually 15–40 cm. tall, of open, sandy areas ---------- 1. *G. triflorum.*

1. Fruiting style jointed above the middle, the terminal portion readily detached, the basal portion hooked at tip, less than 1 cm. long, plumose to glabrous, the achenes dispersed as "stick-tights"; bractlets lanceolate to deltoid, 2–4 mm. long, shorter than the 2–8 mm. long calyx-lobes; petals yellow or white; plants generally over 45 cm. tall, of mesic to moist habitats.

   2. Flowers nodding at anthesis; calyx purple, its lobes 6–10 mm. long; petals yellow with purple veins, obcordate, 6–10 mm. long; head of mature fruit raised above calyx on a distinct stalk (gynophore) 5–8 mm. long ---------- 2. *G. rivale.*

   2. Flowers erect at anthesis; calyx green, its lobes 3–8 mm. long; petals yellow or white, oblong to suborbicular; head of mature fruit sessile.

3. Styles glabrous or pubescent, never glandular; petals white to yellow, longer to shorter than calyx; denuded fruiting receptacle glabrous or pubescent.
   4. Denuded receptacle glabrous or essentially so; pedicel usually copiously pubescent to the naked eye, the hairs all long; petals white (yellowish when dry), 3–5 mm. long, equal to or shorter than the calyx (5–8 mm.) ---------- 3. *G. laciniatum.*
   4. Denuded receptacle pubescent; pedicel sparsely pubescent to the naked eye, the pubescence of many short and scattered long hairs (under 10X); petals white to yellow, equal to or longer than the calyx.
      5. Petals white, oblong, 5–8 mm. long, 2–4 mm. wide; calyx-lobes 3–6 mm. long; head of mature fruits subglobose, 5–10 mm. long; achenes few, 30–80 ---------- 4. *G. canadense.*
      5. Petals yellow, suborbicular to broadly obovate, 4–8 mm. long, 4–8 mm. wide; calyx-lobes 4–8 mm. long; head of mature fruits obovoid, 15–20 mm. long; achenes many, 130–200 ---------- 5. *G. aleppicum.*
3. Style minutely glandular-pubescent; petals yellow, somewhat exceeding calyx-lobes; denuded fruiting receptacle glabrous to short hispid; rare, in northern-most Wisconsin ---------- 6. *G. macrophyllum.*

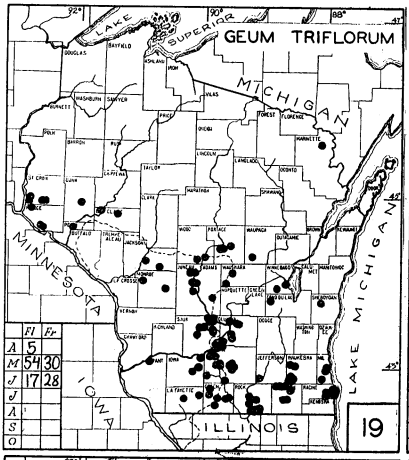
1. G. TRIFLORUM Pursh. Prairie Smoke. Map 19.

Stems 1–5 dm. tall, pubescent throughout; basal leaves ca. 1–2 dm. long, pinnate, the leaflets 7–17, irregularly laciniate or lobed, the terminal leaflet similar and scarcely larger; cauline leaves few, very small, laciniate; flowers nodding; calyx-lobes red-purple, 7–10 mm. long, shorter than the linear 10–15 mm. long bractlets; petals yellow, suffused with purplish-red, 8–12 mm. long; fruiting styles 4–9 cm. long, plumose except the very tip; fruiting heads erect.

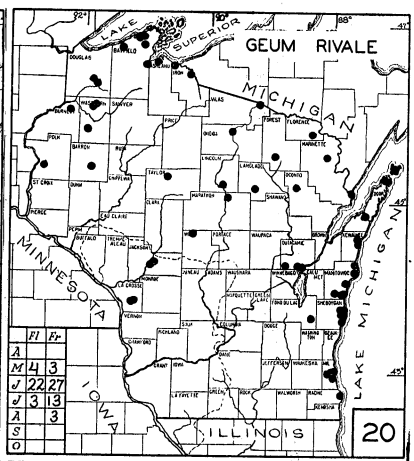
Common over lower half of state on dry hillside prairies, jack pine barrens, sandy prairie relicts, open sandy ridges and bluffs of exposed sandstone, on poor dry soil of roadsides, open fields, and pastures, occasionally on moist meadows and marshes. Flowering April through June.

2. G. RIVALE L. Water-; Purple Avens. Map 20.

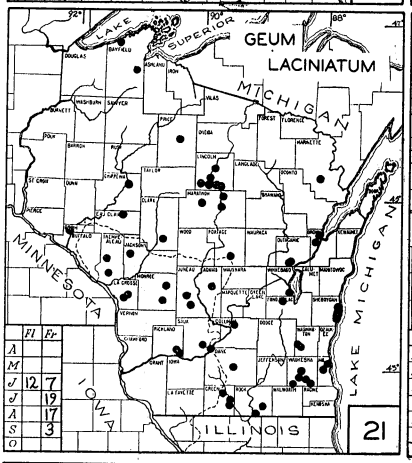
Stems 3–7 dm. tall, sparsely hirsute; basal leaves to 4 dm. long, the principal leaflets 1–3(–5), serrate, more or less 3-lobed, the lateral ones few to many, much smaller; cauline leaves always much smaller, gradually reduced above, variously toothed and lobed or



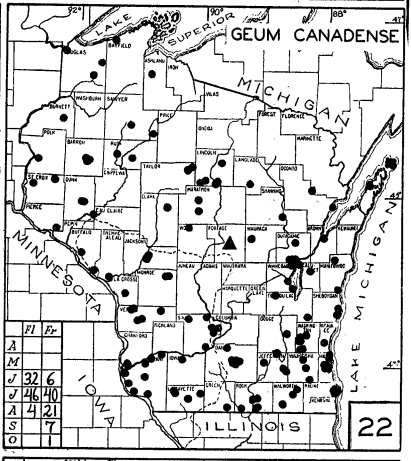
	Fl	Fr
A	5	
M	54	30
J	17	28
J		
A		
S		
O		



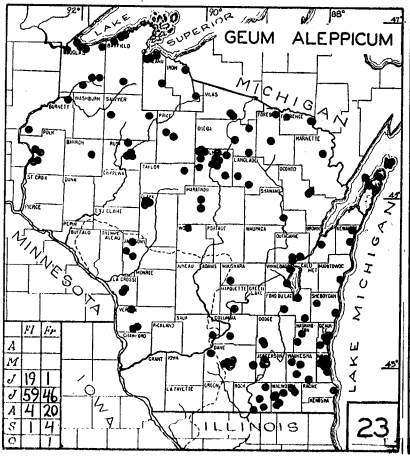
	Fl	Fr
A		
M	4	3
J	22	27
J	3	13
A		3
S		
O		



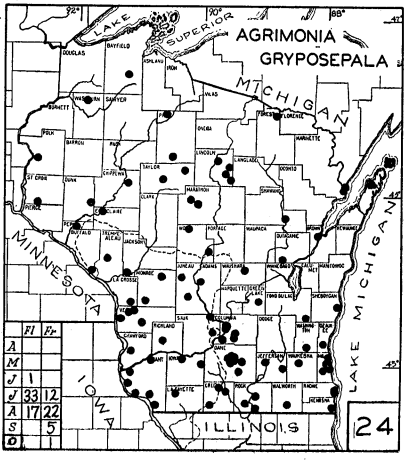
	Fl	Fr
A		
M		
J	12	7
J		19
A		17
S		3
O		



	Fl	Fr
A		
M		
J	32	6
J	46	40
A	4	21
S		7
O		



	Fl	Fr
A		
M		
J	19	1
J	59	46
A	4	20
S	1	4
O		1



	Fl	Fr
A		
M		
J	1	
J	33	12
A	17	22
S		5
O		1

divided; flowers nodding; sepals purple ascending triangular, enlarging after anthesis, 7–10 mm. long; bractlets linear, 3–4 mm. long; petals yellowish, purple-veined, 6–10 mm. long, rounded to truncate, usually shorter than the calyx-lobes; mature achenes and persistent lower half of styles hirsute; styles recurved; achene head elevated above calyx on a 5–8 mm. long stalk (gynophore).

In the northern ⅔ of the state and along Lake Michigan, in *Alnus* or *Thuja* swamp woods, sphagnum bogs with tamarack and black spruce, marshy meadows, moist ground of lake shores and borders of marshes. Flowering end of May through first of July.

3. G. LACINIATUM Murr. Map 21.

Stem 4–10 dm. tall, hirsute with mostly reflexed hairs; basal leaves long-petioled, with a large simple rounded terminal leaflet or with several deeply incised pinnate leaflets; cauline leaves simple, lobed or 3-parted, strongly toothed or incised; petals white, 3–5 mm. long, equal to or shorter than the 5–8 mm. long calyx-lobes; head of achenes subglobose, 12–20 mm. long; receptacle glabrous or with few bristles; achenes (excluding style) 3–5 mm. long, glabrous, or in var. *trichocarpum* Fern. sparsely hirsute. All Wisconsin plants are of this variety.

Locally over the state in rich deciduous woods, moist prairies, wet meadows, mud banks of rivers and streams, bogs, marshes and swamps. Flowering late May through June.

4. G. CANADENSE Jacq. Map 22.

Stems slender, 4–9 dm. tall, glabrescent to sparsely pubescent below, minutely but densely velvety puberulent above, the pedicels in addition often with a few scattered elongate hairs; basal leaves long-petioled, usually 3-foliolate, with oblong-lanceolate to rhombic, serrate to incised leaflets, the cauline leaves mostly simple, subsessile, lanceolate; petals white, 5–8 mm. long, about as long as the 3–6 mm. long calyx-lobes or distinctly exceeding them; head of achenes subglobose, 10–15 mm. in diam.; receptacle densely bristly, the hairs protruding among the ovaries at anthesis, but shorter than mature achenes; mature achenes (excluding style) 2.5–3.5 mm. long.

Fernald's (1950) 4 varieties and 2 forms are "based on the kind and amount of pubescence on the style, sepals, and pedicels and the number of achenes, and (are) scarcely worthy of taxonomic recognition." (Gleason, 1952)

Over the state in dry or wet, open or dense deciduous woods, of oak, hickory, maple, basswood, elm, hemlock or aspen, in low wet boggy soils, pastures, sedge meadows, swamps, edges of bogs, and ravines. Flowering late May through July.

5. G. ALEPPICUM Jacq. Map 23.

Stems robust, 5–13 dm. tall, very hirsute, especially below; leaves variable, the basal ones with a large, rounded or variously divided terminal leaflet and/or with up to 5–9 incised obovate or oblanceolate leaflets; cauline leaves with 3–5 acute, mostly incised to deeply cut rhombic-ovate to oblong leaflets; petals yellow, 4–8 mm. long, as long as or longer than calyx-lobes; fruiting heads obovoid, 15–20 mm. long; achenes ca. 130–190, hispid, 2–4 mm. long (excluding the style), the receptacle pubescent with short hairs.

Our plants, to distinguish them from the European ones, are referred to as var. *strictum* (Ait.) Fern.

Common over the state, usually in damp or wet places, either in the open or in woods, often in marshes, sedge-grass and haying meadows, low prairies, alder swamps, as well as in mixed woods of maple-basswood-hemlock-elm, aspen, birch, arbor vitae-balsam fir, etc., on roadsides and railroads. Flowering July to first part of August.

6. G. MACROPHYLLUM Willd.

Terminal segment of the basal leaves rotund to reniform in outline, cordate, much larger than the lateral segments; petals yellow, somewhat exceeding calyx-lobes; denuded receptacle glabrous or merely short-hispid; basal segment of style minutely glandular.

A rare northern species; the sole Wisconsin collection ("moist ground (sect. 22, T. 42 N., R. 11 W.) Washburn county, Chittamo, June 20, 1929 N. C. Fassett, #8661") can be referred to as var. *perincisum* (Rydb.) Raup.

8. RUBUS L. Bramble, Raspberry, Blackberry.

(THIS GENUS NOT TREATED TO SPECIES)

Perennial, semi-woody herbs or shrubs, often prickly; leaves simple or more often palmately compound, serrate or lobed; flowers perfect or unisexual; hypanthium small, flat to hemispheric; sepals 5; petals mostly 5, white, pinkish or purple; stamens numerous; pistils numerous on convex to conic receptacle; fruit a cluster of druplets, falling *with* the enlarged receptacle in the *Blackberries* and *Dewberries*, and without it in the *Raspberries*.

9. AGRIMONIA L. Agrimony.

Perennial herbs, with interruptedly pinnate leaves; stipules foliaceous; flowers in long, interrupted spike-like racemes; peduncles subtended by a laciniate bract, pedicels by a pair of 3-cleft bractlets; calyx-lobes 5, spreading at anthesis, later forming a beak over the fruit; petals 5, yellow; stamens 5–15; styles terminal; pistils 2,

concealed within hypanthium, which, covered by indurate bristles, in fruit falls as a unit, enclosing the 2 achenes.

1. Axis of inflorescence conspicuously glandular with very few long scattered hairs; hypanthium usually without minute strigose hairs in furrows; bristles of mature fruit in several rows, widely spreading ---------- 1. *A. gryposepala.*
1. Axis of inflorescence not glandular but hairy; hypanthium with minute strigose hairs in furrows; bristles of mature fruit in one row, more or less ascending.
   2. Leaflets conspicuously glandular beneath, with few hairs on veins; mature fruits 6–8 mm. long; roots fibrous ---------- 2. *A. striata.*
   2. Leaflets not conspicuously glandular beneath, densely pubescent; mature fruits 3–5 mm. long; roots tuberously thickened ---------- 3. *A. pubescens.*

1. A. GRYPOSEPALA Wallr. Map 24.

Roots fibrous; stem stout 3–15 dm. tall, spreading hirsute; leaves pinnate, the larger leaves with 5–9 leaflets, ovate-lanceolate to obovate, coarsely serrate, glabrous or nearly so above, and beneath except sparsely hirsute on veins, conspicuously glandular-dotted; inflorescence axis minutely glandular, with remote, long, divergent hairs intermixed; fruiting hypanthium and calyx 6–9 mm. long, the bristles widely spreading and in several rows, the lower row often reflexed over the hypanthium.

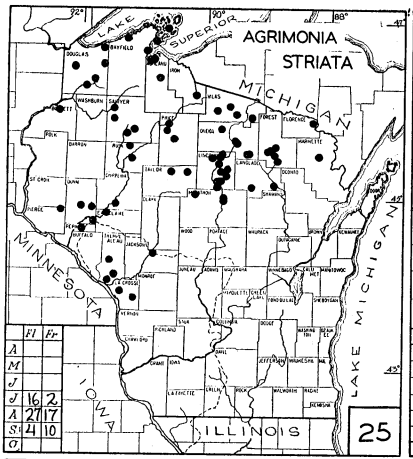
Common throughout the state in deciduous woods of maple, basswood, etc.; also in bottom land pastured woods, on wooded bluffs, roadsides and pastures. Flowers July and August.

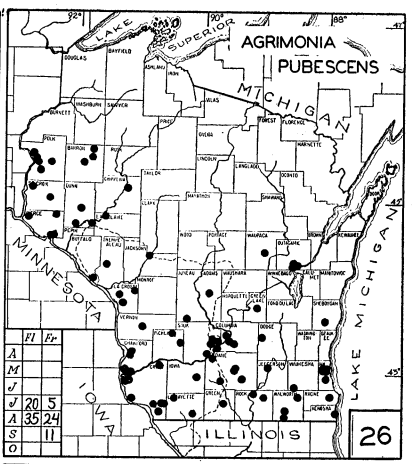
A. parviflora Ait. has not been found in Wisconsin but grows in northern Illinois. It differs from *A. gryposepala* by having stems densely and divergently long-hirsute or villous, by larger leaves with 11–23 principal leaflets, which are finely to softly pubescent beneath, and by the outer bristles of fruit being much shorter than the inner, spreading but ascending ones.

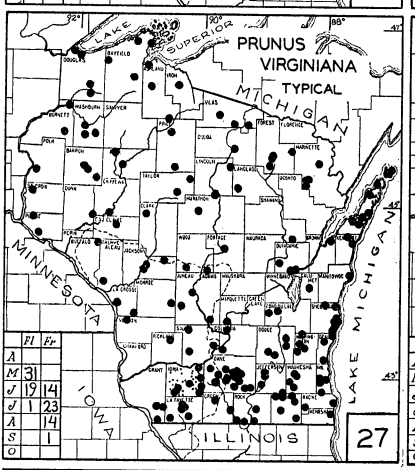
2. A. STRIATA Michx. Map 25.

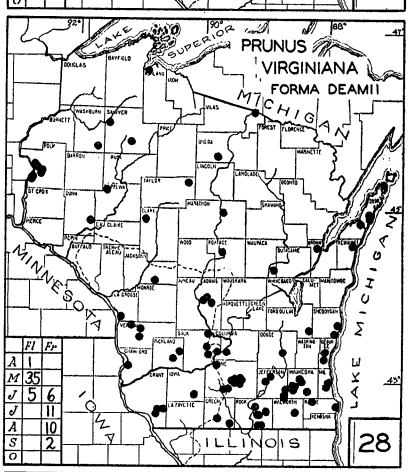
Roots fibrous; stems 3–12 dm. tall, hirsute below, pubescent and slightly glandular above; principal leaflets of larger leaves 7–11, ovate-lanceolate, coarsely serrate, glabrous or nearly so above, beneath sparsely pubescent especially on veins, conspicuously glandular-dotted; axis eglandular-pubescent, the hairs ascending, some long flexuous; mature hypanthium and calyx 5–8 mm. long, reflexed, minutely strigose in furrows, the bristles ascending.

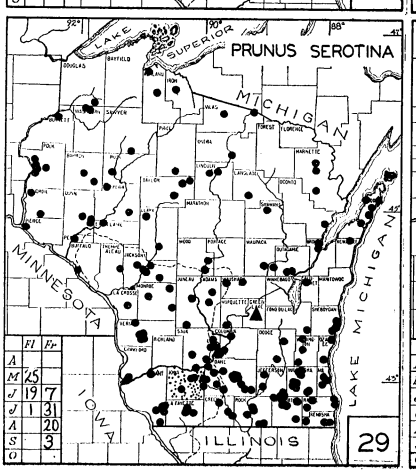
Common in northern Wisconsin, in borders of woods of maple, pine, balsam fir, aspen, basswood, oak, on roadsides, railroad right-

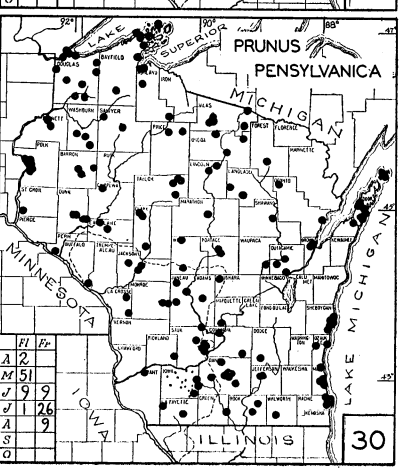

AGRIMONIA
STRIATA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
J 16 2
A 27 17
S 4 10
25


AGRIMONIA
PUBESCENS
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
J 20 5
A 35 24
S 11
26


PRUNUS
VIRGINIANA
TYPICAL
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
M 31
J 19 14
J 1 23
A 14
S 1
27


PRUNUS
VIRGINIANA
FORMA DEAMII
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A 1
M 35
J 5 6
J 11
A 10
S 2
28


PRUNUS SEROTINA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A 25
M
J 19 7
J 1 31
A 20
S 3
29


PRUNUS
PENSYLVANICA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A 2
M 51
J 9 9
J 1 26
A 9
S
30

of-ways, sandy creek bottoms, meadows, and sandy prairie remnants. Flowering from July to early September.

3. A. PUBESCENS Wallr. Map 26.

Roots tuberous-thickened; stems 3–12 dm. tall; stems and leaf-rachises pilose with oblique, ascending or incurving hairs; principal leaflets of larger leaves 5–13, lanceolate to narrowly obovate, coarsely serrate, glabrous, or sparsely pubescent above, velvety-pubescent beneath; axis of inflorescence densely pubescent, the hairs eglandular; fruiting hypanthium and calyx 3–6 mm. long, minutely strigose in the deep furrows, the bristles ascending.

Common in southern Wisconsin in a variety of damp or mesic woods of maple, birch, elm, ash, basswood, and oak, wooded bluffs and dunes, ravines, pastured woodlots, and roadsides. Flowers July and August.

10. ROSA L. Rose.

(THIS GENUS NOT TREATED TO SPECIES)

Shrubs or woody vines, usually thorny; leaves pinnate, 3–11-foliolate; stipules large and adnate to petiole; hypanthium globose to pitcher-shaped, contracted at mouth, becoming fleshy in fruit; sepals usually long-attenuate or prolonged into a foliaceous tip, often persistent in fruit; petals large, spreading at anthesis, white to dark pink, or yellow (in introduced species); stamens numerous, inserted near the orifice of the hypanthium; ovaries numerous, becoming bony achenes, completely enclosed by and inserted on the bottom and sides of hypanthium.

11. PRUNUS L. Plum; Cherry.

Trees or shrubs; leaves simple, often with petiolar glands; hypanthium cup-shaped; sepals 5, spreading or reflexed, usually soon deciduous; petals 5, white to pink, spreading; stamens 15–20, exserted; pistil one, simple, with 2 ovules; fruit a 1-seeded drupe, the exocarp fleshy, the endocarp hard.

1. Inflorescences elongate racemes (15–45 flowers) terminating new leafy branchlets of the season; pedicels 3–8 mm. long, much shorter than inflorescence-axis; calyx-lobes glabrous within; petals 2.5–4.0 mm. long__ Subgenus PADUS (Moench) Koehne.
   2. Calyx-lobes in flower conspicuously erose-laciniate, triangular to semicircular, the many narrow teeth tipped with red glands, the lobes as well as part of hypanthium soon deciduous leaving only a narrow rim beneath fruit; leaf-teeth narrowly triangular, mostly ascending to slightly outcurved; mature leaves generally obovate, dull above; usually shrubs, sometimes trees to 10 m. tall _____ 1. *P. virginiana.*

2. Calyx-lobes in flower entire or occasionally with few (up to 5) elongate glandular teeth, triangular to oblong, persistent in fruit; leaf-teeth very short, with incurved tips; mature leaves generally lance-oblong, shiny above; trees to 25 m. tall ---------- 2. *P. serotina.*

1. Inflorescences umbel-like clusters or short racemes (2–8 flowers) borne on last year's woody branchlets; pedicels 5–20 mm. long, much longer than inflorescence-axis; calyx-lobes glabrous or pubescent within; petals 3–12 mm. long.

3. Fruit (ovary) glabrous and without waxy bloom, globose or nearly so, 5–10 mm. long; stone globose to subglobose, without pronounced longitudinal furrows; calyx-lobes glabrous on inner surface; petals 3–6 mm. long ---------- Subgenus CERASUS Pers. (Cherry).

4. Leaves lanceolate, toothed to base, with margins not thickened; teeth many, 0.5–1.4 mm. apart, irregular in size, gland-tipped when young; mature fruit red, 5–7 mm. diam.; calyx-lobes with eglandular margins; shrubs or small trees ---------- 3. *P. pensylvanica.*

4. Leaves oblanceolate, entire towards base, with thickened margins; teeth few, 1.5–5.0 mm. apart, regular in size, not gland-tipped; mature fruit black, subglobose, 8–12 mm. in diam.; calyx-lobes with glandularly margins; low, erect or decumbent shrubs rarely over 2 m. tall ---- 4. *P. pumila.*

3. Fruit (ovary) sparsely pubescent and with waxy bloom, ellipsoid, 15–25 mm. long; stone distinctly compressed, longer than broad, with one or two longitudinal furrows on edges; calyx-lobes pubescent or tomentose within, at least towards base; petals 6–12 mm. long. ---------- Subgenus *PRUNOPHORA* Focke (Plum).

5. Leaves serrate, the teeth sharply acute or acuminate, ascending, eglandular; petiole glands often lacking; calyx-lobes entire or occasionally toothed towards upper end, in these cases at times glandular; shrubs or small trees, often forming thickets ---------- 5. *P. americana.*

5. Leaves crenate or serrate, the teeth obtuse or rounded, gland-tipped, or when glands deciduous ending in a callus; petioles with sublaminar glands; calyx-lobes essentially entire, always glandular on margins; small trees ---------- 6. *P. nigra.*

1. P. VIRGINIANA L. Choke-cherry. Map 27, 28.

Usually shrubs, sometimes trees to 10 m. tall; leaves ovate-oblong to obovate, short acuminate to obtuse, sharply serrate with slender, ascending or outcurved teeth; racemes 8–14 cm. long, terminating

leafy twigs of season; pedicels 4–8 mm. long; calyx-lobes triangular to semi-circular, 0.5–1.0 mm. long, conspicuously erose-laciniate with gland-tipped teeth; lobes and portion of hypanthium deciduous soon after anthesis; petals white 2.5–4.0 mm. long; fruit 5–10 mm. diam., red to dark purple.

Forma *Deamii* G. N. Jones (map 28) distinguishes plants with soft-pubescence on young stems, raceme-axes, petioles, and veins on underside of leaves. In Wisconsin sporodically throughout the range of the species.

Common throughout the state in a wide variety of habitats; open places as roadsides, railroad right-of-ways, fence rows, open sterile sandy soil, often in prairie thickets, in upland and/or lowland woods, and on edges of swamps and bogs. Flowering May through June, fruiting June and September.

2. P. SEROTINA Ehrh. Black Cherry; Rum-cherry. Map 29.

Tree up to 25 m. tall, often blooming when less than 5 m.; leaves lance-oblong to oblong-ovate, acuminate, 4–14 cm. long, finely serrate with slender or blunt incurved teeth, the lower side often with stiff brown hairs along base of midrib; racemes slender, terminating leafy twigs of current season, 5–14 cm. long; pedicels 3–7 mm. long; calyx lobes entire or sparsely glandular-serrate, persistent under fruit; petals white, 2.5–4.0 mm. long; fruit subglobose, 5–10 mm. diam., dark purple or black.

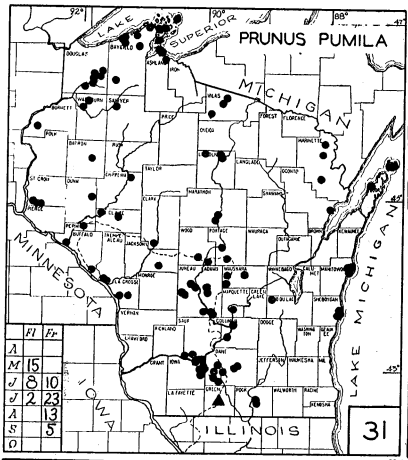
There is some indication that this species may hybridize with *P. virginiana.*

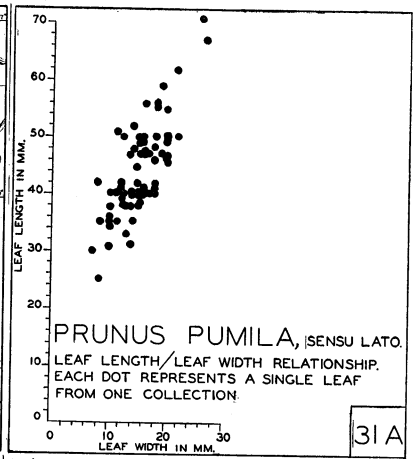
Over the state especially common in the southern half, in a variety of dry to wet woods (beech-maple, oak, pine, bottomland, at times a prominent part of the forest) on open bluffs, hillsides, sandy prairies and fence rows. Flowering May through mid-June, fruiting late June through September.

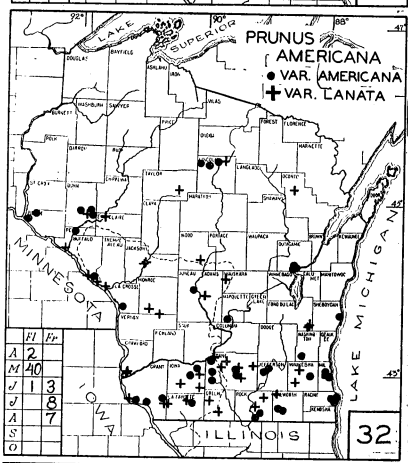
3. P. PENSYLVANICA L.f. Bird-; Pin-; Fire-; Pigeon-Cherry Map 30.

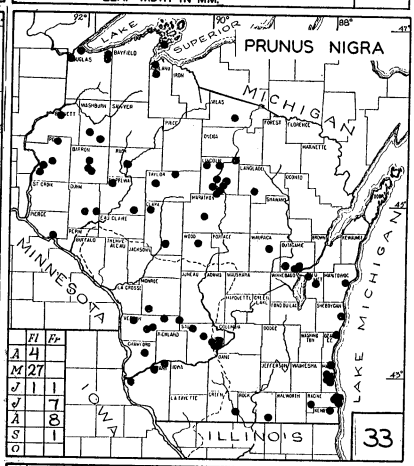
Shrubs or small trees; leaves lanceolate to narrowly ovate, 4–11 cm. long, acuminate, finely and irregularly serrate to base, the rounded teeth very strongly incurved with the gland therefore seemingly between the teeth; flowers 3–8 in each umbel-like cluster or short raceme; pedicels each 1–2 cm. long; calyx-lobes glabrous, glandless; petals white, 3–5 mm. long, sometimes villous on the back near the base; fruit deep red to maroon, globose, 5–7 mm. diam., very sour (*fide* Kruschke) ; stone subglobose.

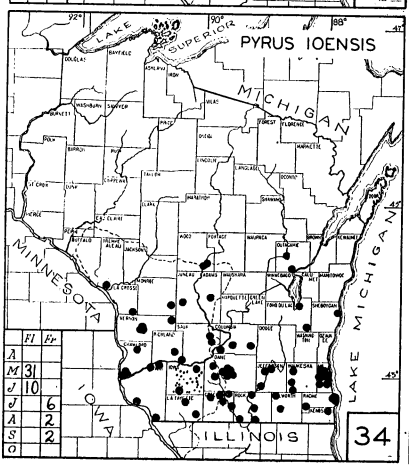
Very common over most of the state in a variety of habitats, as damp or dry, upland or lowland woods (pine-oak-ash; paper birch-yellow birch- red maple-*Sorbus americana-Populus tremuloides*; *Pinus strobus*) rocky, clay or sandy soils, granite or quartzite out-

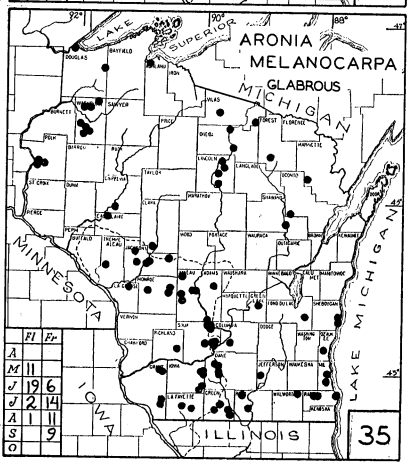

PRUNUS PUMILA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 15
J 8 10
J 2 23
A 13
S 5
O
31


LEAF LENGTH IN MM.
70
60
50
40
30
20
10
0
0 10 20 30
LEAF WIDTH IN MM.
PRUNUS PUMILA, SENSU LATO.
LEAF LENGTH/LEAF WIDTH RELATIONSHIP.
EACH DOT REPRESENTS A SINGLE LEAF
FROM ONE COLLECTION.
31A


PRUNUS
AMERICANA
VAR. AMERICANA
VAR. LANATA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A 2
M 40
J 1 3
J 8
A 7
S
O
32


PRUNUS NIGRA
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A 4
M 27
J 1 1
J 7
A 8
S 1
O
33


PYRUS IOENSIS
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 31
J 10
J 6
A 2
S 2
O
34


ARONIA
MELANOCARPA
GLABROUS
LAKE SUPERIOR
MICHIGAN
MINNESOTA
IOWA
ILLINOIS
LAKE MICHIGAN
Fl Fr
A
M 11
J 19 6
J 2 14
A 1 11
S 9
O
35

crops, lake shores, bluffs and ridges, in pastured woods, along roadsides, common in burned-over areas and in second growth thickets, in the southern parts often "among white pine relics on rocky bluffs" (Iverson 1955). Flowering May and June, fruiting June to September.

4. P. PUMILA L. Dwarf-; Sand-cherry. Map 31, 31A.

Diffusely branched, low or prostrate slender shrubs, usually less than 2 m. tall; leaves oblanceolate to oblong, 3–8 cm. long, 7–25 mm. wide, obtuse to acute, finely and remotely serrulate above middle, entire towards the base; flowers 2–4 in each umbel-like cluster; pedicels 5–14 mm. long; calyx-lobes glandular, glabrous within; petals white, 3–6 mm. long; fruit subglobose, 8–12 mm. diam., black or nearly so, very astringent.

Locally over the state on hillsides, open woods (deciduous woods; *Pinus banksiana*; *Quercus macrocarpa-Q. ellipsoidalis*), bluffs, sandstone cliffs and outcrops, and commonly on dunes, beaches, rocky shores, sandy prairies, sandy glacial outwash plains, and sand blows and barrens, generally in open (sunny) habitats. Flowering May and June, fruiting middle of June to September.

A polymorphic species, perhaps divisible into two ill-defined taxa in Wisconsin; the first, called *P. pumila* var. *cuneata* (Raf.) Bailey by Gleason (1952) and *P. susquehanae* Willd. by Fernald (1950), is according to these authors supposed to grow in dry, rocky woods (Gleason) or in sandy or otherwise acid, dry to wet, open habitats (Fernald), with erect or diffusely branched stems and leaves acute at base and 1.5–2.0 times as long as broad. The second taxon, treated as *P. pumila* var. *pumila* by Gleason and as *P. pumila* L. by Fernald, supposedly prefers sandy soils, sand dunes, and calcareous shores, especially of the Great Lakes, has erect, diffusely branched, sometimes decumbent stems and leaves that are long-tapering to base and 3–6 times as long as broad.

Prunus pumila, sensu lato, is very variable in Wisconsin, with only the extremes separable into the above-named forms. In plotting the length vs. width of all Wisconsin collections (map 31A), it is clear, however, that the extremes are at either end of a continuous variation pattern. Since most specimens fall between the above named morphological extremes, they cannot be assigned to one or the other of the varieties or species. For this reason the segregate taxa are not recognized here. A detailed study of this species throughout its range would seem highly desirable.

5. P. AMERICANA Marsh. Wild Plum; American Plum Map 32.

Shrubs or small trees to 8 m. tall, spreading from the roots and forming thickets; leaves obovate to obovate-oblong, 5–10 cm. long, sharply acuminate; teeth sharply, often doubly, serrate, ascending

and spreading; petiole usually without glands at base of leaf blade; flowers 2–5, in umbel-like clusters; pedicels 7–15 mm. long; calyx-lobes often toothed toward summit, glandless or with few obscure glands, pubescent or tomentose on inner surface, 2–4 mm. long; petals white, 6–10 mm. long; fruits red to yellow, ellipsoid, 1–3 cm. long; stone compressed.

Var. *americana*: hypanthium glabrous; upper side of the petiole and leaf-veins beneath thinly pubescent; rest of leaf sometimes pubescent when very young, but soon glabrescent.

Var. *lanata* Sudw.: branchlets, petioles, lower leaf-surface, sepals, and hypanthium persistently and softly pubescent.

Both varieties occur locally, often commonly, over the southern ⅔ of the state, along roads, edges of woods, fence-rows, thickets, ravines, marshes, river bottoms and banks, fields, or in woods (oak, hickory, maple, basswood), limestone ridges, bluffs and sandy plains. Flowering April through May, fruiting middle of May through August.

6. P. NIGRA Ait. Canada Plum; Horse Plum. Map 33.

Small tree; leaves obovate to broadly oblong-obovate, 7–12 cm. long, 3–7 cm. wide, abruptly acuminate, often doubly crenate or serrate with blunt gland-tipped teeth; petiole glands usually 2; flowers 2–4, in umbel-like clusters; pedicels 1–2 cm. long; calyx-lobes glandular-serrate, 3–5 mm. long, sometimes becoming red; petals white to pink, 8–12 mm. long; fruit ellipsoid, red varying to yellow, 1.5–3.0 cm. long, almost without bloom.

Locally common in rich woods of river bottoms or uplands (maple-basswood-yellow birch; upland oak; *Tsuga-Acer saccharum-Betula papyrifera*) along river banks, ravines, limestone or quartzite cliffs, open field, pastures or swamps. Flowering April through May, fruiting June to September.

12. PYRUS L. Apple.

Small trees or shrubs, sometimes thorny; leaves simple, toothed or lobed; inflorescences umbel-like clusters on dwarf lateral branches; flowers large, showy; hypanthium globose to obovoid; sepals 5; petals 5, elliptic to obovate, short-clawed; stamens 15–50; ovary 5-celled, inferior; styles 2–5; fruit a pome, each cell with 2 seeds.

1. Leaves finely serrate, not lobed; anther yellow; stem not thorny; sepals persistent in fruit; introduced ---------- 1. *P. malus.*
1. Leaves coarsely serrate and usually shallow lobed; anthers pink to salmon color; stems often with thorns; sepals often deciduous in fruit; native ---------- 2. *P. ioensis.*

1. P. MALUS L. Cultivated Apple.

Small trees, not thorny; leaves oblong-ovate, rounded to cordate at base, crenate to serrate, pubescent beneath; inflorescence woolly; calyx-lobes white to gray tomentose, persistent in fruit; petals pinkish-white.

Native of Asia, widely cultivated and rarely escaped. Flowering May and June.

2. P. IOENSIS (Wood) Carruth. Wild Crab Apple. Map 34.

Small trees or much branched and usually thorny shrubs; branchlets tomentose; leaves ovate-oblong to broadly elliptic, coarsely serrate to shallowly lobed, usually persistently pubescent beneath; hypanthium and pedicels densely tomentose; flowers white-pink, fragrant, as large as 4 cm. broad; fruit a small apple, green, very sour, astringent.

Over the southern half of state in open woods, thickets, and pastures, oak openings, dry hillsides and bluffs, prairies and drier borders of marshes and swamps. Flowering May and early June.

13. ARONIA Medic. Chokeberry.

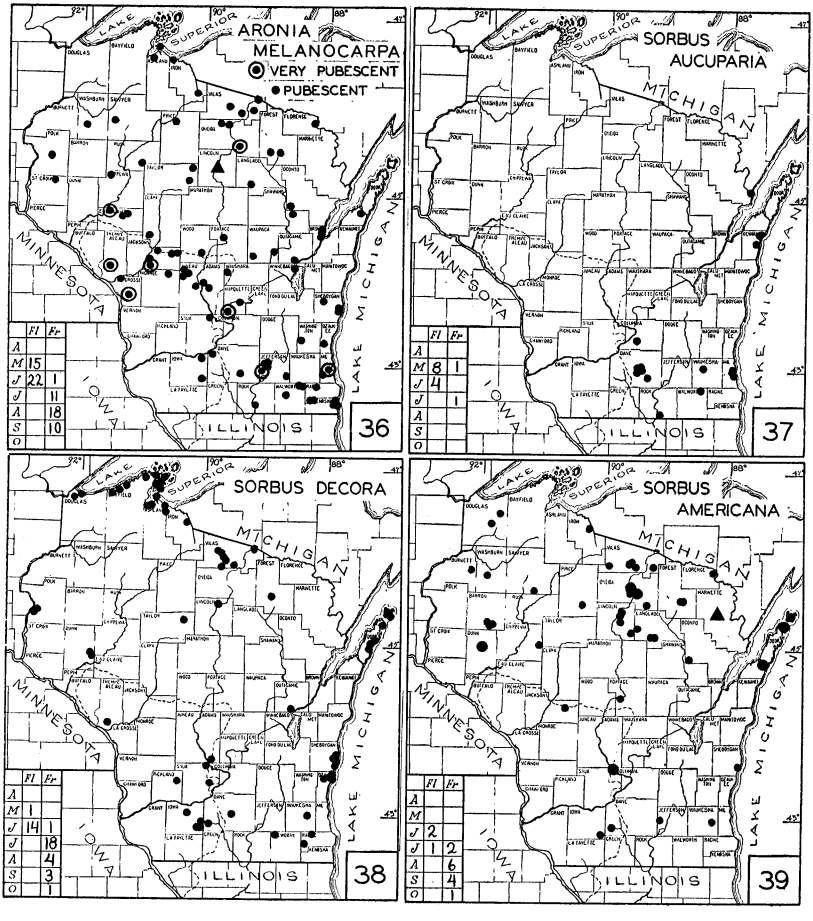
1. A. MELANOCARPA (Michx). Ell. Maps 35, 36.

(Including *A. prunifolia* (Marsh.) Rehder.)

Shrubs with simple, alternate, glandular-serrate leaves with a row of black glands along the mid-vein on the upper side; inflorescence a cluster of small flowers; hypanthium broadly obconic; sepals 5, usually glandular on the margin; petals 5, roundish, short-clawed, spreading; stamens usually 20; ovary densely woolly on the summit; styles 5, connate at base, long persistent; fruit a small pome.

Occurs over the state in acid usually damp soils of *Larix* bogs, marshes, woods, granite outcrops, limestone and sandstone ridges, bluffs, cliffs, and shores of lakes. Flowers May and June.

The Wisconsin collections present a confusing picture, about half having leaves glabrous beneath, even when young, branchlets, pedicels and hypanthium glabrous or nearly so, and the other half having slightly to pronounced pubescence beneath leaves, on branchlets, pedicels and the hypanthium. There seems to be no geographic pattern to the distribution of presence or absence of pubescence. The pubescent forms are called *A. prunifolia* by Gleason (1952) and Fernald (1950) as a separate species, and Jones (1955, map 613) shows both the glabrous and pubescent species occurring about equally common and with the same range in Illinois. The same is true in Wisconsin (map 35 and 36). This pattern suggests one variable species. No clear separation into two species appears possible


ARONIA
MELANOCARPA
VERY PUBESCENT
PUBESCENT
SORBUS
AUCUPARIA
SORBUS DECORA
SORBUS
AMERICANA
LAKE SUPERIOR
LAKE MICHIGAN
MINNESOTA
IOWA
ILLINOIS
MICHIGAN
Fl Fr
A
M 15
J 22 1
J 11
A 18
S 10
O
Fl Fr
A
M 8 1
J 4
J 1
A
S
O
Fl Fr
A
M 1
J 14 1
J 18
A 4
S 3
O 1
Fl Fr
A
M
J 2
J 1 2
A 6
S 4
O 1
36
37
38
39

on the basis of Wisconsin material, the material exhibiting a continuous variation from glabrous to strongly pubescent (shown by circled dots). Nevertheless, for reference, the two maps are furnished in this treatment, one showing distribution of glabrous, the other of pubescent plants.

14. SORBUS L. Mountain Ash.

Small trees or shrubs; leaves odd-pinnate (in Wisconsin), with 11–17 serrate leaflets; flowers white, numerous, in large, much branched rounded or flattened clusters; hypanthium obconic; sepals 5, triagular; petals 5, obovate to orbicular; stamens 15–20; pistils (in Wisconsin) 2–4, half inferior, more or less separate above; styles free; fruit a pome, each cell with 1 or 2 elongate, flattened seeds (See Jones, 1939).

1. Hypanthium and calyx-lobes densely white-villous; outer scales of winter buds densely villous on the back; introduced from Europe ---------- 1. *S. aucuparia.*
1. Hypanthium and calyx-lobes glabrous or sparsely pubescent; outer scales of winter buds glabrous or very sparsely pubescent on back; native.
   2. Leaflets oblong to oblong-elliptic, acute to abruptly short acuminate, 3–7 cm. long, 2.0–3.3 times long as wide; petals 3–4 mm. long; mature fruits 6–10 mm. in diam. ---------- 2. *S. decora.*
   2. Leaflets lanceolate to narrowly oblong, slenderly long acuminate, 4–9 cm. long, 3–5 times long as wide; petals 2–3 mm. long; mature fruits 4–7 mm. in diam. ----- 3. *S. americana.*

1. S. AUCUPARIA L. Rowan tree; European Mountain Ash. Map 37.

Small tree, with young, more or less villous branches; winter buds white-villous, non-glutinous; leaflets 2–6 cm. long, 1–2 cm. wide, oblong, blunt to short-acuminate, sharply or bluntly serrate, paler and soft pubescent beneath, at least when young; inflorescence 10–20 cm. wide; hypanthium densely white-villous; fruit about 10 mm. in diam., bright red.

Native of Europe, commonly cultivated and sometimes escaping into moist woods in southeast Wisconsin. Flowering in late May through June.

2. S. DECORA (Sarg.) C. K. Schneider. Mountain Ash; Roundwood; Dogberry. Map 38.

Shrub or small tree with young branchlets glabrous or nearly so; winter buds glutinous; leaflets oblong to oblong-elliptic, 3–7 cm. long, 1.0–2.3 cm. wide, 2.0–3.3 times as long as wide, abruptly short-

acuminate to acute, sharply serrate, paler and glabrous or sparsely pilose beneath; inflorescence 6–15 cm. wide, open; hypanthium glabrous or very sparsely pilose; petals white, 3–4 mm. long; mature fruit 6–10 mm. in diam., bright red.

Over the state in woods, on rocky soils, limestone and sandstone cliffs, shores of lakes, rivers, swamps, marshes and bogs. Flowering late May and June.

3. S. AMERICANA Marsh. American Mountain Ash; Roundwood; Dogberry. Map 39.

Shrub or tree with young branches glabrous or nearly so; winter buds glutinous or very sparsely ciliate; leaflets lanceolate to narrowly oblong, 4–9 cm. long, 1.0–2.3 cm. wide, 3–5 times as long as wide, long acuminate, sharply serrate, paler and usually glabrous beneath; inflorescence 6–15 cm. wide, densely many flowered; hypanthium and calyx-lobes glabrous; mature fruit bright red, 4–7 mm. diam.

Occurs locally over the state on shores, sandstone bluffs and talus slopes, deciduous woods, swamps, bogs, and marshes. Flowers June and July, fruits August to October, the fruits sometimes persisting through winter.

The six large dots (map 39) indicate collections cited by Jones (1939, p. 14).

15. CRATAEGUS L. Hawthorn; Red Haw.

(THIS GENUS NOT TREATED TO SPECIES)

Small trees or shrubs; branches usually thorny, often reflexed; leaves simple, serrate to variously lobed, those at ends of vegetative shoots differently shaped, larger and usually more deeply cut than those of the flowering branchlets; hypanthium campanulate or obconic; sepals 5; petals 5, white, rarely pink; stamens 5–20, alternately arranged in 1–5 rows, often persistent in fruit; styles 1–5, free, with dilated terminal segments, persistent; ovary 1–5, the carpels inferior or free at apex; fruit a pome, with 1–5 bony, usually 1-seeded nutlets (See Kruschke, 1955).

16. AMELANCHIER Medic. Juneberry; Serviceberry; Shadbrush; Sugarplum.

(THIS GENUS NOT TREATED TO SPECIES)

Small trees or shrubs; leaves simple, serrate; inflorescence racemose (rarely umbelliform); hypanthium obconic, campanulate, or saucer-shaped; sepals 5; petals 5, white, obovate-linear; stamens

usually 20; ovary 5-celled, inferior; styles 5, free or partly united; fruit a small 10-celled pome by intrusion of false septum (See Jones, 1946 and Nielsen, 1939).

Literature Cited

Curtis, J. T. and H. C. Greene. 1949. A study of relic Wisconsin prairies by the species presence methods. Ecology 30:83–92.

Deam, C. C. 1940. Flora of Indiana. Indiana Dept. of Conservation, Indianapolis.

Fernald, M. L. 1950. Gray's Manual of Botany, Ed. 8. American Book Co., New York.

Gleason, H. A. 1952. The New Britton and Brown Illustrated Flora. Lancaster Press, Lancaster.

Iverson, W. D. 1955. A survey of the trees and shrubs of Iowa County, Wisconsin. Unpublished MS. Submitted for Botany 180 under the supervision of Dr. J. W. Thomson, University of Wisconsin.

Jones, G. N. 1939. A synopsis of the North American species of *Sorbus*. Jour. Arn. Arb. 20:1–43.

Jones, G. N. 1946. American species of *Amelanchier*. Ill. Biol. Monog. 20(2), 126 pp.

Jones, G. N. and G. D. Fuller. 1955. Vascular Plants of Illinois. Univ. of Illinois Press, Urbana.

Kruschke, E. P. 1955. Hawthorns of Wisconsin. Milwaukee Pub. Mus. Publ. Botany No. 2. 124 pp.

Nielsen, E. L. 1939. A taxonomic study of the genus *Amelanchier* in Minnesota. Amer. Midl. Nat. 22:160–206.

Rydberg, A. 1908. Rosaceae (pars.) North Amer. Flora 22(4):293–388.

Salamun, P. J. 1951. A population study of the variation in the inflorescence of *Spiraea tomentosa*. Rhodora 53:280–292.

NOTES ON WISCONSIN PARASITIC FUNGI. XXIV

H. C. GREENE
Department of Botany, University of Wisconsin, Madison

The collections of fungi referred to in this publication were, unless otherwise noted, made during the season of 1957.

Bartholomew's Fungi Columbiani No. 3954, issued as *Puccinia patruelis* Arth. I on *Prenanthes crepidinea* Michx. from Madison, Wis. is in obvious error as to the host, which is *P. alba* L. *P. crepidinea* is very rare in Wisconsin, with only two stations known, and so far no rust collected on it.

ERYSIPHE GRAMINIS DC. had profuse development of perithecia on *Secale cereale* at Madison in June. For some reason, or reasons, which are not apparent, production of perithecia in the Wisconsin area is the exception rather than the rule. *E. graminis* has been reported so far on 17 grass species in Wisconsin, but perithecia on only four, *Agropyron repens, A. trachycaulum, Hordeum vulgare* and *Secale cereale,* and there are very few specimens on these.

MYCOSPHAERELLA sp. occurs on dead leaves of *Artemisia serrata,* collected near Brodhead, Green Co., August 6. Two plants with dead leaves were noted in the center of a large group of healthy plants of the same species. The small black perithecia are in numerous clusters over the upper leaf surface, appearing not to have been on distinct spots. The short-clavate asci are about 35 x 7–8 μ, the ascospores curved-fusoid, the upper cell somewhat wider, approx. 12 x 3.5 μ. Possibly parasitic.

PHAEOSPHAERIA sp. occurred on dead apical portions of otherwise green, living stems of *Eleocharis palustris* at Madison, August 25. Perhaps parasitic. The innate, scattered perithecia are medium brown, aparaphysate, subglobose, approx. 100μ diam.; asci clavate-cylindric, thick-walled, approx. 47–50 x 18–20 μ; ascospores pale olivaceous, broadly fusoid, 3-septate, 22–24 x 7–8 μ.

PHAEOSPHAERIA sp., appearing parasitic, developed on vigorous living leaves of *Phalaris arundinacea* at Madison, July 23. The spots are oval or irregular, ashen with narrow darker border, approx. 0.3–0.5 cm. long; perithecia black, subglobose, gregarious, approx. 175–200 μ diam., aparaphysate; asci slender clavate, 85–100 x 8–11 μ; ascospores deep-olivaceous, subcylindric, 3-celled, the central cell slightly inflated, 14–15 x 4–4.5 μ.

LEPTOSPHAERIA sp. is on tiny snow-white spots on leaves of *Populus alba,* collected at Madison, August 4. The spots, about 1–2

mm. diam., bear mostly one, occasionally two or three, perithecia which are blackish, subglobose, thin-walled, about 135–150 μ diam.; paraphyses slender, not capitate; asci approx. 70–80 μ, cylindric and somewhat tapered at base; ascospores light-olivaceous, subfusoid, slightly curved, 5-septate, about 28 x 4 μ. The relation to the host is uncertain, but the leaves are living and the spots only a few per leaf.

"A Check List of North American Rust Fungi (Uredinales)" by G. B. Cummins and J. A. Stevenson (193 pp.) appeared as Supplement 240, Plant Disease Reporter, December 15, 1956. Many name changes involving rusts found in Wisconsin are listed, with pertinent synonymy. The rules adopted at Stockholm in 1950 are followed, with the result that some of the best-known and longest used names are swept away, including *Coleosporium solidaginis*, *Puccinia caricis*, *Puccinia extensicola* and *Puccinia rubigo-vera*. The following changes have been noted in the case of rusts known to occur in Wisconsin—the approved name is given first, followed by the name (in parentheses) formerly used in these notes:—*Chrysomyxa ledi* DeBary var. *cassandrae* (Peck & Clint.) Savile (*C. cassandrae* (Peck & Clint.) Tranz.); *Coleosporium asterum* (Diet.) Syd. (*C. solidaginis* (Schw.) Thum.); *Coleosporium sonchi* (Strauss) Lev. ex Tul. (*C. sonchi-arvensis* (Pers.) Lev.); *Melampsora paradoxica* Diet. & Holw. (*M. bigelowii* Thum.); *Melampsorella caryophyllacearum* Schroet. (*M. cerastii* (Pers.) Schroet.); *Pileolaria brevipes* Berk. & Rav. (*P. toxicodendri* Arth.); *Puccinia tanaceti* DC. (*P. absinthii* (Hedw. f.) DC.); *Puccinia hordei* Otth (*P. anomala* Rostr.); *Puccinia caricina* DC. (*P. caricis* (Schum.) Schroet.); *Puccinia dioicae* P. Magn. (*P. extensicola* Plowr.); *Puccinia caricina* DC. var. *limosae* (P. Magn.) Jørstad (*P. karelica* Tranz); *Puccinia punctiformis* (Str.) Roehl. (*P. obtegens* Tul.); *Puccinia sparganioides* Ell. & Barth. (*P. peridermiospora* Ell. & Tr.); *Puccinia poae-nemoralis* Otth (*P. poae-sudeticae* (West.) Jørstad); *Puccinia lapathicola* Hylander, Jørstad & Nannf. (*P. punctiformis* Diet. & Holw.); *Puccinia recondita* Rob. ex Desm. (*P. rubgio-vera* (DC.) Wint.); *Puccinia cryptandrae* Ell. & Barth. (*P. simulans* (Peck) Barth.); *Pucciniastrum epilobii* Otth (*P. pustulatum* Diet); *Pucciniastrum guttatum* Hylander, Jorstad & Nannf. (*P. galii* (Lk.) Fisch.) *Pucciniastrum vaccinii* (Wint.) Jørstad (*P. myrtilli* (Schum.) Arth.); *Uredinopsis americana* Syd. (*U. mirabilis* (Pk.) Magn.); *Uromyces dactylidis* Otth (*U. alopecuri* Seym.); *Uromyces ari-triphylli* (Schw.) Seeler (*U. caladii* (Schw.) Farl.); *Uromyces dianthi* Niessl (*U. caryophyllinus* (Schr.) Wint.); *Uromyces triquetrus* Cooke (*U. hyperici* (Spreng.) Curt.); *Uromyces polygoni-avicularis* (Pers.) Karst. (*U. polygoni* (Pers.) Fckl.); *Uromyces euphorbiae* Cooke & Pk. (*U. proeminens* (DC.)

Pass.); *Uromyces lineolatus* (Desm.) Schroet. (*U. scirpi* (Cast.) Burr.). In addition to this the rust on *Artemisia dracunculoides* in Wisconsin, formerly listed as *Puccinia absinthii*, has been segregated as *Puccinia dracunculi* Fahrendorf (Ann. Mycol. 39:181. 1941). Aecial stages on Ascelpiadaceae heretofore considered in turn to belong under *Puccinia bartholomaei* Diet. and then under *P. vexans* Farl. are here placed under *Puccinia chloridis* Speg., not hitherto recorded for Wisconsin.

PUCCINIA DIFFORMIS Kunze was collected on *Galium aparine* at Madison in July. J. J. Davis made a single previous collection in 1925 at Spring Valley, Pierce Co.

PUCCINIA HELIANTHI Schw. I on *Helianthus hirsutus*. Dane Co., Madison, June 13. A collection of II, III was made at the same station in 1956.

PHYLLOSTICTAE indet., some of them uncertain as to parasitism, continue to turn up on diverse hosts and are reported on collectively as follows:

1) On *Panicum scribnerianum*. Dane Co., Madison, July 22. Amphigenous on oval tan spots, about .5–.7 cm., with narrow darker border. Pycnidia gregarious, pale brown, thin-walled, about 75 μ diam.; conidia hyaline, subfusoid, 13–15 x 3–3.5 μ. The cell content is withdrawn from the wall and it is somewhat doubtful that the spores are properly matured.

2) On *Polygonum sagittatum*, collected in Tower Hill State Park, Iowa Co., September 17. The large pycnidia were much more noticeable in the fresh material than in the dried. They are epiphyllous on irregular, immarginate, dull brownish areas, gregarious, pale brown, subglobose, approx. 150–185 μ diam.; conidia hyaline, subcylindric or subfusoid, straight or slightly curved, 10–14 x 4–5 μ.

3) On *Dianthus barbatus* (cult.) at Madison, July 6. Spots oval, pale brown, with a narrow darker border, large, 1–1.2 cm. x .5 cm.; pycnidia epiphyllous, pale brown, ostiolate, slightly flattened, about 50–75 μ diam.; conidia hyaline, short-cylindric, 2–2.5 x 3–5 μ.

4) On *Ranunculus acris* collected in the Flambeau State Forest, Sawyer Co., July 18. The lesions are similar to those produced by *Phyllosticta decidua*, but the conidia are quite variable, 5–12 x 2.5–3 μ. The brown pycnidia are approx. 125–150 μ diam.

5) On ripened silicles of *Thlaspi arvense*, collected at Madison, July 13. The gregarious pycnidia are black, prominently ostiolate, subglobose, approx. 175–200 μ; conidia hyaline, fusoid or subfusoid, 2.5–3.5 x 7–10 μ. Perhaps a *Phomopsis*, but scolecospores were not observed.

6) On *Sanguinaria canadensis* collected at Madison, July 14. The spots are cinerous, irregular, red-bordered, many of them sterile;

pycnidia epiphyllous, black, globose, scattered, approx. 75 μ diam., widely ostiolate; conidia greenish-hyaline, ovoid, 5–7 x 3–3.5 μ. This seems not to be *P. sanguinariae* Wint. (Jour. Mycol. 1:123. 1885) described as having ellipsoid spores, 5–7 x 1.5–2.5 μ.

7) On *Pyrus malus* collected at Madison, August 2. The lesions are similar to those which bore *Mycosphaerella* as described in my Notes XVII (Trans. Wis. Acad. Sci. 41:117. 1952). It seems likely there is a relationship, since the pycnidia are similar in appearance and in their disposition on the spots. The pycnidia are epiphyllous, black, subglobose, approx. 125–150 μ diam.; conidia hyaline, fusoid, biguttulate, 9–11 x 3–3.5 μ.

8) On *Rhus aromatica* at Madison, September 3. Lesions black, wedge-shaped, narrowing inward from the leaf apex; pycnidia sooty-black, subglobose, scattered, epiphyllous, approx. 100–150 μ diam.; conidia subhyaline, ellipsoid or broadly fusoid, 16–19 x 5–7.5 μ, extruded in cirrhi. An immature *Sphaeropsis*?

9) On *Acer rubrum*, near Falun, Burnett Co., July 16. This appears not to be *Phyllosticta minima*, common on *Acer rubrum* in Wisconsin. The medium-sized, rather superficial, flesh-colored, flattened pycnidia are epiphyllous and clustered in the centers of orbicular tan spots, approx. .5–1 cm. diam., similar to those caused by *Cladosporium humile* J. J. Davis on this host; conidia hyaline, 4–6 x 3–3.5 μ, as compared to about 6 x 8 μ for *P. minima*.

10) On *Pentstemon tubiflorus* at Madison, August 12. Spots orbicular, tan with a narrow reddish border, approx. .3–.5 cm. diam.; pycnidia epiphyllous, scattered, black, subglobose, approx. 150–175 μ diam.; conidia hyaline, very numerous, bacilliform, 5–7 x 1.5 μ.

11) On *Sambucus pubens* at Madison, July 28. The spots are tan, more or less translucent areas of indefinite extent, somewhat angled and frequently shredding. The pycnidia are blackish, subglobose, approx. 150–175 μ diam.; conidia hyaline, cylindric, 2.5–3 x 5–6 μ.

12) In small amount on *Eupatorium perfoliatum* at Madison, August 11, 1956. The lesions are angular and brown, the epiphyllous pycnidia pale brown, clustered, subglobose, about 100 μ diam. Conidia are hyaline ellipsoid to subfusoid, 6–8 x 2.5–3 μ. This is perhaps identical with *Phyllosticta umbrino-fumosa* H. C. Greene which occurred on *Eupatorium rugosum* (Trans. Wis. Acad. Sci. 38:243. 1946), but more material would be desirable.

13) On *Aster novae-angliae* at Madison, July 30. The small, cinerous, purple-bordered lesions are reminiscent of those commonly produced by *Septoria solidaginicola* Peck on various species of *Solidago* and *Aster*. Pycnidia epiphyllous, one or two per lesion, subglobose, black, widely ostiolate, approx. 75 μ diam.; conidia cylindric, hyaline, 4–6 x 2.5–3 μ.

14) On rosette leaves of *Erigeron glabellus* collected near Earl, Washburn Co., September 12, 1956. The subglobose, brown pycnidia are approx. 125–140 μ diam., hypophyllous on small, rounded, light brown spots which have a darker reddish-brown border; conidia hyaline, ovoid or ellipsoid, 4.5–6 x 2.5–3 μ.

15) On *Ambrosia psilostachya* at Tower Hill State Park, Iowa Co., September 17. This is a striking, but at the same time a not too well-marked and somewhat puzzling fungus. The black pycnidia are almost superficial, globose or subglobose, approx. 100–225 μ diam., scattered or clustered, often at the base of leaf lobes, causing notable leaf curvature and subsequent death of the lobe, or sometimes arranged serially on the midrib, with similar effect on the host. The conidia fall into two principal classes, as shown by the extremes, 1) narrowly subfusoid, approx. 9–11 x 2.5–3.5 μ, and 2) broadly ellipsoid, approx. 7–8 x 4–5 μ. Intermediate are conidia which are broadly subfusoid, approx. 10–11 x 4.5–5 μ. Dimensionwise there is no sharp differentiation between these groups.

16) On *Echinacea pallida* at Madison, July 20. Spots orbicular, large, up to 2 cm. diam., blackish. Pycnidia epiphyllous, scattered and few on spots, thin-walled below, with darker heavier cells in the ostiolar region, subepidermal, somewhat flattened, approx. 50–100 x 35–60 μ; conidia hyaline, short-cylindric, 2–2.5 x 3–3.5 μ. Strong leaf curvature is often associated with the lesions.

17) On marginal portions of languishing and dead leaves of *Tragopogon pratensis* at Madison, August 5. The pycnidia are scattered to gregarious, black, globose, markedly erumpent, approx. 125–200 μ diam.; conidia hyaline, cylindric to subfusoid, 5–7 x 2–3 μ.

CICINNOBOLUS sp. occurs on *Microsphaera euonymi* (DC.) Sacc. on *Evonymus atropurpureus* collected at Oakly, Green Co., October 3. The large pycnidia are up to 100 x 40 μ, the hyaline conidia mostly about 6–8 x 3.5–4 μ, some smaller and a very few larger. Obviously not *C. cesati* DeBary, which has much smaller spores. Other species have been described, of which *C. plantaginis* Oud. seems closest in conidial measurements.

PHOMA sp. is present in small amount on dull brownish, oval spots on living stems of *Eryngium yuccifolium*, collected at Madison, July 27. The pycnidia are gregarious, blackish, subglobose, approx. 100–125 μ diam.; conidia hyaline, subfusoid, 4–5 x 1.5 μ.

PHOMA sp. occurred on stems of *Linaria vulgaris* collected at Parfrey's Glen, Sauk Co., September 24. The stems in question are dead, but other branches of the same plants were still green and living. The seriate pycnidia are deep brown, subglobose, approx. 150–200 μ diam.; the very numerous conidia are small short-cylindric, hyaline, 3–4 x 1.5 μ.

ASCOCHYTA sp. on pale, oval or irregularly elongate lesions on leaves of *Calamagrostis canadensis*, Madison, September 14. The pycnidia are deeply immersed, closely gregarious, black, subglobose, approx. 100–125 μ diam.; conidia hyaline, fusoid with acute, somewhat refractive apices, slightly or not constricted at the median septum, 18–25 x 3.5–4.5 μ.

ASCOCHYTA sp. occurs on dead outer portions of leaves of *Oxalis europea* collected at Madison, July 21. The pycnidia are subglobose, pale brown below, darker above, prominently ostiolate, approx. 120–160 μ diam.; conidia uniformly 1-septate, hyaline, cylindric or subfusoid, 11–15 x 3.5–4 μ.

ASCOCHYTA sp. occurs on *Lactuca canadensis* leaves collected at Madison, August 25, 1956. The dull brown pycnidia are few on sharply defined, suborbicular, grayish-brown lesions, with a narrow blackish-purple border, about 1 cm. diam. The lesions are often confluent. The conidia are uniseptate, often biguttulate, hyaline, cylindric, 14–16 x 4–5.5 μ. This may well be actually only a rather poorly developed specimen of *Stagonospora*, although it does not seem identical with one found on *Lactuca spicata*, reported in my Notes XXIII (Trans. Wis. Acad. Sci. 46:141–158. 1957).

STAGONOSPORA sp. is present in small amount on straw-colored areas of indefinite shape on leaves of *Apios tuberosa*, collected at Juda, Green Co., August 6. The brownish, globose pycnidia are approx. 100 μ diam., the hyaline conidia cylindric or subcylindric, 12–17 x 4–4.5 μ, 1–2-septate. The collection was made for *Phyllosticta phaseolina* Sacc. which occurs on nearly all the lesions, and the presence of the *Stagonospora* was not suspected until microscopic examination. There is no mixture of the two on the same lesion, from all appearances. *P. phaseolina* produces lesions with a more reddish cast and the black pycnidia are more readily seen in a surface inspection.

STAGONOSPORA sp. occurs on a smooth, applanate, brownish insect gall of the type commonly observed on *Solidago* (*S. gigantea* in this case) collected at Madison, August 2. The pycnidia are scattered on the gall itself and on its adjacent leaf, indicating perhaps that their presence is incidental. They are pale brown, subglobose, approx. 200–300 μ diam.; conidia are subcylindric, 12–18 x 3.5–4.5 μ, 1-, 2-, or 3-septate.

HENDERSONIA CRASTOPHILA Sacc. occurred in profusion on languishing leaves of *Sporobolus asper*, collected at Madison, July 29. The plants were in the main vigorous and healthy and it seems possible that the fungus was at least mildly parasitic.

SEPTORIA sp. occurred on leaves of an undetermined double-flowered cultivated *Ranunculus* collected at Madison, July 13. Large

areas of the leaves are brown and dead, with the pycnidia clustered in groups, indicating perhaps that they were on separate spots at an earlier stage of infection. The pycnidia are amphigenous, inconspicuous because deeply seated in the tissue, black, subglobose, small, approx. 40–60 μ diam.; conidia hyaline, acicular, slightly curved, appearing continuous, approx. 15–25 x 1–1.5 μ. Reminiscent of *Septoria anemones* Desm. in microscopic characters.

SEPTORIA CRATAEGI Kickx. occurred in profusion, in September at Madison, on ornamental hawthorns of an undetermined species in the University of Wisconsin Arboretum. The only previous state collection was made at Racine in 1888 by J. J. Davis.

SEPTORIA sp. on *Aster paniculatus* from Madison, June 2, is epiphyllous on somewhat elongate, angled, dull brown spots, with spores approx. 45–55 x 2–2.5 μ, appearing continuous, mostly curved. Another of the numerous *Septoria* variants on *Aster* and *Solidago*, and one which does not fit into any of the established specific niches.

RHABDOSPORA PINEA Karst., reported on branches of *Pinus sylvestris*, as described, corresponds well microscopically with a sphaeropsidaceous fungus on *Pinus mugho* foliage, collected at Barron, Barron Co., June 23, 1955 by R. F. Patton who stated that the tree was much stunted, with all the old growth foliage affected. Karsten described the pycnidia as erumpent-superficial, variable in shape but mostly rounded, slightly roughened, blackish, astomatous, .4 mm. diam.; spores fusoid-bacilliform, curved or almost straight, usually 3-septate, greenish-hyaline, 22–40 x 3–4 μ.

RHABDOSPORA (?) occurs on stems and fruiting pedicels of dead and dying plants of *Lysimachia* (*Naumburgia*) *thyrsiflora* collected at Madison, July 31. The stems are blackened and more or less sclerotized, while the leaves are brown and dead. The pycnidia, if such they properly are, are subepidermal, somewhat elongate, or even at times branched and chambered, rather imperfectly developed, especially below, and of the order of 125–150 μ in cross section. They are black, thick-walled and irregularly scattered, as a rule, although sometimes arranged in concentric groups. Vast numbers of hyaline, acicular scolecospores are produced. These are straight, flexuous, or most often strongly curved, appearing continuous, 15–28 x 1–1.5 μ. In a few sections there were observed, more deeply imbedded in the host tissues, rounded fruiting bodies with immature contents, suggesting the possible ultimate production of an ascomycetous stage. It seems a reasonable assumption that the fungus was the primary agent of destruction.

GLOEOSPORIUM sp. occurs on leaves of *Salix glaucophylla*, collected near Cambria, Columbia Co., September 10. The lesions are

very noticeable, dappled dull brown and blackish above and rufo-fuscous below, orbicular or irregular, up to more than 2 cm. diam. The acervuli are hypophyllous, scattered or tending to be clustered along the principal veins, subcuticular, flattened, 80–110 μ diam. by about 13–15 μ thick, sordid flesh-colored; conidiophores simple, closely crowded, hyaline, 10–12 x 1.5 μ; conidia hyaline, narrow-cylindric, 5–8 x 1.5–2 μ. Possibly the precursor of a perfect stage.

ELLISIELLA CAUDATA (Peck) Sacc. is shifted to *Ellisiellina caudata* (Peck) Camara in a paper by A. C. Batista entitled "Systematic Revision of the Genera *Ellisiella* Sacc. and *Ellisiellina* Camara, and the new genus *Ellisiopsis*" (An. Soc. Biol. Pernambuco 14:16–25. 1956). This fungus occurs in Wisconsin on *Andropogon gerardi* (*furcatus*), *A. scoparius, Sorghastrum nutans* and *Sporobolus heterolepis.*

SEPTOGLOEUM SALICINUM (Peck) Sacc. is represented by a number of Wisconsin specimens, collected by J. J. Davis, several of which on *Salix rostrata* are microconidial primarily, but with limited development of typical conidia in at least one of them. A specimen on *Salix petiolaris*, collected in Barron Co. near Chetek, September 13, 1956, bears small, rod-shaped microconidia in acervuli which are hypophyllous on conspicuous, orbicular, light brown, zonate lesions. It seems likely this should also be referred to *S. salicinum.*

CERCOSPORA sp. on *Sorbus aucuparia,* collected at Madison, August 15, does not correspond to *C. ariae* Fckl., the only species Chupp lists on this host. Here the spots are rounded, purplish above, sordid below, about 1–2 mm. diam. Conidiophores not strongly tufted, amphigenous, but mostly hypophyllous, pale brown, one to several septate, 5–10 or occasionally more geniculate, often strongly so near the apex, 45–170 x 3.5–5 μ; conidia hyaline, narrowly obclavate to almost acicular, base obconic, obscurely multiseptate, 25–80 x 2.5–4 μ.

CERCOSPORA sp. occurred in small amount on *Campanula rapunculoides* at Madison, July 25. Spots are small subangular, grayish with yellowish halo, approx. 2–3 mm. diam.; conidiophores amphigenous, mostly epiphyllous, fascicled in tufts of approx. 6–8, widely divergent, 2–3-geniculate, with geniculations very widely spaced, 4–5 x up to 200 μ or more, several septate; conidia narrowly obclavate to acicular, base obconic or truncate, 40–135 x 3.5–4 μ, 2–11-septate. Very different from either of the two species on *Campanula* listed by Chupp.

CERCOSPORA sp. on *Rudbeckia hirta* was collected at Madison, August 17. This is not at all in the range of *C. tabacina* Ell. & Ev., the only species Chupp reports on *Rudbeckia.* Here the fungus

occurs on small, angled, cinerous spots. The conidiophores are epiphyllous, lax, about 5–6 in a fascicle, pale brown, multiseptate, 6–8 mildly geniculate, approx. 185–215 x 4–4.5 μ, the conidia straight to slightly curved or flexuous, acicular to narrowly obclavate, base truncate, multiseptate, 135–270 x 3.5–5.5 μ. Unfortunately the specimen is very small.

Viola canadensis leaves collected July 18 in the Flambeau State Forest, Sawyer Co., bear an interesting hyphomycete which Dr. S. J. Hughes of the Canadian Science Service points out is suggestively similar to *Cercospora murina* Ell. & Kell. (Bull. Torr. Bot. Club 11:122. 1884) which also has inflated conidiophore tips with localized minute spore scars. In the Wisconsin specimen, however, many of the conidiophores are branched and there is evidence of catenulation, so the systematic position remains uncertain.

HELMINTHOSPORIUM specimens in the University of Wisconsin Cryptogamic Herbarium have been studied by Dr. R. A. Shoemaker of the Canadian Science Service, who is monographing the genus. The study has resulted in various changes and shifts in the names of Wisconsin-collected specimens which are reported at appropriate points in this paper.

HELMINTHOSPORIUM sp., reported as *H. buchloes* (Ell. & Ev.) Lefebvre & A. G. Johnson on *Bouteloua curtipendula* and *B. hirsuta* in Wisconsin is a so far unnamed species according to Shoemaker.

HELMINTHOSPORIUM RAVENELII Curtis, as concerns the specimen reported on *Sporobolus neglectus* in Wisconsin, is an undetermined species of *Curvularia*, according to Shoemaker.

HELMINTHOSPORIUM SOROKIANUM Sacc. replaces the name *H. sativum* Pamm., King & Bakke. *H. sorokianum* occurs on several grasses in Wisconsin.

FUSARIUM sp. is present on rounded, fuscous, subzonate spots about 2–3 mm. diam. on leaves of *Euphorbia corollata* collected at Madison, June 29. The fungus is hypophyllous and both micro- and macrospores are present in profusion. Such spots have often been seen on *E. corollata*, but no fungus has been noted. The spots do not appear to be due to insects, but the relation of the *Fusarium* remains uncertain.

VIBURNUM spp. of the *V. lantana* group seem to be highly susceptible to leaf spotting of more or less indefinite origin. For example, *V. carlesii* plants in the University of Wisconsin Arboretum in August had conspicuously spotted leaves, with prominent, black, epiphyllous, subcuticular pycnidia on the spots, which are all very similar—orbicular, silvery, somewhat zonate and sunken, about 3 mm. diam. The silvery aspect is due to the upraised cuticle. Rather cursory examination showed *Phyllosticta*, *Coniothyrium* and *Asco-*

chyta from pycnidia and on spots almost identical in appearance, so that one is at a loss as to the true relation of fungi and host.

Carex lacustris leaves, collected September 17 at Tower Hill State Park, Iowa Co., bear an interesting melanconiaceous fungus. The conspicuous chestnut-brown spots are orbicular or elongate-orbicular, 1–2.5 cm., usually running from margin to margin of the linear leaves. The numerous subcuticular acervuli are epiphyllous, from 125–200 μ diam., with slender hyaline, closely ranked conidiophores which are somewhat variable in length, but mostly about 20–25 x 1.2 μ. The conidia, if strictly speaking such they are, are of the same diameter and general appearance as the phores, resembling rod-like segments fragmented from them. The large air spaces of the leaves are filled with a coarse ramifying mycelium which is assumed to belong to the same fungus producing the acervuli.

Pastinaca sativa, collected at Madison June 18, bears small, black, shining, subapplanate fruiting bodies containing hyaline microspores on the undersides of the leaflets. The distal portion of the leaflet is first affected and the brown, wedge-shaped lesion is enlarged until the entire leaflet is involved. Possibly parasitic.

Senecio balsamitae, collected in Gov. Dodge State Park, Iowa Co., July 24, has epiphyllous, black, subglobose fruiting bodies approx. 125–175 μ diam., mostly empty, but a few with tiny microconidia. The pycnidia are on small, cinerous, purple-bordered spots on otherwise healthy green leaves.

Danthonia spicata, collected at Parfrey's Glen, Sauk Co., September 24, has minute, punctate, closely clustered, shiny black, applante, sclerotoid structures on the upper surface of the green basal leaves. The grass plants were growing in a large cushion of *Leucobryum glaucum* which provided quite moist conditions and presumably furthered development of the fungus which, while it is probably not parasitic, no doubt had an adverse effect on the photosynthetic activity of the host.

Euphorbia esula stems, collected near Middleton, Dane Co., October 12, are heavily infected by a striking non-fruiting fungus which appears definitely parasitic. The mycelium is composed of black, thick-walled, pseudoparenchymatous cells which are components of black, shiny, radiate-dendritic strands arranged to form numerous, rounded, plate-like structures, largely intraepidermal, and about 1–2 mm. diam. The host tissue adjacent to and within the area of infection is a dead white, affording a conspicuous contrast to the black of the fungus.

Fraxinus americana leaves collected at Madison, August 4 bear an interesting sterile fungus, not so far determined. It consists of tiny, rounded, flattened to hemispherical structures composed of

massed, moderately thick-walled, brown, parenchyma-like isodiametric cells about 6–8 μ. The entire body varies from about 45–65 μ diam. by about 15–30 μ in elevation. These bodies are on minute, rounded, straw-colored spots surrounded by a dark purple border. The light centers are not over .2 mm. diam., while the entire spot including border runs from .3–.5 mm. The spots are scattered to crowded. In the latter case they are often confluent to form irregular purplish patches, mostly around the midrib and other principal veins. Probably parasitic, as the leaves are in the main healthy.

Solidago patula, collected at Parfrey's Glen, Sauk C., September 24, has a sclerotium-producing fungus on the leaves, perhaps identical with one on Solidago altissima reported as *Sclerotium mendax* Sacc. (Trans. Wis. Acad. Sci. 35:134. 1944). Although the sclerotia are superficial, the mycelium from which they are produced is firmly seated in the green leaf tissue and appears to be in a definitely parasitic relationship.

Additional Hosts

The following hosts have not been previously recorded as bearing the fungi mentioned in Wisconsin.

ERYSIPHE POLYGONI DC. on *Ranunculus* (yellow double-flowered, cult.). Dane Co., Madison, July 13. The host probably cannot be determined as to species, but it is one of the broad-leaved double-flowered forms so commonly cultivated.

ERYSIPHE CICHORACEARUM DC. on *Scutellaria galericulata*, Dane Co., Madison, September 14, 1889. Coll. L. S. Cheney. This was placed in the herbarium as *E. galeopsidis*, but it has the characteristic two-spored asci of *E. cichoracearum*. Also on *Cosmos bipinnatus* (cult.). Dane Co., Madison, September 15. On *Centaurea maculosa*. Green Co., near Juda, October 3.

SPHAEROTHECA HUMULI (DC.) Burr. on *Rhus copallina*. Dane Co., Madison, September 3.

PHYLLACTINIA CORYLEA (Pers.) Karst. on *Quercus ellipsoidalis*. Dane Co., Madison, October 8.

CRONARTIUM COMPTONIAE Arth. I on *Pinus sylvestris* (cult.). Marathon Co., Town of Plover, May 17. Coll. Ray Weber.

COLEOSPORIUM SOLIDAGINIS (Schw.) Thum. II, III on *Solidago missouriensis*. Dane Co., Madison, July 11. Although reported on this host in a comprehensive list of Wisconsin parasitic fungi, there is no mention of it elsewhere and I find no previous specimens in the herbarium.

GYMNOSPORANGIUM GLOBOSUM Farl. III on *Juniperus horizontalis*. Green Co., near New Glarus, October 16, 1956. Det. G. B. Cummins.

PUCCINIA CARICIS (Schum.) Schroet. II on *Carex conoidea.* Dane Co., Madison, July 30.

PUCCINIA AMPHIGENA Diet. I on *Smilacina stellata.* Sheboygan Co., Terry Andrae State Park, June 2. Coll. by J. W. Baxter who used this material to successfully inoculate rust-free plants of *Calamovilfa longifolia,* producing uredia. This would seem to be the first record of *P. amphigena* on *Smilacina.*

PUCCINIA ANGUSTATA Peck I on *Pycanthemum virginianum.* Dane Co., Madison, June 12, 1951; Hanerville, June 15, 1953. These collections were originally referred to *Puccinia menthae,* but J. W. Baxter, who has made a special study of these rusts, considers them to be *P. angustata.*

PUCCINIA LIATRIDIS (Webber) Bethel I on *Liatris aspera* var. *intermedia.* Dane Co., Madison, May 28, 1945. See the remarks in this paper on *Septoria liatridis* on the same host.

UROMYCES SILPHII (Burr.) Arth. I on *Silphium laciniatum* X *terebinthinaceum.* Dane Co., Madison, June 19.

PELLICULARIA FILAMENTOSA (Pat.) Rogers on *Euphorbia maculata.* Dane Co., Madison, August 19, 1956.

CERATOBASIDIUM ANCEPS (Bres. & Syd.) Jacks. on *Salix petiolaris.* Chippewa Co., New Auburn, September 13, 1956. Also on *Pyrola elliptica.* Dane Co., Madison, June 21, 1943. Included with a collection of undetermined *Colletotrichum* and not noted until recently.

PHYLLOSTICTA MINIMA (B. & C.) Underw. & Earle on *Acer platanoides* (cult.) Fond du Lac Co., Fond du Lac, August 16, 1912. Coll. H. J. Baker. This specimen was in the Ricker Herbarium, recently incorporated in the University of Wisconsin Herbarium.

PHYLLOSTICTA PHOMIFORMIS Sacc. on *Quercus ellipsoidalis.* Dane Co., Madison, August 5.

PHYLLOSTICTA DECIDUA Ell. & Kell. on *Circaea latifolia.* Dane Co., Madison, July 13. On *Plantago rugelii* at Madison, July 28.

SCLEROPHOMA PITHYOPHILA (Cda.) Hoehn. on *Pinus flexilis* (cult.). Columbia Co., Poynette State Game Farm, June 15, 1955. Coll. R. F. Patton. Prominent on leaves still green below the affected portions which are mostly apical. Probably parasitic. The tree was said to have been almost denuded of foliage except for new growth. *Sclerophoma* is considered by some authors to be synonymous with *Dothichiza.*

ASCOCHYTA COMPOSITARUM J. J. Davis on *Erechtites hieracifolia.* Dane Co., Madison, September 27. This is the smaller-spored form, earlier set aside as var. *parva* Davis. The lesions, however, are all highly characteristic, regardless of spore size.

ASCOCHYTA SONCHI (P. Henn.) Syd. on *Sonchus arvensis.* Dane Co., Madison, August 10.

DARLUCA FILUM (Biv.) Cast. on *Puccinia chloridis* III on *Bouteloua curtipendula.* Dane Co., Pine Bluff, September 17. On *Puccinia circaeae* on *Circaea latifolia.* Dane Co., Madison, August 5. On *Puccinia helianthi* III on *Helianthus strumosus.* Dane Co., Madison, August 16.

STAGONOSPORA ALBESCENS J. J. Davis on *Carex lasiocarpa.* Dane Co., Madison, July 31.

STAGONOSPORA CIRSII J. J. Davis on *Cirsium discolor.* Dane Co., Madison, September 2. The spores measure up to 35 x 8 μ, somewhat larger than specified, but the lesions seem entirely characteristic.

SEPTORIA MUSIVA Peck on *Populus alba.* Dane Co., Madison, August 4.

SEPTORIA BETULICOLA Peck on *Betula populifolia* (cult.). Dane Co., Madison, July 4. This specimen has well-developed, noticeably septate spores, up to 60 x 2.5 μ or more.

SEPTORIA SII Rob. & Desm. on *Carum carvi.* Waukesha Co., near Eagle, June 20.

SEPTORIA MELANDRII Pass. on *Lychnis chalcedonica* (cult.). Dane Co., Madison, July 4.

SEPTORIA LIATRIDIS Ell. & Davis on *Liatris aspera* var. *intermedia* (Lunell) Gaiser, Madison, June 12. This handsome variety is firmly established and is spreading in the University of Wisconsin Arboretum. It is an escape from a nursery plot, set up some twenty-odd years ago, and is characterized by definitely later blooming than the species proper in the relatively northern Madison location. The plants are also larger on the average and have noticeably pedicellate, rather widely spaced flowering heads. This host was determined some years ago by Gaiser whose monograph of *Liatris* appeared in Rhodora in 1946.

PHAEOSEPTORIA FESTUCAE var. MUHLENBERGIAE R. Sprague on *Agropyron repens.* Dane Co., Madison, July 30. The fungus appears weakly parasitic on dead margins of otherwise living leaves.

HAINESIA LYTHRI (Desm.) Hoehn. on *Ludvigia polycarpa.* Dane Co., Madison, September 14.

CYLINDROSPORIUM FILIPENDULAE Thum. on *Spiraea vanhouttei* (cult.). Dunn Co., Falls City, September 10, 1956; also at Madison, August 11, 1957.

PASSALORA FASCICULATA (C. & E.) Earle on *Euphorbia maculata.* Dane Co., Madison, August 19, 1956.

CLADOSPORIUM AROMATICUM Ell. & Ev. on *Rhus aromatica*. Dane Co., Madison, August 31.

RAMULARIA PLANTAGINIS Ell. & Mart. on *Plantago lanceolata*. Sauk Co., Devil's Lake, September 24.

CERCOSPORELLA NIVEA Ell. & Barth. on *Solidago missouriensis*. Dane Co., Madison, July 11.

CERCOSPORA CERCIDICOLA Ell. on *Cercis canadensis*. Grant Co., near Cassville, August 31. Coll. H. H. Iltis.

CERCOSPORA ZEBRINA Pass. on *Trifolium arvense*. Polk Co., Balsam Lake, July 16.

CERCOSPORA VIOLAE Sacc. on *Viola canadensis* (cult.). Dane Co., Madison, July 14.

HELMINTHOSPORIUM SOROKIANUM Sacc. (*H. sativum*) on *Bromus ciliatus*. Dane Co., Madison, August 20, 1949. Det. R. A. Shoemaker. Originally reported as *H. bromi* Died.

HELMINTHOSPORIUM VAGANS Drechsler on *Koeleria cristata*. Dane Co., Madison, June 15, 1951. Det. R. A. Shoemaker. This was discussed in my Notes XVI (Amer. Midl. Nat. 48:746. 1952).

TUBERCULINA PERSICINA (Ditm.) Sacc. on *Puccinia convolvuli* I on *Convolvulus sepium*. Dane Co., Madison, July 14.

ADDITIONAL SPECIES

The fungi mentioned have not been previously reported as occurring in the state of Wisconsin.

MYCOSPHAERELLA NIGERRISTIGMA Higgins. *Septoria* stage on *Prunus pennsylvanica*. Douglas Co., Superior, Wisconsin Point, September 11, 1956; also at Madison, August 2, 1957.

PUCCINIA FARINACEA Long var. AZUREA Baxter & Cummins II, III on *Salvia reflexa* (*lanceolata*). Green Co., near Albany, September 4. Det. J. W. Baxter. Not hitherto reported on this host (see Lloydia 14:221. 1951).

PUCCINIA CHLORIDIS Speg. I on *Acerates hirtella*, *A. lanuginosa*, *A. viridiflora*, *Asclepias syriaca*, *A. tuberosa*, *A. verticillata*, III on *Bouteloua curtipendula*. There are numerous Wisconsin collections, formerly filed under *Puccinia vexans* Farl.

PUCCINIA DRACUNCULI Fahrendorf II, III on *Artemisia dracunculoides*. There are several collections from Madison in the University of Wisconsin Herbarium. Originally reported as *Puccinia absinthii* (Hedw. f.) DC.

PHYLLOSTICTA ERYTHRONII Cooke & Shaw on *Erythronium albidum*. Green Co., Town of Spring Grove near Oakly, May 5, 1955. Notes on this as an undetermined species of *Phyllosticta* appear in

my Notes XXII and XXIII. The description of Cooke and Shaw (Mycologia 44:796. 1952) was overlooked until recently.

PHYLLOSTICTA PALUSTRIS Ell. & Dearn. on *Stachys palustris*. Dane Co., Madison, August 15. The original description is very brief, with no statement as to dimensions or other characters of the pycnidia which, in this specimen, are black, subglobose, epiphyllous, erumpent, approx. 125–175 μ. The conidia in the Wisconsin material are slightly larger than specified, but overall it seems likely that the assignment to *P. palustris* is correct.

Neottiospora umbelliferarum sp. nov.

Maculis griseo-brunneis, centris pallidioribus, marginatis vel orbicularibus varie, ca. 0.25–0.5 cm. diam.; pycnidiis gregariis, epiphyllis, ostiolatis, nigris, muris crassis, subglobosis, ca. 190–210 x 160–190 μ; conidiophoris confertis, brevo-cylindraceis, fere obsoletis; conidiis hyalinis, continuis, fusoideis vel late fusoideis, 12–) 15–20 (–22) x 4.5–6.5 μ, 2-, 3-, –4, vel 5-ciliatis distale; ciliis divergentibus late, flexuosis nonnihil, ca. 15–30 x 0.5–0.7 μ, variabilibus.

Spots grayish-brown, centers somewhat paler, narrow marginal to variously orbicular, approx. 0.25–0.5 cm. diam.; pycnidia gregarious, epiphyllous, ostiolate, black, thick-walled, subglobose, approx. 190–210 x 160–190 μ; conidiophores crowded, short-cylindric, almost obsolete; conidia hyaline, continuous, fusoid to broadly fusoid, (12–) 15–20 (–22) x 4.5–6.5 μ, 2-, 3-, 4-, or 5-ciliate distally; cilia widely diverging, somewhat flexuous, approx. 15–30 x 0.5–0.7 μ, variably borne.

On living leaves of *Oxypolis rigidior*. Scuppernong Prairie near Eagle, Waukesha County, Wisconsin, U. S. A., June 20, 1957.

As indicated in the description, the cilia are quite variably produced, sometimes arising uniformly from the tip of the conidium, but more often being borne in a staghorn branching manner where three or more are present. That is to say, one cilium will be produced from the tip of the conidium proper, while the others will be formed as side branches of the first named, sometimes branching at the same level, at other times not. There seems no doubt that this striking fungus is parasitic. The sporiferous layer encompasses the entire inner pycnidial surface except for a small zone about the ostiole, and large numbers of conidia are formed.

Neottiospora geranii (Schroet.) comb. nov.

Dilophospora geranii Schroet. in "Ein Beitrag zur Kentniss der nordischen Pilze." Breslau 1881, p. 16.

This fungus occurs on *Geranium maculatum* in Wisconsin and has been cited in Wisconsin lists as *Dilophospora geranii*. Since the

cilia are produced only from one end of the sopre, such an assignment cannot be correct.

Ascochyta madisonensis sp. nov.

Maculis fuscis vel griseis, magnis et conspicuis, immarginatis, ovalibus vel orbicularibus, confluentibus aliquoties, ca. 1–2 cm. diam.; pycnidiis epiphyllis, carneis vel pallido-brunneis, muris tenuibus, ca. 125–150 μ diam., subglobosis, subzonatis in maculis; conidiis hyalinis, subcylindraceis, rectis vel curvis leniter, uniseptatis, saepe biguttulatis, 8–12 (–14) x 2.5–3.5 μ.

Leaf spots dull brown to grayish, large and conspicuous, immarginate, oval to rounded-orbicular, sometimes confluent, approx. 1–2 cm. diam.; pycnidia epiphyllous, flesh-colored or pale brown, thin-walled, approx. 125–150 μ diam., subglobose, subzonately arranged on spots; conidia hyaline, subcylindric, straight to moderately curved, uniseptate, often biguttulate, 8–12 (–14) x 2.5–3.5 μ.

On living leaves of *Mertensia virginica*. University of Wisconsin Arboretum, Madison, Dane County, Wisconsin, U. S. A., May 28, 1957.

I have found no report of *Ascochyta* on any species of Boraginaceae. It must be confessed that the erection of the species is based principally on host relation considerations rather than on any highly distinctive morphology.

SEPTOGLOEUM OXYSPORUM Sacc., Bomm. & Rouss. on *Glyceria striata*. Sauk Co., Parfrey's Glen, Town of Merrimac, July 19, 1951. Although this is immature, the fungus concerned is such a seemingly distinct entity, judging from western United States and Alaskan specimens, that it is felt the report is justified. Sprague, in his "Diseases of Cereals and Grasses in North America" gives an extensive discussion of *S. oxysporum*.

Botrytis viciae sp. nov.

Maculis conspicuis, zonatis, centris ferrugineis, marginibus obscuro-incanis, ovalibus vel orbicularibus, ca. 4–6 x 2–3 mm.; conidiis subhyalinis vel pallido-brunneis, globosis vel subglobosis, 16–21 x 17–24 μ, glabris, muris tenuibus, ca. 1 μ, granulosis; conidiophoris pallido-brunneis vel brunneis, variabilibus, ca. 300–450 x 11–14 μ, saepe inflatis infra, 2–3-septatis infra ramis, prope 2–3-septatis supra ramis; fere 3 ramis, 1 terminalibus, 2 lateribus, interdum solum 1 lateribus; conidiophoris apicibus inflatis leviter, sterigmatibus digitatis-cruciformibus, fere 4–6 conidiis acervatim; conidiophoris amphigenis, sparsis vel gregariis.

Spots conspicuous, somewhat zonate, centers dull reddish, borders grayish, sometimes with a narrow darker margin, oval or irregularly orbicular, approx. 4–6 x 2–3 mm.; conidia subhyaline to

pale brown, globose or subglobose, 16–21 x 17–24 μ, smooth, wall thin, about 1 μ, cell content slightly granular, occasionally a slight protrusion at hilum; conidiophores pale brown to brown, variable, approx., 300–450 x 11–14 μ, often inflated to 20 μ or slightly more toward base, 2–3-septate below point of branching, closely 2–3-septate above this point; usually three branches, consisting of a short terminal extension of the main stalk with two side branches departing from it at right angles, occasionally only a single lateral branch; conidiophore tips slightly inflated with short digitate-cruciform sterigmata on which the conidia are borne, about 4–6 in a cluster; conidiophores amphigenous, scattered to gregarious.

On living leaves of *Vicia villosa*. University of Wisconsin Arboretum, Madison, Dane County, Wisconsin, U. S. A., June 15, 1957.

This has been noted on a number of occasions in the same general area and seems to be a strong parasite. It was briefly discussed in my Notes III (Trans. Wis. Acad. Sci. 35:120. 1944). As might be expected, the lower leaves are usually the most heavily infected, while those near the growing point are clean. Infected leaflets usually have one to three spots, with the entire leaflet becoming finally involved and dropping off.

DIDYMARIA LINARIAE Pass. on *Linaria vulgaris*. Sauk Co., Parfrey's Glen, Town of Merrimac, September 24. Not reported in Seymour as occurring in North America.

Ramularia parva sp. nov.

Maculis conspicuis, orbicularibus, 3–7 mm. diam., sordido-brunneis, subzonatis, marginibus angustis, elevatis, fuscis, cum haloibus rufo-purpureis; conidiophoris amphigenis, sparsis vel aggregatis laxe, continuis vel 1-septatis raro, hyalinis, rectis vel subgeniculatis raro, apicibus denticulatis frequenter, 12–25 x 3–4 μ; conidiis hyalinis, cylindraceis vel subfusoideis, continuis plerumque, 1-septatis interdum, catenulatis, (10–) 15–22 (–28) μ.

Spots conspicuous, orbicular, 3–7 mm. diam., dull brownish, subzonate, with narrow raised dark brown border, the whole surrounded by a reddish-purple halo; conidiophores amphigenous, scattered or loosely aggregated, continuous or rarely 1-septate, hyaline, simple, or rarely weakly geniculate, apex frequently denticulate, 12–25 x 3–4 μ; conidia hyaline, cylindric or subfusoid, mostly continuous, occasionally 1-septate, catenulate, (10–) 15–22 (–28) μ.

On living leaves of *Hieracium longipilum*. University of Wisconsin Arboretum, Madison, Dane County, Wisconsin, U. S. A., July 25, 1957.

Although the spots are very noticeable, the fungus itself is extremely inconspicuous and apt to be missed in an ordinary hand lens examination in the field. *R. parva*, in very small amount, was

collected near the type station in 1944 and reported on in my Notes XII (Amer. Midl. Nat. 41:730. 1949).

Cercospora lychnidis sp. nov.

Maculis orbicularibus, parvis, 2–3 mm. diam., pallido-brunneis, marginibus angustis, fuscis, elevatis leviter; conidiophoris amphigenis, fasciculatis laxis, basibus stromaticis parvis; fasciis cum 5–15 conidiophoris divergentibus, laxe multigeniculatis, pallido-brunneis claris, 120–330 x 4–4.5 μ, 1–4-septatis; conidiis hyalinis, flexuosis, subacicularibus vel obclavatis anguste, obscure multiseptatis, basibus truncatis, 80–260 x 2.5–4 μ.

Spots orbicular, small, 2–3 mm. diam., pale brown with slightly elevated, narrow, darker border; conidiophores amphigenous, loosely fascicled from a small stromatic base, about 5–15 divergent conidiophores per fascicle, laxly multigeniculate, clear light brown, 120–350 x 4–4.5 μ, 1–4-septate; conidia hyaline, flexuous, subacicular or narrowly obclavate, obscurely multiseptate, base truncate, 80–260 x 2.5–4 μ.

On living leaves of *Lychnis coronaria* (cult.). Madison, Dane County, Wisconsin, U. S. A., August 4, 1957. Also on *Lychnis chalcedonica* (cult.). Same station and date.

Although the specimen on *Lychnis coronaria* is here designated as the type, the characters and measurements actually are based on both host specimens. The conidiophore measurements were taken from the underside of the leaf. In the non-hairy *L. chalcedonica* especially, phores produced on the upper surface are shorter and more compactly fascicled from a somewhat better developed stromatic base and the conidia tend to be shorter. This points to the fact that absolute measurements, particularly as to length, may not always be very reliable for descriptive purposes in exogenous fungi such as *Cercospora*. Chupp, in his monograph records no Cercosporae on *Lychnis* or *Silene*. *C. lychnidis* is noteworthy for the long, lax, yet consistently geniculate conidiophores. Geniculation extends from the tip almost to the base of the phores, with long "intergeniculate" spaces, so that the tortuous effect produced where geniculations are close together is almost lacking here.

CERCOSPORA LEONURI Stevens & Solheim on *Leonurus cardiaca*. Dane Co., Madison, July 13. Described originally on material from Costa Rica (Mycologia 23:395. 1931). The Madison specimen matches the description and illustration quite closely.

CERCOSPORA NEPETAE Tehon on *Nepeta hederacea*. Dane Co., Madison, August 16. This specimen corresponds well with the emended description of the fungus, as it appears on *Nepeta cataria*, given by Chupp in his monograph.

CURVULARIA GENICULATA (Tr. & Earle) Boedijn on *Eragrostis spectabilis*. Dane Co., Madison, September 8, 1945. Det. R. A. Shoemaker. Originally reported as *Helminthosporium rostratum* Drechsler. Also on *Sporobolus asper* at Madison, August 1, 1957. Det. R. Sprague. The fungus appears very actively parasitic on this host.

HELMINTHOSPORIUM YAMADAI Nisikado on *Panicum capillare*. Waukesha Co., Eagleville, August 18, 1942. Also on *Panicum implicatum*. Dane Co., Madison, August 8, 1949. Det. R. A. Shoemaker. Originally reported as *H. sativum* Pamm., King & Bakke.

HELMINTHOSPORIUM HADROTRICHOIDES Ell. & Ev. on *Eragrostis cilianensis*. Dane Co., Madison, August 11, 1947. Also on *Eragrostis pectinacea*. Dane Co., Madison, August 6, 1944. Det. R. A. Shoemaker.

HELMINTHOSPORIUM TRITICI-REPENTIS (Died.) Died. on *Agropyron repens*. Dane Co., Madison, May 25, 1943. Det. R. A. Shoemaker. Originally reported as *H. sativum* Pamm., King & Bakke.

HELMINTHOSPORIUM TUBEROSUM Atk. on *Secale cereale*. Dane Co., Madison, November 18, 1948. Det. R. A. Shoemaker. This was reported as *H. secalis* Whitehead & Dickson and is the type specimen.

HELMINTHOSPORIUM FLAGELLOIDEUM Atk. on *Scirpus acutus*. Dane Co., Madison, August 8, 1952. Det. R. A. Shoemaker. Discussed in my Notes XVIII (Trans. Wis. Acad. Sci. 42:74. 1953). Also on *Carex* sp. (*C. convoluta-C.* rosea group). Green Co., near Albany, May 8, 1948. Shoemaker states that these both correspond well with the description and that, although Atkinson mentions the host as *Panicum* (?), it is very likely it was actually a sedge.

NOTES ON WISCONSIN PARASITIC FUNGI. XXV

H. C. GREENE
Department of Botany, University of Wisconsin, Madison

These notes are based principally on collections made during the season of 1958 which was, owing to drouth conditions, unfavorable for the development of fungi. Unless otherwise noted, collections referred to were made in 1958.

Unidentified powdery mildews have been found on 1) *Brassica campestris.* Dane Co., Madison, October 21, 1957; 2) *Amelanchier canadensis,* Madison, October 15; 3) *Multiflora* rose, Madison, August 6; 4) *Lycopus virginicus,* Madison, September 4; 5) *Helianthus giganteus.* Juneau Co., Petenwell Wilderness Park, July 16; 6) *Lactuca floridana.* Green Co., New Glarus Woods Roadside Park, August 26. These hosts have not been recorded previously as bearing powdery mildews in Wisconsin.

PARODIELLA PERISPORIOIDES (B. & C.) Speg. has been found in mature condition on *Desmodium acuminatum,* August 26, in the New Glarus Woods Roadside Park, Green Co. The only previous Wisconsin specimen on this host was an immature one, now in the National Fungus Collections, collected by Pammel 75 years ago at La Crosse.

OPHIODOTHIS HAYDENI (B. & C.) Sacc. on *Aster lucidulus* (cult.), collected at Madison, September 28, by G. Latch, bears rod-shaped microconidia, about 4–5 x 0.7 μ, in profusion within the crowded, flattened fruiting bodies. This is the first Wisconsin specimen seen bearing spores of any sort. It seems probable that the production of microconidia precedes the initiation of the perfect stage. According to Ainsworth and Bisby, *Ophiodothis* should be referred to *Balansia* Speg.

MYCOSPHAERELLA sp. occurs on *Phyllosticta decidua*-like lesions on leaves of *Ratibida pinnata,* collected at Madison, July 19. The spots are rounded, thin, translucent, about 1.5–2 mm. diam.; perithecia gregarious, black, subglobose, approx. 80–115 μ in diam., the walls made up of large, isodiametric, pseudoparenchymatous cells; asci hyaline, clavate or curved-clavate, 37–41 x 10–11.5 μ; ascospores 12–14 x 3.5–4 μ. Parasitism and relation to host questionable.

MYCOSPHAERELLA sp. occurs on small, angled, whitish, subtranslucent spots on leaves of *Aster umbellatus,* collected at Madison, August 9. The perithecia are epiphyllous, usually only one to a

spot—many of the spots have no fruiting on them—blackish, subglobose about 125–150 μ diam. The asci are curved-cylindric, 40–50 x 7–8 μ; ascospores hyaline, arcuate, 12–14 x 2.7–3 μ. Associated with the *Mycosphaerella*, and indistinguishable under the hand lens, is a *Phyllosticta* with hyaline, rod-shaped to subfusoid conidia, 4–9 x 1.5–2 μ. This obviously bears no relation to the very distinct *Phyllosticta astericola* Ell. & Ev. on this host.

LEPTOSPHAERIA sp. is present on rounded, sunken, cinerous spots, about 1 mm. diam. on leaves of *Monarda fistulosa*, collected at Madison, July 3. The perithecia are scattered, black, subglobose, approx. 100–115 μ diam.; asci are 10–12 x 60–70 μ, broadly clavate; ascospores are olivaceous, broadly fusoid, 4-celled, the penultimate cell somewhat enlarged, 23–25 x 5–5.5 μ. Appearing probably parasitic.

Dutch elm disease continues to spread and increase in Wisconsin and, from the first case, discovered at Beloit in July, 1956, the infection has now, in the fall of 1958, spread to ten counties, including Dane, Green, Jefferson, Kenosha, Milwaukee, Ozaukee, Racine, Rock, Walworth and Waukesha, involving more than 2000 trees. It may be noted that the counties concerned represent a solid block confined to the southeastern and south central part of the state.

PHYLLOSTICTAE, undetermined as to species, have been found on various hosts, as indicated in the following descriptive notes: 1) On *Calamagrostis canadensis*. Dane Co., Madison, October 17. The lesions are sordid straw-colored to dull purplish-brown, variable in size, irregularly elongate, often confluent and conspicuous on the still green leaves. Pycnidia scattered, very inconspicuous, produced entirely within and not distorting the host. Pycnidia dull brown, flattened-fusoid to broadly ellipsoid, approx. 100–150 μ in long dimension, 60–90 μ in short dimension, without well-marked ostiole, but seeming to have an opening to the adaxial leaf surface. The conidia are rod-shaped, hyaline, 4–7 x .8–1.2 μ, borne on slender, hyaline conidiophores which are closely ranked over the entire inner surface of the pycnidium. Appearing parasitic, but, as a very late season development, of uncertain status. There is no evidence of an incipient ascomycetous stage. 2) On *Arisæma atrorubens* collected at Gibraltar Bluff, Columbia Co., June 17. The translucent, rounded to oval spots are approx. 4–7 mm. diam., pale cinereous-brown with slightly darker borders; pycnidia pallid, scattered, flattened to subglobose, about 90–120 μ diam.; conidia hyaline, mostly short-cylindric, occasionally subfusoid, 2.5–4 x 4–8 μ. 3) On *Conringia orientalis* near Cross Plains, Dane Co., June 28. The spots are whitish, thin, translucent, irregularly rounded or elongate, with narrow raised border, 1–3(–4) mm. in long diam. Pycnidia are gregarious to clustered, medium- to dark-brown, subglobose, mostly 150–175 μ diam., but exceptionally up to 200 μ. Conidia are rather

sparingly produced, hyaline, subcylindric, subfusoid, or occasionally allantoid, 3–5.5 x 1.5–2.5 μ. There are only one or two spots per leaf as a rule, and generally but a single infected leaf was borne on any one plant. Dubiously parasitic, but consistently present on many plants over a wide area. 4) On sordid-brownish lesions on leaflets of *Rubus strigosus*, collected near Pine Bluff, Dane Co., July 31. The lesions are variable from orbicular to wedge-shaped, up to 2 cm. diam. The subglobose pycnidia are very inconspicuous, 60–85 μ diam., deeply imbedded in the tissue and seeming to merge with it, discernible only by strong transmitted light. They tend to be clustered in the centers of the spots. The conidia are hyaline, cylindric, approx. 6–10 x 2–3 μ. Possibly the precursor of a perfect stage. The conidia are similar in dimension to *Phyllosticta variabilis* Peck, but in specimens in the Wisconsin Cryptogamic Herbarium the pycnidia of that species are easily seen in surface view with a hand lens. 5) On large, pale-brown, wedge-shaped areas at the apices of leaflets of *Agrimonia gryposepala*, collected at Madison, July 11. The epiphyllous pycnidia are blackish-brown, subglobose, scattered, approx. 125–150 μ diam.; conidia hyaline, fusoid, 5–9 x 2–3 μ. 6) In small amount on leaves of *Lupinus perennis*, collected at Madison, June 19. This is not *Phyllosticta ferax* Ell. & Ev., common in northwest America. The rounded spots are 2–3 mm. diam., pallid brown with a narrow reddish-brown border. The amphigenous pycnidia are gregarious, subglobose, sooty, the ostiole marked by a conspicuous ring of darker cells, diam. approx. 100–125 μ; conidia are hyaline, broadly ellipsoid, ovoid, or short-cylindric, 2.5–3.5 x 4–7 μ, often biguttulate, but with no evidence of septation. 7) On *Aralia racemosa* at Madison, September 13, 1957. Epiphyllous on yellow-brown spots; pycnidia sooty black, subglobose, about 100 μ diam.; conidia hyaline, cylindric with rounded ends, 5–8 x 2.5–3 μ. 8) On *Asclepias incarnata* at Madison, September 14, 1957. Hypophyllous; spots sordid brownish, orbicular, about 1.5 cm. diam.; pycnidia imperfectly formed, dull brownish, closely gregarious, about 75–125 μ diam.; conidia hyaline, slender-cylindric, approx. 4–6 x 2–3 μ.

ASCOCHYTA sp. is present on *Pachypsylla* galls on leaves of *Celtis occidentalis*, collected at Madison, October 10. The pycnidia are sordid amber-colored, scattered to gregarious, flattened, approx. 100–175 μ diam., almost superficial; conidia are hyaline, obtuse, cylindric, 9–12 x 2.5–3.5 μ. A rather high percentage of the conidia lack septa, and these are mostly smaller.

ASCOCHYTA (or *Stagonospora*) occurred on languishing leaves of *Barbarea vulgaris*, collected at Madison, May 19. The subglobose, olivaceous pycnidia are about 140–150 μ diam. The spores are hyaline, slightly to strongly curved, subcylindric to subfusoid, uniseptate so far as observed, 10–18 x 2.5–3 μ.

ASCOCHYTA sp., well-characterized, but in small amount, occurred on *Euphorbia esula* near Cross Plains, Dane Co., June 28. The tiny white spots bear only one or two pycnidia per spot. The pycnidia are black, subglobose, approx. 150–175 μ diam. The majority of the conidia seen were continuous, but many showed a well-defined septum. They are subhyaline, ovoid or short-cylindric, 6–8 x 2.5–3.5 μ. I have found no report of any *Ascochyta* on *Euphorbia*, other than *Ascochyta euphorbiae* Lasch, which is actually *Septoria euphorbiae* (Lasch) Desm.

CONIOTHYRIUM sp. occurs on aeciae of *Puccinia ellisiana* Thum. (on *Viola pedata*) collected June 17 at Gibraltar Bluff, Columbia Co. The sooty conidia are 4–8 x 3–4 μ, broadly ellipsoid or short cylindric. The relationship is uncertain.

DARLUCA FILUM (Biv.) Cast. has overrun sori of *Puccinia dioicae* P. Magn. I on *Oenothera biennis*, collected at Madison, July 11, to add another to a slowly growing list of examples of this hyperparasite on aecia, as opposed to the usual uredial substratum.

STAGONOSPORA sp. occurred on leaves of *Scleria triglomerata* at Madison, July 5. The long-oval spots, approx. .7–1.5 cm., have dark reddish borders, with paler central portions and usually extend from margin to margin of the narrow blade. The scattered pycnidia are globose, sooty, 80–100 μ diam., the spores hyaline, cylindric, 13–18 x 3–4 μ, obscurely 1–3 septate.

STAGONOSPORA on *Verbena hastata*, collected at Madison, July 20, is, in microscopic characters, very similar to *Stagonospora verbenae* H. C. Greene (Amer. Midl. Nat. 48:52. 1952) described on *Verbena stricta*, but the leaf spots differ in being translucent, more of the *Phyllosticta decidua* type.

MARSSONINA THOMASIANA (Sacc.) Magn. has been listed as doubtfully present on *Celastrus scandens* in Wisconsin on the basis of a specimen collected at Blue River, Grant Co., by J. J. Davis in June 1929, which was at first referred to *Evonymus* but, according to a penciled note on the packet, was later determined as *Celastrus*. Davis evidently felt uncertain about the specimen, for he did not publish on it. In the summer of 1958 good specimens were found on *C. scandens* at three stations in southern Wisconsin, at Madison, Dane Co., at Tower Hill State Park, Iowa Co., and at Gibraltar Bluff, Columbia Co.

RAMULARIA CHIMAPHILAE Greene on *Chimaphila umbellata* was described in my Notes XI (Amer. Midl. Nat. 41:723. 1949), with the statement that it was reminiscent of certain species of *Septocylindrium*. J. A. Parmelee of the Canadian Science Service, who has been making a study of parasites of the Ericaceae, considers that *R. chimaphilae* should be referred to *Septocylindrium*, and

points out that it is very similar to *S. leucum* Bayl.-Ell. & Stansf. (Trans. Brit. Mycol. Soc. 8:249. 1923).

CERCOSPORA sp., collected in small amount on *Conringia orientalis* near Cross Plains, Dane Co., June 28, seems close to *Cercospora erysimi* J. J. Davis, but the Cercosporae on Cruciferae seem to be not well characterized taxonomically. The current specimen has conidia which are truncate at base, subobtuse at tip, slightly curved, multiseptate, slender-clavate, about 40–50 μ long.

CERCOSFORA SILPHII Ell. & Ev. normally occurs on small, dark, squarish or oblong leaf spots, about 1–2 mm. diam. However, in a collection on *Silphium laciniatum* made near Orfordville, Rock Co., in July, the spots are orbicular, dark purplish-brown, about 1 cm. in diam., very conspicuous and striking.

Euphorbia esula stems, collected near Middleton, Dane Co., October 12, 1957, and reported on in my Notes XXIV as bearing a conspicuous non-fruiting fungus, were collected again at the same station in June 1958, after overwintering. Sections showed an immature Ascomycete, as well as an imperfect stage with cylindric, hyaline, guttulate conidia, 1–3-septate, 10–16 x 3–5 μ, apparently produced from sporiferous layers, without well-developed conidiophores. Incubation in a moist chamber failed to induce further development of the ascomycetous stage.

ADDITIONAL HOSTS

The following hosts have not been previously recorded as bearing the fungi mentioned in Wisconsin.

ALBUGO CANDIDA (Pers.) O. Ktze. on *Brassica arvensis* (*B. kaber*). Dane Co., Madison, July 14. Also on *Conringia orientalis*. Dane Co., near Cross Plains, June 28.

ERYSIPHE GRAMINIS DC. Conidia on *Cinna arundinacea*. Rock Co.. near Avon, September 2.

SPHAEROTHECA HUMULI (DC.) Burr. on *Rosa lucida* (*R. virginica*) (cult.). Jefferson Co., Waterloo, October 9. Coll. D. L. Coyier.

ROSENSCHELDIA HELIOPSIDIS (Schw.) Theiss. & Syd. on stems of *Aster pilosus*. Dane Co., Madison, October 28, 1957. Reported in Seymour as occurring on the closely related *Aster multiflorus* (*ericoides*). Additional material, which had overwintered in the field, was gathered in the spring of 1958 and placed in a moist chamber where typical asci and spores developed. Also on *Helianthus giganteus*. Juneau Co., Petenwell Wilderness Park, July 16. The conidial phase, *Phyllosticta helianthi* Ell. & Ev., is likewise present.

PSEUDOPLEA TRIFOLII (Rostr.) Petr. on *Medicago lupulina*. Dane Co., Madison, July 4. The numerous gregarious perithecia are on

rather extensive dead areas, for there are no sharply defined spots in this collection.

PUCCINIA PYGMAEA Erikss. II on *Koeleria cristata.* Dane Co., near Mazomanie, July 5, 1929, coll. J. J. Davis; Sauk Co., Ferry Bluff, July 7, 1945. Originally determined as *P. liatridis* (Webber) Bethel. This is *P. koeleriae* Arth. which Prof. G. B. Cummins regards as synonymous with *P. pygmaea.*

PUCCINIA SPOROBOLI Arth. II, III on *Calamovilfa longifolia.* Marquette Co., near Montello, September 12, 1937. Coll. N. C. Fassett. Also from Sheboygan Co., near Oostburg, October 9, 1949. Both these specimens were first determined as *Puccinia amphigena* Diet. and the Montello specimen formed the basis for the report of *P. amphigena* in Wisconsin. According to Prof. G. B. Cummins, the Oostburg specimen is a mixture of *P. sporoboli* and *P. amphigena,* so the latter retains its Wisconsin listing. Cummins has found that many of the standard American exsiccati, issued as *P. amphigena* on *Calamovilfa,* are actually *P. sporoboli.*

PUCCINIA SCHEDONNARDI Kell. & Sw. II, III on *Muhlenbergia schreberi.* Dane Co., near Cross Plains, September 5.

PUCCINIA CARICINA DC. III on *Carex typhina.* Grant Co., Bridgeport, September 11, 1929. Coll. E. P. Breakey. On a phanerogamic specimen in the University of Wisconsin Herbarium.

PUCCINIA SEYMOURIANA Arth. I on *Asclepias purpurascens.* Juneau Co., Meadow Valley, July 16.

GYMNOSPORANGIUM GLOBOSUM Farl. I on *Crataegus lavallei* (cult.). Dane Co., Madison, September 21.

ENTYLOMA COMPOSITARUM Farl. on *Bidens cernua.* Dane Co., Madison, July 12. A scanty specimen, but characteristic. Evidently rarely collected on *Bidens* in any locality. Savile, in his study of *Entyloma* on North American Compositae, cites only two specimens. There is a single earlier Wisconsin collection on *Bidens vulgata.*

SCHIZONELLA MELANOGRAMMA (DC.) Schroet. on *Carex deweyana.* Columbia Co. Park at Gibraltar Bluff, near Okee, June 17.

PHYLLOSTICTA DECIDUA Ell. & Kell. on *Urtica dioica.* Dane Co., Madison, July 26. Also on *Verbena urticaefolia.* Madison, July 3.

PHYLLOSTICTA NEBULOSA Sacc. on *Lychnis chalcedonica* (cult.). Dane Co., Madison, August 24. In this specimen the orbicular spots are reddish-brown with paler centers, very conspicuous, .7–1.5 cm. diam., subzonate; pycnidia epiphyllous, tending to be concentrically arranged; conidia obtuse, cylindric, or rarely subfusoid, 6–11 x 2.5–3.5 μ. This seems without much doubt to be the fungus described as *P. lychnidis,* by A. Bondarzew, on *Lychnis chalcedonica* from the Caucasus, which had spores 6–8 x 3–3.6 μ, rarely 10 x 4 μ. As ex-

plained in my Notes XV (Amer. Midl. Nat. 48:45. 1952) it is my opinion that Phyllostictae in this general range of dimensions and hosts should all be referred to *P. nebulosa.*

PHYLLOSTICTA CORNICOLA (DC.) Rabh. on *Cornus femina.* Dane Co., Madison, September 16. *Septoria cornicola* Desm., so widespread on this host, occurs in close association, confusing the picture. Also on *Cornus alternifolia* at Madison, September 15. An earlier report (Trans. Wis. Acad. Sci. 35:129. 1944) of this species on *Cornus alternifolia* is now considered to be in error, and the specimen does not seem to correspond well with any *Phyllosticta* so far described on *Cornus.* In this 1944 specimen the spots are rounded, cinereous, with narrow purple borders, small, about 1–1.5 diam. and ranged along the principal leaf veins; pycnidia black, subglobose, epiphyllous, 75–90 μ diam., one to five per spot; conidia hyaline, short-cylindric, 4–5.5 x 1.5–2.5 μ.

ASSCOCHYTA LOPHANTHI J. J. Davis on *Blephilia hirsuta.* Vernon Co., Champion Valley near Hillsboro, July 17.

STAGONOSPORA BROMI Smith & Ramsb. on *Bromus japonicus.* Dane Co., Madison, July 4.

SEPTORIA ASCLEPIADICOLA Ell. & Ev. on *Asclepias purpurascens.* Juneau Co., Meadow Valley, July 16. Each and every *Septoria* spot bears old sori of *Puccinia seymouriana* Arth. I on the reverse, indicating the later development of the *Septoria.* However, no such condition has ever been noted in the numerous specimens of *S. asclepiadicola* on other species of *Asclepias.*

HAINESIA LYTHRI (Desm.) Hoehn. on *Steironema ciliatum.* Iowa Co., Tower Hill State Park, August 13. One of the stages of *Pezizella lythri* (Desm.) Shear & Dodge. The other, *Sclerotiopsis concava* (Desm.) Shear & Dodge, has been reported on this host in Wisconsin.

CYLINDROSPORIUM SPIRAECOLA Ell. & Ev. on X *Spiraea billiardi* (cult.). Dane Co., Madison, July 10. The host is a hybrid between the West American *S. douglasii* Hook. and a South European species.

HELMINTHOSPORIUM SOROKIANUM Sacc. on *Elymus villosus.* Sauk Co., Parfrey's Glen, Town of Merrimac, September 24, 1957.

CERCOSPORA ROSICOLA Pass. on *Multiflora* rose (cult.). Dane Co., Madison, August 24. Also on *Rosa heliophila* (*R. pratincola*). Madison, August 25.

Additional Species

The fungi mentioned have not been previously reported as occurring in the state of Wisconsin.

Phyllosticta tenebrosa sp. nov.

Maculis magnis, orbicularibus, 1–4 cm. diam., fuligineis, centris pallidioribus leviter; pycnidiis gregariis, pallido-brunneis, muris tenuibus, subglobosis vel complanatis aliquantum, 125–165 μ diam.; conidiis hyalinis, cylindraceis, late ellipsoideis vel subfusoideis, rectis vel curvis leviter, 5–8 x 2–3.5 μ; conidiophoris hyalinis, confertis, brevibus, fere obsoletis.

Spots large, orbicular, 1–4 cm. diam., dull black with slightly paler central portions; pycnidia gregarious, pale brown, thin-walled, subglobose or somewhat flattened, 125–165 μ diam.; conidia hyaline, cylindric, broadly ellipsoid or subfusoid, straight or slightly curved, 5–8 x 2–3.5 μ; conidiophores hyaline, crowded, short, almost obsolete.

On living leaves of *Ranunculus septentrionalis.* Sugar River bottoms near Avon, Rock County, Wisconsin, U. S. A., September 2, 1958.

Ultimately entire leaves become involved and killed back, so that the fungus is evidently a strong parasite. Very many pycnidia are borne on the larger spots and they are occasionally subzonately arranged. The pycnidia are very numerous, as stated, but are also very inconspicuous except by transmitted light.

Sphaeropsis astericola, sp. nov.

Maculis rufo-brunneis, immarginatis, orbicularibus, 4–6 mm. diam.; pycnidiis sparsis vel gregariis, amphigenis, plerumque epiphyllis, nigris, subglobosis, 135–160 μ diam.; conidiophoris hyalinis, exilibus, 6–8 x 2–2.5 μ; conidiis claro-brunneis, ovoideis, ellipsoideis late, vel subfusoideis, 9–15 x 5–7.5 μ.

Spots reddish-brown, immarginate, orbicular, 4–6 mm. diam.; pycnidia scattered or gregarious, amphigenous, mostly epiphyllous, black, subglobose, 135–160 μ diam.; conidiophores hyaline, slender, 6–8 x 2–2.5 μ; conidia clear brown, ovoid, broadly ellipsoid, or subfusoid, 9–15 x 5–7.5 μ.

On living leaves of *Aster shortii.* Chicago & Northwestern R. R. right-of-way at Warner Beach adjacent to Maple Bluff, Madison, Dane County, Wisconsin, U. S. A., September 27, 1958.

This fungus appears to be parasitic despite the fact that many of the spots have been mined by insects. There is no sign of any other fungus, or any of the usual saprophytes, which might be expected to develop if there were no parasitic relation between fungus and host.

ASCOCHYTA DULCAMARAE Bubak on *Solanum dulcamara.* Dane Co., Madison, July 20. The specimen corresponds closely to the description. Not reported for North America by Seymour.

Cercoseptoria capsellae (Ell. & Ev.) comb. nov.

Cylindrosporium capsellae Ell. & Ev. Jour. Mycol. 3:130. 1887.

The small, compact hyphal masses on which the condia are borne are actually elevated, and hence this species cannot properly be maintained as a *Cylindrosporium.*

Amphichaeta rosicola sp. nov.

Maculis pallido- vel languido-brunneis, marginibus rubricosis angustis, orbicularibus, .3–1 cm. diam.; acervulis epiphyllis, applanatis, fumosis, subzonatis, sublinearibus, ellipsoideis vel rotundatis, ca. 100–200 μ diam., peridiis tenuibus, brevi fractis; conidiophoris pallido-olivaceis, exilibus, confertis, 10–15 μ longis; conidiis bicoloribus, cellis terminalibus subhyalinis, cellis centris olivaceis, subarcuatis, 4-cellis, 3-septatis, 15–20 x (3.5–)4–5(–5.5) μ, setulis 2, lateralibus, uno in singulis cellis terminalibus, hyalinis, exilibus, rigidis, brevibus, ca. 2–3 μ longis.

Spots pale to dull brown, with narrow reddish borders, orbicular, .3–1 cm. diam.; acervuli epiphyllous, flattened, dull black, subzonately arranged, sublinear, ellipsoid, or rounded, approx. 100–200 μ in long diam., peridium thin, soon ruptured; conidiophores pallid olivaceous, slender, closely ranked, 10–15 μ long; conidia bicolored, terminal cells subhyaline, central cells olivaceous, subarcuate, 4-celled, 3-septate, 15–20 x (3.5–) 4–5(–5.5) μ, setulae 2, one produced laterally from each terminal cell, hyaline, slender, rigid, short, approx. 2–3 μ long.

On living leaves of *Rosa heliophila Greene* (*R. pratincola* Greene). University of Wisconsin Arboretum, Madison, Dane County, Wisconsin, U. S. A., August 25, 1958.

One of the bristle-like setulae is usually attached at a wider angle than the other. In occasional spores only one bristle is well-developed, which would seem to indicate that this genus may not be sharply distinct from *Monochaetia* Sacc. *Monochaetia discosioides* (Ell. & Ev.) Sacc. has been reported on Rosaceae in Wisconsin.

Amphichaeta rosicola appears parasitic but, in view of the saprophytic nature of other fungi in this group, it seems possible that it is secondary, or only weakly parasitic.

Cladosporium elsinoes sp. nov.

Conidiophoris claro-brunneis, sparsis vel confertis solute, non fasciculatis, ramosis aliquoties, flexuosis, subgeniculatis, multiseptatis, muris succrassulis, plerumque ca. 150 x 4–5 μ, raro 300 μ;

conidiis olivaceo-brunneis claris, levibus, muris tenuibus, cylindraceis, brevo-cylindraceis, vel ovoideis aliquoties, 9–15 x 5–6 μ, uniseptatis plerumque, raro 2–3-septatis.

Conidiophores clear intense brown, scattered to loosely clustered, not fascicled, occasionally branched, flexuous, subgeniculate, multiseptate, moderately thick-walled, mostly about 150 x 4–5 μ, rarely up to 300 μ; conidia clear olivaceous-brown, smooth, thin-walled, cylindric, short-cylindric, or sometimes ovoid, 9–15 x 5–6 μ, mostly uniseptate, rarely 2–3-septate.

On fructifications of *Elsinoe wisconsinensis* H. C. Greene on *Desmodium illinoense*. Ipswich, Lafayette County, near Platteville, Wisconsin, U. S. A., August 16, 1951.

Closely associated with *Elsinoe wisconsinensis* and seeming parasitic on it. This has been observed consistently over the years and several *Elsinoe* specimens now in the University of Wisconsin Cryptogamic Herbarium have well-developed fruiting of the *Cladosporium*. Too much emphasis should not be placed on conidiophore length. The specimen chosen as the type was developed under conditions of adequate moisture. On the other hand, a specimen collected at Madison in 1958, developed under severe drouth conditions, has much shorter conidiophores, and more of them are branched, but they are the same in their essential characters, and the conidia of the two specimens do not differ, except that perhaps a slightly higher per cent are 2–3-septate in the Madison collection. Measurements of conidia are based on the vast majority, which are uniseptate, and not on those with more than one spetum, which tend to be somewhat longer. In the uniseptate conidia the septum is sometimes not exactly median.

Cercosporella tephrosiae sp. nov.

Maculis nullis; fructificationibus epiphyllis, sparsis, albidis; conidiophoris hyalinis vel tinctis infirme; fasciis compactis, ca. 25 μ diam. ad basibus; conidiophoris leviter divergentibus, multigeniculatis admodum et saepe arte, flexuosis, aseptatis simulate, 50–125 x 3.5–5.5 μ; conidiis hyalinis, cylindraceis, subcylindraceis, vel subfusoideis, basibus conicis vel subconicis, cicatricibus prominentibus, 1–3-septatis, (19–)23–38(–46) x (3–)4–5(–5.5) μ.

Spots none; fruiting epiphyllous, scattered, white; conidiophores hyaline or very faintly tinted, closely and compactly fascicled, base of fascicle about 25 μ in diam.; conidiophores only slightly divergent, strongly and often closely multigeniculate, flexuous, apparently aseptate, 50–125 x 3.5–5.5 μ; conidia hyaline, cylindric, subcylindric, or subfusoid, base conic or subconic, scar prominent, 1–3-septate, (19–)23–38(–46) x (3–)4–5(–5.5.) μ.

On living leaves of *Tephrosia virginiana.* Tower Hill State Park, Iowa County, Wisconsin, U. S. A., August 13, 1958.

This fungus verges on *Cercospora,* for the closely compacted conidiophores viewed in mass have a faint brownish tinge. Individually, however, they appear hyaline and the profusely produced conidia are snow-white in mass, as seen under a hand lens. *Cercosporella tephrosiae* bears no resemblance to *Cercospora tephrosiae* Atk. which has relatively slender, long-obclavate, strongly tinted, multiseptate conidia, up to 125 μ or more in length, as well as very deeply colored phores.

CERCOSPORA HELIANTHICOLA Chupp & Viegas on *Helianthus grosseserratus.* Dane Co., Madison, July 5. Quite inconspicuous. Determined on the basis of Chupp's key character of slender, acicular, hyaline conidia.

MYROTHECIUM RORIDUM Tode on *Viola cucullata.* Dane Co., August 1. Bisby notes that this species is sometimes parasitic on violets, and the current specimen certainly appears so. Also on *Viola eriocarpa.* Columbia Co., near Poynette, August 6, 1952.

NOTES ON ROCKY MOUNTAN RUST FUNGI

JOHN W. BAXTER
University of Wisconsin—Milwaukee

This paper reports the results of a study of three species of the Uredinales or rust fungi occurring in the central Rocky Mountain region. The research was conducted during 1957 and included field observations and collections, greenhouse inoculations and examination of herbarium specimens. This study was supported in part by a grant from the Wisconsin Alumni Research Foundation. Specimens from the Purdue University Arthur Herbarium were obtained through the courtesy of Dr. G. B. Cummins, Department of Botany and Plant Pathology, Purdue University.

PUCCINIA MENTHAE

Puccinia menthae Pers. is an autoecious, long-cycle rust occurring on a large number of genera of the Labiatae throughout the world. Physiologic specialization within this species was demonstrated by Cruchet (3), Niederhauser (5) and Baxter and Cummins (2). *Puccinia menthae* also shows considerable morphologic variation, as pointed out by Fischer (4) and Arthur (1). During the present study, uredial and telial specimens of *P. menthae* were collected in Utah and Wyoming for the purpose of studying physiologic specialization and morphologic variation within the species in the Rocky Mountain region. Five collections, obtained during July and August, were later tested in the greenhouse on a series of differential hosts. The results of the inoculations, based on three trials, are summarized in Table 1. Four of the collections produced infection reactions characteristic of previously described races. One collection, on *Monarda fistulosa* L. var. *menthaefolia* Graham, proved to be a new race.

The infection reactions produced on the differential hosts by collections 3 and 4 indicate that they represent race 8 as defined by Baxter and Cummins (2), while collections 1 and 2 used in the present study probably are identical with the races which Baxter and Cummins designated 3 and 4. Collection 5 in the present study appears to represent a new race and brings to sixteen the number of races of *P. menthae* known to occur in North America.

Telial material of the five Rocky Mountain collections was examined in a study of variation in teliospore morphology, and was com-

TABLE I

INFECTION REACTIONS PRODUCED BY FIVE COLLECTIONS OF *Puccinia Menthae*

Hosts Inoculated	COLLECTIONS				
	1. On *Mentha arvensis* (Wyoming)	2. On *Monarda fistulosa* var. *menthaefolia* (Wyoming)	3. On *Monardella oblongifolia* (Utah)	4. On *Monardella oblongifolia* (Utah)	5. On *Monarda fistulosa* var. *menthaefolia* (Wyoming)
Monardella oblongifolia Rydb.	0	1	3	4	1
Monarda fistulosa L.	0	4	0	0	3
Monarda punctata L.	0	0	0	0	0
Hedeoma drummondii Benth.	0	0	0	0	3
Mentha arvensis L.	4	0	0	0	0
Mentha piperita L.	0	0	0	0	0
Mentha spicata L.	0	0	0	0	0
Mentha cardiaca L.	0	0	0	0	0
Mentha rotundifolia Huds.	0	0	0	0	0
Mentha longifolia Huds.	0	0	0	0	0

0, immune; 1, highly resistant; 2, moderately resistant; 3, moderately susceptible; 4, highly susceptible.

pared with telial material from Europe, eastern North America and South America. The results of this study indicate the advisability of establishing a geographic subspecies to accommodate the races or varieties of *P. menthae* occurring in western North America on species of *Monardella, Hedeoma* and *Monarda.* Further study of morphologic variation on a worldwide basis may reveal a need for subdividing *Puccinia menthae* into several subspecies or varieties.

Puccinia xanthifoliae and Puccinia helianthi

Puccinia xanthifoliae Ell. & Ev. occurs on marsh elder, *Iva xanthifolia* Nutt., in the central plains states and Rocky Mountain area, with a known distribution extending from South Dakota to southern Idaho and southward to Kansas and Arizona. During the summer of 1957 specimens of this rust were collected by the writer near Guernsey, Wyoming and in the vicinity of Greeley, Colorado. Field observations made at the latter location indicated a possible relationship between rust infection on *Iva xanthifolia* and rust occurring on nearby plants of *Helianthus annuus* L. Greenhouse inoculations during October and November, 1957 provided a partial answer to this question. In 2 trials, urediospore material on *Iva xanthifolia,* collected near Guernsey, Wyoming, was used to inoculate plants of *Helianthus annuus* grown from seed in the greenhouse. In both tests abundant infection was obtained. Check plants remained free of rust. Although the reciprocal inoculation has not been made, it seems reasonable to conclude that at least one strain of *Puccinia xanthifoliae* or *Puccinia helianthi* Schw. is capable of infecting both *Iva xanthifolia* and species of *Helianthus.*

Further interest in this problem led to a study of urediospore and teliospore morphology in *P. helianthi* and *P. xanthifoliae.* Specimens examined included material collected by the writer during 1956 and 1957 in Wyoming, Colorado, Nebraska and Indiana, as well as specimens in the Arthur Herbarium, Purdue University. The study of *P. helianthi* yielded the following data: urediospores 18–26 x 22–28 μ, wall 1–1.5 μ, thickened to 2 μ near the hilum; teliospores 19–26 x 32–48 μ, wall 1.5–3 μ, thickened to 7–12 μ at the apex. Examination of specimens of *P. xanthifoliae* yielded the following measurements: urediospores 16–24 x 22–26 μ, wall 1–1.5 μ, thickened to 2 μ near the hilum; teliospores 18–24 x 31–45 μ, wall 1.5–2.5 μ, thickened to 7–10 μ at the apex. In both rust species the urediospores were observed to have an obovoid or ellipsoid shape with the pores in surface view and a narrower, oblong shape when viewed with the pores in optical section. In size and shape of teliospores the two rusts do not differ appreciably. This can be readily seen in the photomicrographs of teliospores of the two species (Figs. 1 and 2).

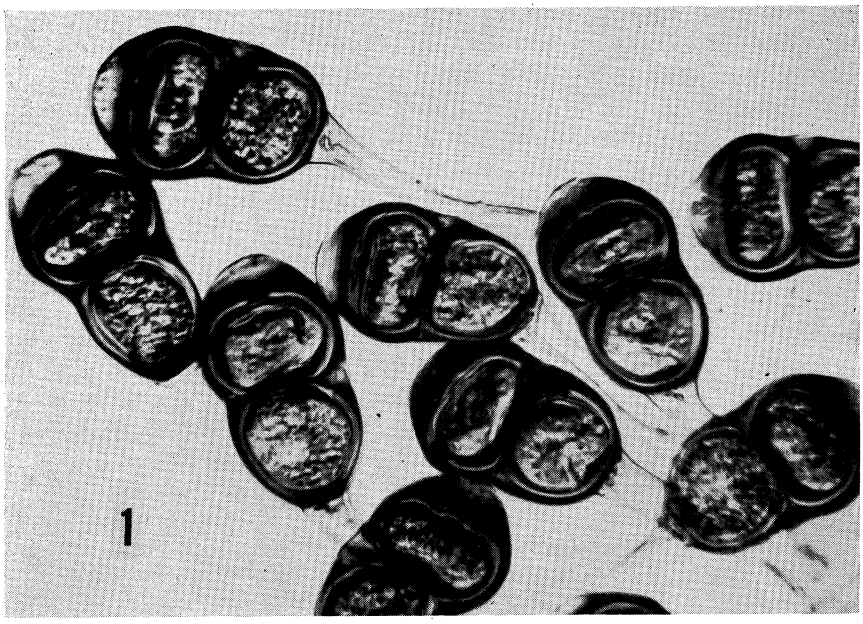


FIGURE 1. Teliospores of *Puccinia xanthifoliae* (from Barth. N. Am. Ured. 2976, × 800).

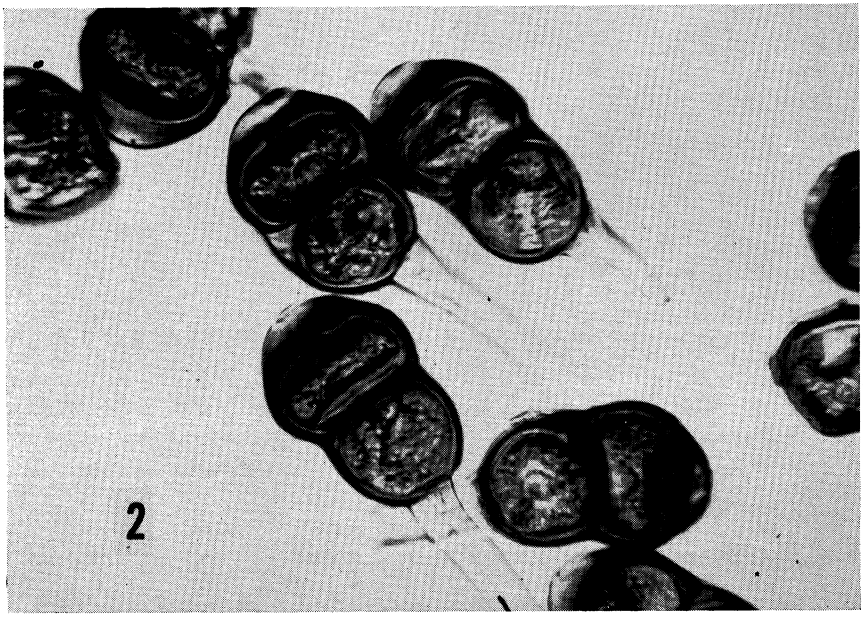


FIGURE 2. Teliospores of *Puccinia helianthi* (from Barth. Fungi Colum. 4851, × 800).

Some differences exist between *P. helianthi* and *P. xanthifoliae* with respect to size of urediospores and teliospores and thickness of the teliospore wall, but these differences are so slight that the two rusts cannot be readily distinguished one from the other except on a host basis. In the writer's opinion *P. xanthifoliae* should be treated as a variety of *P. helianthi.* The results of the inoculations reported above show that at least one collection of the rust on *Iva xanthifolia* is capable of crossing generic lines and infecting *Helianthus annuus.* However, if it had proved to be capable of infecting only *Iva xanthifolia* this would not have been a sufficient basis for maintaining the *Iva* rust as a separate species. Such specialization occurs commonly within rust species and in this case would have indicated treatment of the *Iva* rust as a host-specialized variety of *P. helianthi.* In conclusion it must be pointed out that final settlement of the status of *P. xanthifoliae* must await a critical study of other rusts of similar morphology occurring on the trible Helianthae, particularly *Puccinia verbesinae* Schw. and *Puccinia cognata* Syd. The status of these species and their relationship to *P. helianthi* remain to be clarified.

Literature Cited

1. Arthur, J. C. 1934. Manual of the rusts in United States and Canada. Purdue Research Foundation, Lafayette, Ind. pp. 327–329.
2. Baxter, J. W. and G. B. Cummins. 1953. Physiologic specialization in *Puccinia menthae* Pers., and notes on epiphytology. Phytopath. 43:178–180.
3. Cruchet, P. 1906. Contributions a l'etude biologique de quelques Puccinies sur Labiees. Centralbl. Bakt. 17:212–224.
4. Fischer, E. 1904. Die Uredineen der Schweiz. K. J. Wyss, Bern.
5. Niederhauser, J. S. 1945. The rust of greenhouse-grown spearmint, and its control. Cornell Univ. Ag. Exp. Sta. Mem. 263.

LAND FORMS OF THE BARABOO DISTRICT, WISCONSIN

FREDRIK T. THWAITES
Madison, Wisconsin

ABSTRACT

The following account of the development and classification of the several different land forms of the Baraboo District, Wisconsin, is based upon the experience of the writer in taking students on field trips to that region for nearly 40 years. Most of these trips were made during April, when observation is better than in summer because there are no leaves on the trees and brush. The several land forms are classified according to their age and origin. Where the interpretations of the writer are in conflict with those of others, all views are explained and their merits compared. It is concluded that there are no proved remnants of ancient peneplains formed by ordinary erosion when the land stood much lower with respect to sea level than it now does. The upland level, known locally as Happy Hill, is accounted for by wave erosion when the ancient islands of quartzite were being submerged by the Paleozoic seas. The name, Weidman Falls, is proposed for the little known example of a stream which was let down from the overlying sandstone onto the harder quartzite beneath in relatively recent time. It is named in honor of the late Samuel Weidman, who was born a few miles to the north of this location. The enclosed depression near North Freedom is as yet not fully explained. A few new facts on the history of glaciation are included. Many errors in the old topographic maps of the area are noted, many of them discovered by the aid of air photographs.

PRECAMBRIAN LAND FORMS

Precambrian deposition and mountain building. (Fig. 1) One of back on the quartzite because it is a ground water dam. There is the major reasons why the Devils Lake Baraboo district has been visited by so many geology classes is that in it the events of the geologic past can easily be demonstrated to beginners. For instance, the ripple marks on the layers of quartzite unquestionably record deposition of sand under water. The tilted and fractured beds record uplift and mountain building. (Irving, 1877) Many facts of these ancient events remain undeciphered. It is not positively known how thick the quartzite is or whether there is more than one quartz-

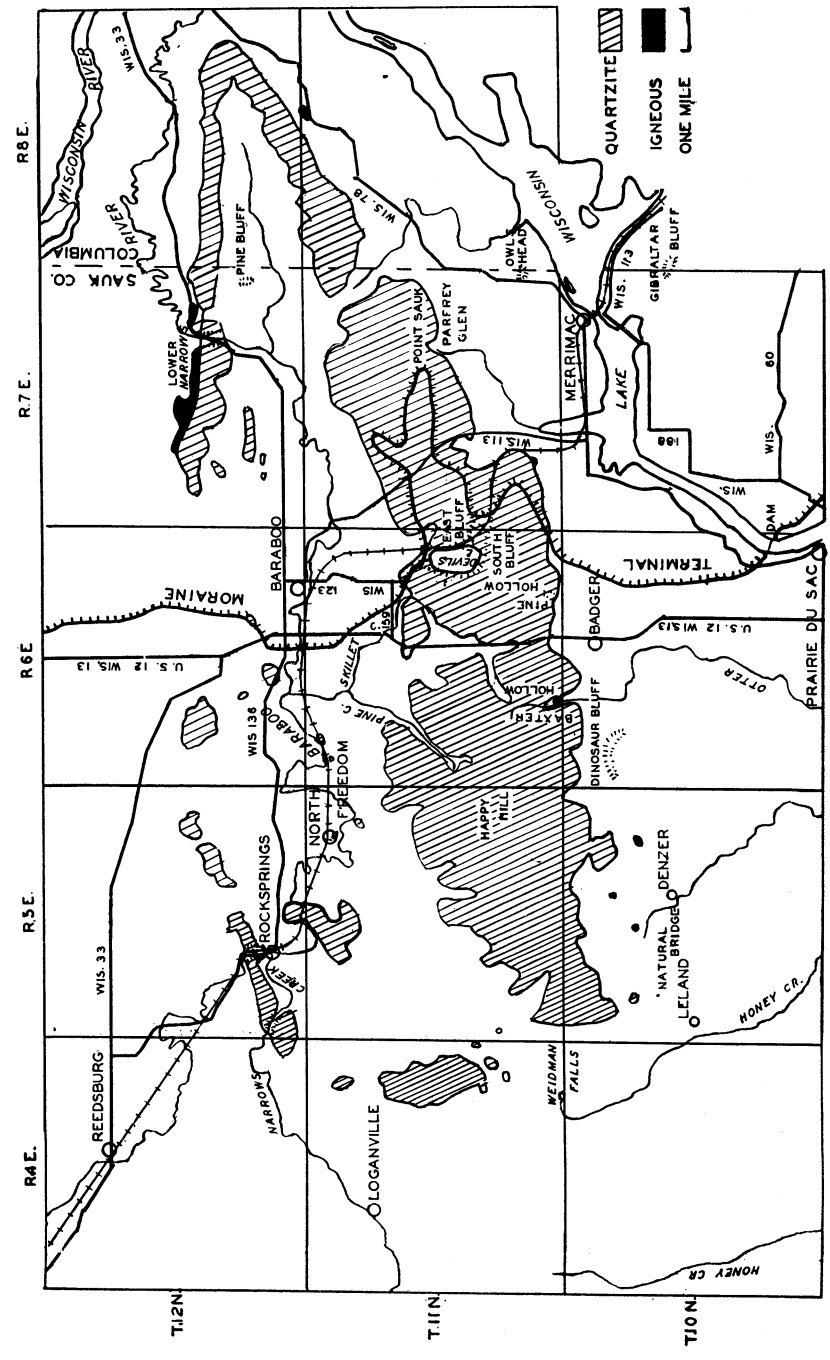


FIGURE 1. Outline map of Baraboo, showing major geological features.

ite formation. A large part of the facts discovered during the period of exploration and development of the iron ore resources has been lost to science. Mining and drilling ceased soon after the First World War (Weidman, 1904).

Precambrian land forms. There is no record of land forms older than those of the prolonged erosion of the mountains built from quartzite and associated sediments. This period of erosion led to mature, or perhaps even old, land forms, for quartzite is extremely

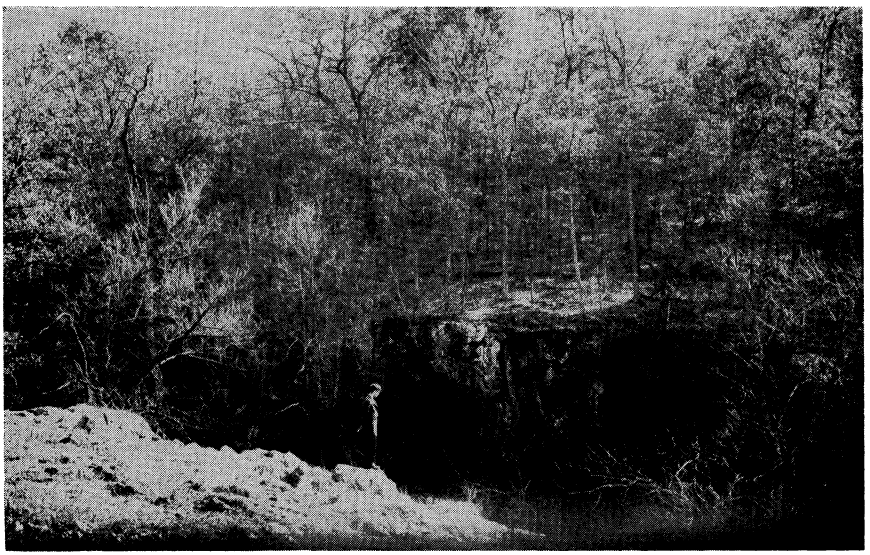


FIGURE 2. Weidman Falls from north, showing smooth surface of quartzite and narrow gorge eroded in quartzite by superimposed stream.

resistant to weathering and erosion. It is insoluble, and although brittle, is very hard to break. The landscape formed during the time that the surrounding Precambrian igneous rocks were reduced to low relief was rather gently sloping with few cliffs, although the quartzite synclinal remnant rose fully a thousand feet above the surrounding country. This ancient surface is commonly called the Precambrian peneplain but no part of it is entirely unaltered by either marine or subaerial erosion since its formation. Good examples of the Precambrian surface of the quartzite can be found throughout the district and their age is indisputable where there is more or less cover of later strata. An excellent example is the smooth upper surface of vertical quartzite layers at the gorge of Weidmans Falls (Fig. 2). This exposure is evidently part of a hogback on the quartzite because it is a ground water dam. There is

always water flowing over the falls from a spring held against one of the sides of this buried ridge. Figure 3 shows the smooth slopes of quartzite on which there are only rare exposures; similar topography occurs over large areas of quartzite, for instance in the north part of Baxter Hollow and in the area north of Pine Hollow (Fig. 4). It has been suggested (Alden, 1918, p. 170) that the depression southwest of North Freedom, which Weidman described as a kettle hole (Weidman, 1904, p. 102), is the result of solution of the deeply buried Precambrian dolomite which affected the over-

FIGURE 3. Five different land forms: upland plain, mature slopes on quartzite, valley of superimposed stream (Skillet Creek), top of delta in Glacial Lake Baraboo, and endmoraine of Cary glacier.

lying sandstone. The theory requires a very large solution cavity, for a collapse area normally becomes smaller and smaller upward. If the iron ore exploration holes gave any clue, their records are not available and many have been lost (Ekern and Thwaites, 1930).

Upland plain. The crests of the higher quartzite hills are truncated by a plain which lies, as far as incomplete measurements indicate, between 1450 and 1480 feet above sea level. West of Devils Lake this plain, which is level enough for marginal farms, is known as Happy Hill. The plain is present in all three hills which border Devils Lake: West, South, and East bluffs. Fig. 5 shows that it bevels the tilted layers of quartzite. Farther west this fact is more marked because the dip of the quartzite is greater (Fig. 6). The plain is little known in the glaciated part of the district because of

the cover of drift. In the unglaciated area, it is overlain by clay which contains much angular quartzite fragments which have been gathered into stone fences over considerable areas. A few fragments of Paleozoic chert are also present (Fig. 7). Some geologists regarded this plain (Martin, 1916, p. 68, 1932, p. 74 and Smith, 1937, pp. 128, 129) as remnants of a once continuous peneplain formed in Precambrian time and later dissected. The hypothesis had the advantage of removing the formation of the plain to a very distant time, but one may well ask just how quartzite could have ever been reduced to a level surface. It is virtually insoluble and weathers into a rubble of angular fragments which is not easily removed by either slope wash or mass movement. The idea of Precambrian peneplanation may, therefore, be rejected. It involves preservation of unaltered remnants on the tops of the bluffs alongside 1,000 foot valleys.

Hanging valley problem. At several places along the south side of the Baraboo quartzite there are mature valleys which hang above the present surface and the buried rock floor adjacent to the bluffs. Fig. 4 is a contour map showing one of these as surveyed by several students. The shape of the valleys above the break in slope is characteristic of those of Precambrian age and this conclusion is checked by the occurrence of younger sandstone remnants within the upper parts of these valleys. There may be more examples not yet discovered, because of the crude contouring of the old maps. The example given is cut by a narrow gorge known as Pine Hollow (omitted on Denzer quadrangle) which was later eroded into the floor of the older broad valley. It contains no younger sediments. Hypotheses may be advanced that: (1) the valleys had the lower parts removed by erosion of the Paleozoic sea, (2) the valleys were eroded to an ancient base level before the surrounding Precambrian rock was eroded, that is they are relics of a cycle of erosion within the Precambrian, or (3) they were eroded during a still stand during either burial or exhuming of the quartzite. The second hypothesis is not acceptable, for there are no remnants of Cambrian sandstone within the narrow gorges and there should be if they are Precambrian. The idea of wave erosion at a level corresponding to the upper part of the Eau Claire member of the Dresbach formation of Cambrian age is difficult to understand because the direction of Cambrian waves and currents as shown by sediments clearly shows that the south side of the quartzite islands was sheltered. Shale extends at least as far south as the Wisconsin-Black Earth valleys. On the other hand there is evidence of wave action on the southeast side of the quartzite by the presence of considerable conglomerate, which—near the shore—is interbedded with shale and siltstone. It is noteworthy that the slope of the quartzite

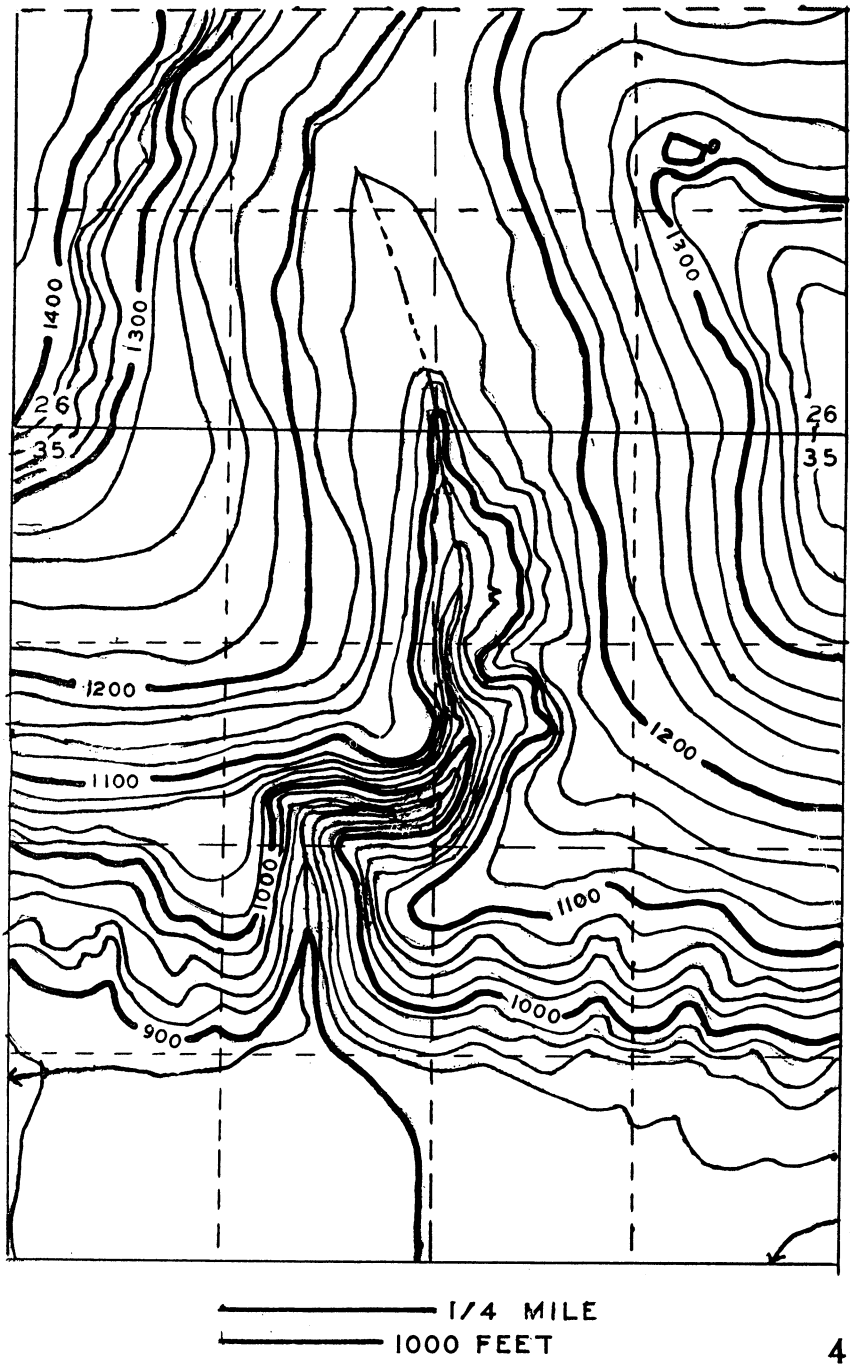


FIGURE 4. Contour map of Pine Hollow, showing hanging valley with incised gorge.

is steeper below the level of these hanging valleys than it is above. The north side of the quartzite is so covered with Paleozoic sediments that it has not been investigated for similar hanging valleys. If due to wave erosion of the lower parts, they should be more abundant on the north side than on the south.

Summary. In summary, the Precambrian erosion forms of the quartzite where unaltered by glaciation or by later erosion are smooth and rounded with only a few small outcrop crags and cliffs. The surface as seen today is strewn with angular fragments of the bed rock imbedded in clay. This clay did not originate from decay of the quartzite as apparently was once supposed. (Alden, 1918, p. 59; Geib and others, 1925, p. 11). Even the contact with the summit plain is more or less rounded. Most hills which do not rise to this level have rounded summits.

PALEOZOIC

Burial of the quartzite. Submergence after erosion of the Precambrian mountains led to deposition of nearly horizontal strata of sandstone and dolomite of Paleozoic age. That these strata buried the remnants of the ancient mountains completely is indicated by the following facts: (1) 25 miles to the south is Blue Mound capped with a remnant of Silurian strata with a top elevation of 1716 feet whereas the highest known quartzite is only about 1480 feet; (2) there are Paleozoic chert fragments on the highest unglaciated part of the Baraboo quartzite and much of the clay soil (Baraboo silt loam, Geib and others, 1925) of the unglaciated area is apparently residual from dolomite not from quartzite; (3) the drainage arrangement shows little effect of the quartzite topography on major stream courses; and (4) several small exposures of Paleozoic conglomerate have been found at the margin of the summit plain. From this evidence it follows that many stream valleys are the result of superposition of the drainage from the emerged Paleozoic strata. There has been much discussion on discrimination of such valleys from those formed in Precambrian time and filled with sediments. A good example of such a valley occurs at the old sandstone quarry just northeast of Rock Springs (Ableman). The sandstone at that locality was once extensively used for abutments, retaining walls, and paving blocks because it is harder than the normal Cambrian sandstone. There must have been ground water alteration in such situations, for there is also a strong suggestion of the removal of cementing quartz from parts of the buried quartzite including boulders of quartzite in the conglomerate.

Superimposed stream valleys. The best key to discrimination of the valleys of superimposed streams is their youthful appearance

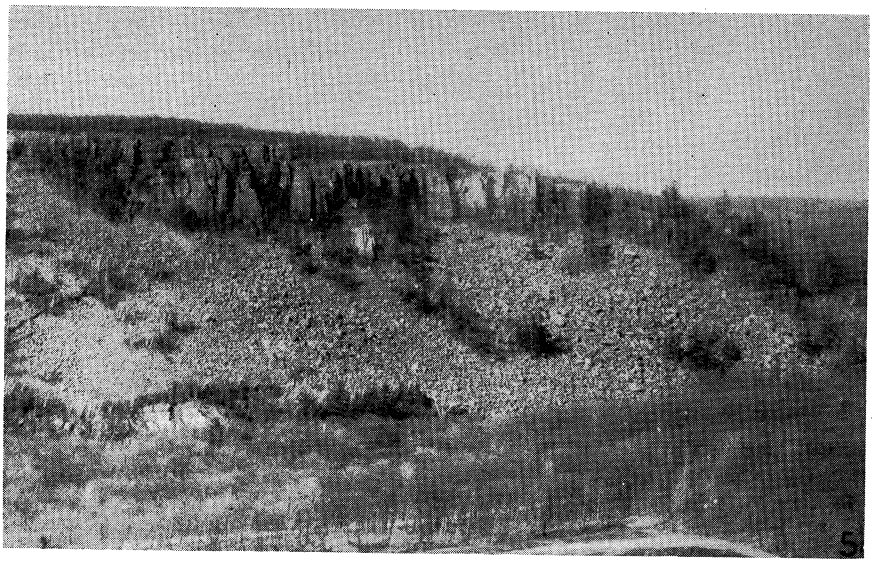


FIGURE 5. East Bluff, Devils Lake, from South Bluff showing bevel of strata by upland plain.

FIGURE 6. Summit plain on Happy Hill with terrace in quartzite on north. The terrace strikingly resembles a shore cliff.

with many cliffs, crags, and rock outcrops, coupled with their almost complete disregard of the structure of the quartzite. The type locality for this determination is Weidman Falls as shown in Fig. 2. Here the gorge below the falls is in sharp contrast with the smooth transverse profile of the Precambrian hogback seen in the foreground. The above criterion shows that the gorge of the Baraboo above Rock Springs is not of Precambrian age, although often claimed to be such. The same applies to the gorge of Narrows Creek farther to the southwest, the Devils Lake gap north of the open valley southwest of the lake which contains Cambrian sandstone, the Lower Narrows of the Baraboo, the entrance to Baxter Hollow, as well as several small valleys through quartzite ridges. Among these may be mentioned the quartzite outcrops at the quarry south of North Freedom and the cliffs along U. S. 12 at the foot of the sandstone hill south of the junction with Wisconsin 159. In Precambrian time Baxter Hollow drained east to the location of U. S. 12, north along that line and then discharged into the center of the syncline northwest of the ledges in an area where there are large sandstone hills. Weidman Falls is a fine example of superposition in a youthful stage because the stream has only a small drainage area. The falls are due to the vertical strata of the quartzite in this locality. In addition to the above criterion of age, both the Lower Narrows and the north part of Devils Lake gorge are unrelated to the form of adjacent exhumed quartzite hills. It is in these superimposed post Paleozoic valleys that most of the spectacular exposures which have been so commonly visited by geology students are situated. Exposures of the quartzite elsewhere are relatively poor.

Marine erosion of summit plain. The writer has previously (Thwaites, 1931, p. 745) suggested that the summit plain is the result of marine erosion during the submergence of the region. Acceptance of this hypothesis was hampered by the error on the Denzer quadrangle of 1898 which makes Happy Hill about two miles wide. Inspection of air photographs shows that the topographers were not allowed enough time to discover the deep valleys in the woods between the roads. They were even unable to cover all the roads, for there are such obvious errors in some places to prove that conclusion. The maximum width of the upland is less than three quarters of a mile. The upland is not exactly level but slopes gently toward the margins (Fig. 7). In following divides, several instances were discovered where there is locally a steeper slope so that it might be that the plain is multiple with distinct levels of different ages. If so, the elevation data presently available are not accurate enough to make definite correlations. Proof of the marine origin of the upland rests upon (1) presence of coarse boulder conglomerate which could have been derived only from strata above

FIGURE 7. The level upland of Happy Hill with clay soil containing both quartzite and chert stones.

FIGURE 8. Air photograph of Dinosaur Bluff. Spurs to the north were eroded by migration of a stream down the sloping quartzite. The dark circles identify section corners.

the present level. (2) competence of waves to make such a level surface, and (3) the improbability of any other agent making so regular a nearly level surface. Elevations ascribed to this plain on the Denzer and Baraboo quadrangles are extremely inaccurate with known errors up to 160 feet. The Baraboo quadrangle was surveyed in 1892 and has been shown to be in error by many later surveys. The bluffs at Devils Lake are given about 100 feet too high and are not correctly located or delineated. If the base of the Platteville formation of Ordovician age is projected northward to the Baraboo Bluffs, it is found to coincide with the summit plain. This horizon has been shown to be that of a very extensive marine transgression where the Platteville rests upon St. Peter sandstone in Wisconsin to where it lies on the Precambrian in Ontario. Conditions were favorable to reduce the relatively small islands of quartzite to such a plain of marine erosion (Thwaites, 1935, pp. 396, 401–402). The only direct evidence in favor of marine erosion is the presence of several exposures of conglomerate along the edges of the upland plain. The boulders of this conglomerate must have come from strata which lay higher than the present plain and which were removed by wave action. Criticism based on supposed weak wave action during deposition of sandstone adjacent to the islands is also disproved by discovery of initial dips up to 11 degrees near Rock Springs. Such an inclination indicates quite deep water close to the ancient shores. (Raasch, 1935; Wanenmacher and others, 1934)

Terrace problem. The hypothesis of marine erosion of parts of the quartzite during burial is supported by the discovery of a marked terrace about 200 feet below the summit plain. This terrace is shown in Fig. 6 which shows the northeast part of Happy Hill. The terrace is best developed on north-facing spurs although fainter examples have been discovered on south slopes. Its inner margin is distinctly steeper than most Precambrian slopes on quartzite. Locally it strikingly suggests a shore cliff. The outer slope is gentle and is in many places covered with a thin plaster of Paleozoic conglomerate. At the far southwest, one of these terraces contains an outlier of the lower strata of the Prairie du Chien dolomite, the main body of which formation occurs at about the same level to the west. In the glaciated area the terraces are difficult to distinguish and correlation is indefinite. At Rock Springs there is a local terrace making the top of the hogback ridge at elevation about 1100 feet. This terrace is thinly covered with basal Franconia sandstone conglomerate. Objection (unpublished) was raised because of the good preservation of this terrace for such a long period of time. The answer is that it was soon buried under Paleozoic sediment and has been exhumed only in relatively recent geologic time. The inter-

pretation of the terrace as a marine feature strengthens the theory of marine origin of the summit plain.

Post Paleozoic

Erosion forms of Paleozoic sediments. Following the elevation of the land above the Paleozoic sea erosion started. There is no direct means of finding the age of this uplift or the age of the youngest covering strata. Aside from the immediate vicinity of the quartzite islands, the Paleozoic strata are nearly horizontal. The land forms developed on them are, for the most part, flat-topped, and the texture of the drainage is much finer than in the more resistant quartzite. Some physiographers have related drainage texture to amount of infiltration of the rainfall, but this relationship cannot hold here. It is obvious that the widely spaced drainage of the Precambrian landscape required larger drainage areas to make valleys. Air photography demonstrates that the upland plateaus shown on the Denzer quadrangle are much smaller. Many are very narrow divides. Topography of these younger and softer Paleozoic sediments is closely related to lithologic differences. The oldest formation exposed is the Galesville member of the Dresbach formation. This sandstone is thickbedded and for the most part white; hence it develops striking cliffs and steep slopes which are best observed in the unglaciated part of the district both south of and within the quartzite bluffs. Overlying this formation is the dolomitic fine-grained Franconia sandstone, of which the Mazomanie facies is here best developed. It forms a bench with local cliffs and crags. Its green-gray color is in striking contrast to the light colored cliffs below. Among the scenic features is Natural Bridge near Leland. (Salisbury and Atwood, 1900, pl. XXVI, p. 69) The arch resulted from undercutting of one side of a very narrow cliffed ridge. Weathering was probably more important than stream erosion in making the arch. Over the Franconia lies the siltstone, dolomite, and sandstone of the Trempealeau formation. This formation makes cliffs and part of the upland in the west end of the district, where all the overlying Prairie du Chien (Oneota or Lower Magnesian) dolomite has been removed. At the southwest, this dolomite with overlying residual cherty clay caps broad rolling uplands, which many geologists regarded as remnants of a peneplain which also accounted for the terrace on the north face of the quartzite bluffs. (Trowbridge, 1917, p. 253, 1921, p. 85) The youngest Paleozoic formation preserved within the district is the St. Peter sandstone. This weak formation case-hardens and forms some cliffs. It is found in the far southwest where it makes no distinctive topography and in the eastern part of the district in Pine Bluff near the Lower Narrows of the Baraboo River. This bluff may have some of the overlying

Platteville formation beneath the drift cover, for a few feet of this dolomite is found on Gibralter Bluff south of Wisconsin River.

Dinosaur Bluff. A phenomenon noted (Salisbury and Atwood, 1900, p. 62) long ago is the lateral movement of a valley which cuts down along the slanting upper surface of the quartzite. This phenomenon is well developed all along the south border of the quartzite and reaches its most striking example in what the writer has termed Dinosaur Bluff, west of Badger. In this case the lateral stream work cut away all northern spurs (Fig. 8) of a sandstone hill, leaving the outline of a gigantic dinosaur. This bluff is best seen from the air, for it is very crudely contoured on the Denzer quadrangle. Valleys along the contact are all best seen on the air photographs.

Peneplain theory of summit plain. It has been postulated that the summit plain of the Baraboo district is a peneplain developed during the erosion of the Paleozoic strata (Trowbridge, 1921, pp. 64–65). The same objections may be raised against this theory as were applied to the similar origin in Precambrian time. Besides, the presence of Paleozoic chert in the residium on Happy Hill and elsewhere is almost positive proof that this plain existed prior to the deposition of the covering dolomite. If eroded later, all remnants of the younger strata should have been removed. We can here refer to the gravel and potholes on East Bluff at Devils Lake where they occur through a vertical range of 80 feet. In order to make the potholes, which contain much chert gravel, the water must have had a considerable velocity and on top of the bluff this could only have come by fall from higher now-vanished dolomite strata. These gravels furnish no evidence of the origin of the upland plain, but are simply an incident of the superposition of drainage on the quartzite (Thwaites and Twenhofel, 1921, pp. 296, 302–303). The youngest fossils in the gravel are Silurian. Salisbury (1895) (Chamberlin, 1874) reported gravel in a dug well north of the bluff margin but extensive test-pitting (Alden, 1918, pp. 99–102) and examination of the side of the well failed to confirm this. The original information might have been obtained by asking "leading questions." The gravels have been referred to the Windrow Formation whose age is unknown but may be Cretaceous. The bulk of the mantle rock on top of East Bluff is clearly residium from dolomite and not gravel. It has been termed the Baraboo silt loam (Geib and others, 1925). (See also Andrews, 1958)

Other peneplains. Trowbridge (1921) and other authors (Salisbury and Atwood, 1900, pp. 50–55, 62–69) have postulated that subequality of summit levels in different parts of the district is evidence of the occurrence of two or more dissected peneplains formed

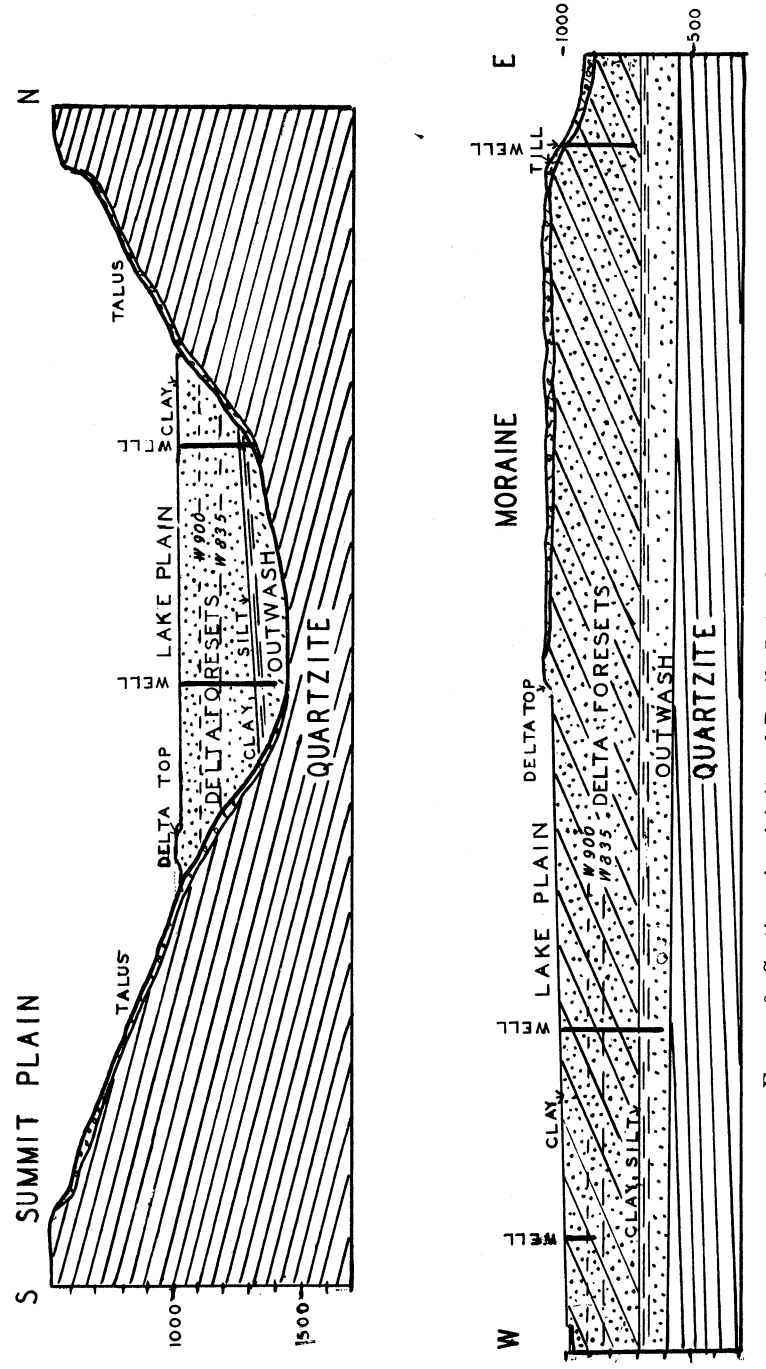


FIGURE 9. Sections in vicinity of Devils Lake showing the glacial deposits.

during the removal of the Paleozoic cover. None of the evidence thus far presented, however, is regarded as conclusive by the writer. Apparently these physiographers thought of peneplains as valley widening only and hence as growing upstream during the time that remnants of older erosion surfaces survived nearer the divides. They did not consider either removal of interstream ridges by reduction in slope or weathering. The terrace in the quartzite is clearly not related to peneplanation.

Preglacial topography. It was long ago demonstrated (Alden, 1918, pp. 105–107) that the Wisconsin River north of the Baraboo district must have had a preglacial course east of the present one as far south as the Lower Narrows of the Baraboo (Fig. 1). From there the river could only have flowed south of west to the Devils Lake gap, for there is no other possible course. The cause of this five mile detour is not evident. It might have been due to the partial exhumation of the quartzite by the time the river assumed its course although this idea does not check with the evident superposition of the north part of the gap. Possibly the cause lies in the initial dip of the Paleozoic strata. The Wisconsin River turned south just east of a buried Precambrian valley west of the lake. At the south end of the lake it discovered a Precambrian valley which contains sandstone. This valley must have discharged east. Although the only sandstone in this valley is near the eastern extremity, many of the tributaries (very poorly contoured on the Baraboo quadrangle) hang above the rock floor. It seems most probable that the river was diverted by this belt of weak rock, although it later deepened and widened the Precambrian valley. The ancient course of the Baraboo River west of Baraboo prior to glaciation is well known from exploration drilling for iron ore. The records given probably show the depth of casing below the surface, for they were not based on samples so far as known. Owing to the soft character of the preglacial rock surface it may be that many indicate too great a depth of fill. The maximum recorded is 260 feet. East and south of Baraboo the preglacial surface is not known with as much detail. No well has ever reached the rock bottom of the Devils Lake gap. The deepest appears to be the new supply well not far from the railroad (Fig. 9), 383 feet in depth with no rock. It is safe to conclude that the bluffs where Devils Lake is now situated rose fully 900 feet above the preglacial river. South of the quartzite the river course must have approximated its present location below Merrimac. The maximum depth of drift shown by samples is 260 feet in the Badger Ordnance Works. Very few well records are recorded on the glaciated part of the quartzite bluffs, but it is known that the drift is locally quite thick although the average depth may be small.

PLEISTOCENE

Extra glacial surficial deposits. Pleistocene deposits west of the terminal moraine shown in Fig. 1 consist of several classes: (1) a mantle of residual material both from Paleozoic rocks and from quartzite (Baraboo soil series), (2) non-glacial alluvial deposits, (3) wind-blown silt (loess), (4) talus, and (5) lake sediments. Within the glacial boundary we can distinguish (1) terminal moraine, (2) ground moraine, (3) outwash, and (4) lake deposits.

Residual mantle. A mantle of clay and rubble covers the quartzite hills and extends down the slopes to end against the adjacent plains. Locally on U. S. 12 there is a strong suggestion of a dissected alluvial fan of rubble. Some of the surficial material may be loess although most of it contains many angular stones, chiefly quartzite. Some of the larger stones may have been mistaken for outcrops of bed rock. The problem is to determine to what extent this mantle is the product of mass movement, solifluction, running water, or mud slides under periglacial conditions. That the conditions of accumulation of the mantle were different from those of the present is demonstrated by modern erosion. Such erosion by wet-weather streams is producing "stone rivers", concentrations of quartzite boulders. In the spring of the year one can hear water running through these removing the finer material (Smith, 1949). Only locally is there any suggestion of movement of these boulders where they are higher than the adjacent slopes. Whether or not these "stone rivers" required a climate different from that of today is debatable, for snow is often found among the stones quite late in the spring. In places the parallel ravines in the mantle have left narrow, comparatively straight ridges which students have mistaken for eskers.

Old terrace gravel. Gradational from the mantle described above are poorly sorted stream-laid gravel deposits. These may form part of the fan on U. S. 12 but have been definitely discriminated only near Plain and on a sandstone plateau on the Galesville sandstone north of Denzer. The gravels contain quartzite (Alden, 1918, p. 170) pebbles derived from conglomerate and possibly some diorite from the diorite outcrop north of Denzer. The Denzer locality was mistaken by Weidman for glacial drift (Weidman, 1904, p. 102). Such deposits can be interpreted in more than one way: (1) remnants of valley fill consequent upon glacial outwash of pre-Wisconsin age in the main valleys, (2) a periglacial phenomenon due to scarcity of vegetation on adjacent hills, or (3) an interglacial accumulation due to aridity with scanty vegetation. It is not possible with existing knowledge to decide between these hypotheses (Thwaites, 1928).

Loess. Where stones have not been introduced by overturning trees, burrowing animals, and soil creep it is easy to distinguish loess by (1) lack of pebbles, (2) its silty composition, and (3) its lighter color than that of dolomite residium. We need not here discuss the different opinions of the origin and derivation of loess. It is noteworthy that the loess mantle of the Baraboo district rests upon older residual clay from dolomite with no bleached A horizon at its top and no accumulation of chert pebbles. This indicates the soil profile of a warmer climate than that of the present which developed the modern soil profile in the loess.

Talus. Coarse talus with little or no fine material occurs mainly in unglaciated narrow youthful valleys of streams superimposed on the quartzite. Boulders in this type of talus are large, angular, well settled, and overgrown by lichens. It is safe to step on almost all of them without danger of their rolling or sliding. Two distinct opinions have been expressed about the talus: (1) Martin (Martin, 1932, p. 123) held that the formation of the talus is so slow that there has not been time since glaciation for very much to form. This agrees with the fact that there is little talus on top of the glacial lake sediments of the vicinity of Devils Lake. The lake sediments have sunk into previously formed talus leaving depressions such as the Alaskan Grotto where cold air emerges from the talus in warm weather. In a few places the talus has been filled up so that water descending under the talus forms springs. (2) H. T. U. Smith regarded talus formation as an accompaniment of glaciation due to frequent freezing when the ice was near. This theory also fits with the observed slow formation of today and the scarcity of talus in glaciated valleys. One would think, however, that talus formation should then have followed the retreating ice margin resulting in heavy accumulations along the ice margin. Such accumulations are not present. Both theories, themselves not entirely incompatible, neglect the normal reduction of rate of talus accumulation as the cliffs became buried. Preservation of so much unaltered talus is explicable by the extreme resistance of quartzite to weathering, although there has undoubtedly been much breaking up of quartzite beneath the mantle of clay as shown by the large number of angular fragments in the mantle rock of the unglaciated district.

Pre-Wisconsin glaciation. Although it is now known that all the evidences presented by Weidman (Weidman, 1904, pp. 99–102) to demonstrate glaciation of the Baraboo region prior to the ice advance which formed the recognized terminal moraine are invalid, there is distinct indication of such glaciation nearby. In a test hole at the Baraboo City Waterworks organic material was found in a clay layer in sand at a depth of 145 feet. This clearly demonstrates

an interruption of deposition of the valley filling which may indicate an interglacial interval. In the well at the Waterstreet resort north of Devils Lake a weathered zone in sand was found at 215 feet. Neither of these occurrences proves that the earlier ice extended as far west as the longitude of Devils Lake, for no pre-Wisconsin till has been recorded. The writer must, therefore, endorse Weidman's general conclusion although he rejects his evidence.

Lake sediments. As has long been realized, the presence of glacial ice in the east end of the Baraboo bluffs blocked the drainage and resulted in extensive lake sediments. Salisbury and Atwood describe (Salisbury and Atwood, 1897, 1900, pp. 120, 129, 134; Alden, 1918, pp. 222, 226, 245–276) many of these and discriminated several lake basins. The principal basin was the valley of Baraboo River now known to have been confluent with Glacial Lake Wisconsin north of the quartzite bluffs. The second was an expanded Devils Lake enclosed between the two crossings of the gap by glacial ice (Fig. 1). Smaller lakes have been discovered (1) northeast of Devils Lake and (2) southeast of the lake in a tributary valley. The maximum level to which Devils Lake was raised probably depended upon leakage along the ice front northwest of the lake and not upon the divide west of the lake. There is no evidence of any overflow despite reports of glacial boulders near to this level (Trowbridge, 1917, p. 366; Alden, 1918, p. 246). The highest delta front is at elevation 1040 or about 80 feet above the lake. Some instructors tried to show students the sloping plain at the southeast side of Devils Lake as an outwash plain. As a matter of fact it is underlain by clay with quartzite and other boulders which overlies delta sand and gravel (Fig. 9). It must be an erosional surface not depositional, but just why the clay cover was deposited is not clear. It seems to be lake clay with ice rafted boulders, but its exact distribution has not been determined. In the Baraboo Valley the lake sediments are fairly well exposed. Where seen they are clay, but it is not unlikely that there is stream-laid sand and gravel below. Weidman (Weidman, 1904, pp. 100–102) did not accept the lake origin because there is no marl and peat, deposits which could not be present in a glacial lake bed. Weidman regarded the ice-rafted glacial stones as direct glacial deposits. Those he reports are all below the level of 980 of the maximum lake elevation. The position of the lake level is determined from isolated shore deposits plus the level of the delta fronts. One of those mentioned by Salisbury and Atwood is northeast of North Freedom and consists of a spit of tabular pebbles from the Trempealeau siltstone with ice-rafted glacial boulders (Salisbury and Atwood, 1900, p. 130). The pebbles of this deposit were driven north by waves from their origin in the

rock spur. Some of the localities they mention were located so indefinitely that they could not be found. Others are now concealed by loess and crept material but were observed when roads were first graded. An excellent spit of siltstone pebbles, now almost entirely dug away as a county gravel pit, occurs on Wisconsin 23 just south of Reedsburg outside the district shown in Fig. 1.

North Freedom kettle hole. The "typical kettle similar to the depressions and sags in terminal moraine 'located' in the coarse drift on the south slope of a sandstone hill about one-half mile southwest of North Freedom" (Weidman, 1904, p. 102) is far from typical. It is rimmed with Franconia sandstone on three sides and on the fourth by clay. We have already mentioned this depression under the theory that it could be due to collapse of the deeply buried Precambrian dolomite with the conclusion that this theory appears to be an inadequate explanation. Another suggestion is that it was a narrow ravine or cave in the sandstone blocked at the entrance either by Pleistocene lake deposits or by landsliding. No drift other than lake clay could be found either in or near the depression. Although unsupported by borings, the crevice theory appears the more plausible.

Glacial erosion forms. The invasion of the eastern part of the district by glacial ice occurred in the Cary substage of the Wisconsin stage of glaciation. We have already demonstrated that Weidman's conclusion (Weidman, 1904, p. 102) that an earlier ice advance extended much farther west is not supported by acceptable evidence. The erosive action of the ice so close to the margin appears to have been slight. It is doubtful that on the quartzite it did little but smooth and round some of the hills and remove the talus. In the sandstone area little effect can be seen save at Owls Head Bluff near Merrimac, which shows a gentle side toward the direction from which the ice came, compared with cliffs on the other or west side. Field examination showed, however, that much of the supposed shaping by ice is due to accumulation of drift and not to erosion.

Terminal or end moraine. The moraine at the maximum of the Cary ice invasion was mapped and described by Salisbury and Atwood many years ago (Salisbury and Atwood, 1897, 1900, pp. 102–111; Alden, 1918, pp. 214–216) and very little can now be added to their description of the effect of topography on the position of the ice margin. The inaccuracies of the old topographic maps make their estimates of slope of the margin too high. During the survey of the glacial geology of the eastern part of the quartzite bluffs by Alden, it was a source of disappointment that the end moraines within the glacial margin are so weak and doubtful. Con-

siderable areas of topography with many small depressions do occur but their distribution is irregular and not demonstrative of definite ice margin. The outer moraine was traced by so many students through such a period of years that its crest was marked over long stretches by a veritable footpath. It is possible, although not checked in the field, that some of the lower areas mapped by Alden as terminal moraine are really pitted outwash. Much of the moraine south of the quartzite strongly suggests overridden pitted outwash. Some well logs support this idea. An exposure at the dam of the Wisconsin Power and Light Company where the outermost moraine crosses Wisconsin River shows outwash beneath till.

Ground moraine. Much of the area inside the outermost end-moraine is classified as ground moraine or till deposited when the ice melted. It shows no characteristic topographic form. Such till mantles many rock hills, preserving their former topographic form. In this connection it must be realized that much of the area shown on most geologic maps as quartzite in fact has a considerable cover of Paleozoic sediments.

Outwash and deltas. It appears from perusal of older literature on the Baraboo district that the phenomenon of deltas in the margin of standing water could not have been understood by all geologists. Deltas formed at the margin of the ice sheet consist of sand and gravel layers which dip about 25 degrees into adjacent standing water. Some till masses slid from the ice. As the delta grew wider, such events could not occur. The outer margin of the delta plain displays a sharp break from subaerial beds (topset) on the plain to inclined layers (foreset) on the slope of the face. Such a condition is well displayed north and south of the quartzite range and along Baraboo River. At Devils Lake the case is not as clear. The moraines on both sides show from old gravel pits plus sample-controlled well logs that the layers of sand, gravel, and till dip toward the lake. These segments of the moraine are certainly deltas. Outwash could only be deposited above the level of the lake enclosed in the gorge. Apparently there are no remnants of topset beds. The only place which has a flat top is the little hill southeast of the old railroad station which rises 80 feet above the lake to 1040 feet elevation. This hill is now isolated and the front of the moraine north of the railroad track is indented by two valleys leading west to the low plain near the lake. Test pits disclose that this ridge is sand and gravel. The plain noted above is underlain by sand and gravel of glacial origin overlain by at least 15 feet of dense unstratified clay with abundant glacial boulders. This clay extends east up the flanks of the moraine to a higher elevation than the inferred delta top. The writer offers the following hypothesis. After the Cary ice

first advanced deltas were deposited at both ends of the enclosed lake with a water level of about 1040. How far the topset beds extended into the lake is unknown. Following this the ice melted back from the moraine at the north end of the lake and the glacial lake drained out to the lake in the Baraboo Valley which lay at elevation about 980. This erosion initiated the valley followed by the railroad north of the lake which had a creek which originally drained into Baraboo River until an artificial dam diverted part of the discharge through a canal into Devils Lake. Next the ice readvanced and blocked this valley for a short time. No younger moraine across it can be discovered. At this time the water level rose higher than before and the clay with ice-rafted stones was deposited. This hypothesis is admittedly without sufficient supporting evidence. It could be that the second moraine at the north end of the lake was eroded away when the ice finally left both of the two moraines.

Pre-lake outwash. An interesting light on events in the Devils Lake gap was the discovery of outwash gravel below the bottomset silt and clay beds of the delta at the south end as shown in Fig. 9. This records through drainage in the gorge before the formation of the delta moraines at both ends. Three distinct water levels may be distinguished: (1) Devils Lake which is a perched body of water held in by its own sediments at elevation about 960, (2) a shallow water table, also perched, in the delta sand and gravel at elevation about 900, and (3) a deeper and more important water level in the deep outwash at level about 835. This level is slightly higher than the land to north and south suggesting recharge by leakage of local higher ground water. Bretz has described (Bretz, 1950) Glacial Lake Merrimac, a body of water enclosed in Wisconsin River valley above the end moraine. He ascribes a body of deltaic bouldery gravel near the east end of the quartzite bluffs as the product of the initial discharge when the glacier freed the east end of the bluffs. The lack of any scoured area on the bluffs suggests that the discharge must have been very short lived. Thwaites (Thwaites, 1943, p. 127) describes a valley eroded in the drift when the waters of Glacial Lake Wisconsin stood at an elevation of about 835 feet. No sediments have been discovered which record either the later eastward extension of Lake Wisconsin north of the Baraboo bluffs or Lake Merrimac. Although the writer has seen both deltas and lake clays only north of the quartzite area, glacial lake waters must have remained in the east part of the Baraboo valley until drift dams were eroded. Presence of a kettle hole in the outwash just south of Badger has long been a puzzle, for such normally indicate that glacial ice was present in the area not long before its formation. The finding of the layer of till in a well within the kettle appeared to substantiate

this theory, but no till could be found at that level in the samples from a number of wells inside the Badger Ordnance Works. It has also been suggested that water just outside the moraine was deep enough prior to deposition of the delta to float out a large iceberg. The till might have come from its melting. In conclusion it may be explained that most of the glacial lakes of the Baraboo region are proved mainly by their level bottoms and sediments, for examples of shore features are rare.

Drainage outlets. Definite drainage outlets for glacial waters are not common in the Baraboo region. The best example is near the south side of Badger Ordnance Works where there is a break in the moraine which is continued west by a shallow channel in the outwash plain. Just north of the quartzite range a low fan on the outwash indicates discharge through a depression in the moraine.

Recent

Postglacial erosion. Since the glacial ice melted away, there has locally been considerable erosion. This has been mainly along the major streams, the Wisconsin and Baraboo where the slope was greater than that needed to carry the load from above. The total depth of erosion along the Wisconsin appears to have been close to 100 feet. The material eroded was largely sand. On the steeper slopes of the quartzite range and its covering drift many ravines have been eroded. Most famous of these are the glens: Parfreys, Durwards, and Fox. The last two are not shown on Fig. 1. All of these gorges are in part eroded in Paleozoic rock. A ravine south of the railroad southeast of Devils Lake is about 80 feet deep in till. South of this the soft sediments of a minor glacial lake are dissected intricately by gullies.

Postglacial shorelines. Devils Lake appears to have become stabilized at a level several feet higher than the normal maximum of today. The cause of the later recession could be either climatic change or increased leakage to the ground water below.

Postglacial deposition. Devils Lake has received a considerable thickness of mud (Twenhofel and McKelvey, 1939) which is very black and seen through the water is mistaken for a "bottomless" depth. As a matter of fact the normal depth of the lake is only a little over 40 feet. Alluvial fans, some of them very bouldery, are common below ravines where the grade of the surface changed abruptly. The swamps contain considerable depths of peat.

REFERENCES CITED

ALDEN, W. C., 1918. Quaternary geology of southeastern Wisconsin: *U. S. Geol. Survey Prof. Paper* 106.

ANDREWS, G. W., 1958. Windrow formation of Upper Mississippi Valley region—a sedimentary and stratigraphic study: Jour. Geology, vol. 66, pp. 597–624.

BRETZ, J. H., 1950. Glacial Lake Merrimac: *Illinois Acad. Sci.*, Trans., vol. 43: pp. 132–136.

CHAMBERLIN, T. C., 1874. On the fluctuation of level of the quartzites of Sauk and Columbia counties (Wisconsin): *Wisconsin Acad. Sci., Trans.*, vol. 2: pp. 133–138.

EKERN, G. L., and THWAITES, F. T., 1930. The Glover Bluff structure, a disturbed area in the Paleozoics of Wisconsin: *Wisconsin Acad. Sci., Trans.*, vol. 25: pp. 89–97.

IRVING, R. D., 1877. Geology of central Wisconsin: *Geology of Wisconsin*, vol. 2: pp. 504–519, 579–597.

GEIB, W. J., *and others*, 1925. Soil Survey of Sauk County, Wisconsin: *U. S. Dept. Agriculture, Bureau of Chemistry and soils*, No. 29, Series 1925: *Wisconsin Geol. and Natural History Survey, Bull.* 60C.

MARTIN, LAWRENCE, 1932. Physical geography of Wisconsin: *Wisconsin Geol. and Nat. History Survey*, Bull. 36: pp. 55–59, 120–125.

RAASCH, G. O., 1935. Paleozoic strata of the Baraboo area (Wisconsin), *Kansas Geol. Soc., Ninth Field Conference, Guidebook:* pp. 405–414.

SALISBURY, R. D., 1895. Preglacial gravels on the quartzite range near Baraboo, Wisconsin: *Jour. Geology*, vol. 3: pp. 655–667.

SALISBURY, R. D., and ATWOOD, W. W., 1897. Drift phenomena in the vicinity of Devils Lake and Baraboo, Wisconsin: *Jour. Geology*, vol. 5: pp. 131–147.

SALISBURY, R. D., and ATWOOD, W. W., 1900. The geography of the region about Devils Lake and the Dalles of the Wisconsin: *Wisconsin Geol. and Nat. History Survey*, Bull. 5.

SMITH, G.-H., 1937. Physiography of Baraboo Range of Wisconsin: *Pan-American Geologist*, vol. 56: pp. 123–140.

SMITH, H. T. U., 1949. Periglacial features in the Driftless Area of southern Wisconsin: Jour. Geology, vol. 57: pp. 196–215.

THWAITES, F. T., and TWENHOFEL, W. H., 1920. Windrow formation: an upland gravel formation of the Driftless and adjacent area of the Upper Mississippi Valley: *Geol. Soc. America, Bull.*, vol. 32: pp. 293–314.

THWAITES, F. T., 1928. Pre-Wisconsin terraces of the Driftless Area of Wisconsin: *Geol. Soc. of America, Bull.*, vol. 39: pp. 621–642.

THWAITES, F. T., 1935. Physiography of the Baraboo District, *Wisconsin, Kansas Geol. Soc., Ninth Field Conference, Guidebook:* pp. 395–404.

THWAITES, F. T., 1931. Buried Precambrian of Wisconsin: *Geol. Soc. America, Bull.*, vol. 42: pp. 719–750.

THWAITES, F. T., 1940. Buried precambrian of Wisconsin. *Wis. Acad. Sci., Trans.*, vol. 32: pp. 233–242.

THWAITES, F. T., 1943. Pleistocene of part of northeastern Wisconsin: *Geol. Soc. America, Bull.*, vol. 54: pp. 127–129.

TROWBRIDGE, A. C., 1917. History of Devils Lake, Wisconsin: *Jour. Geology*, vol. 25: pp. 344–372.

TWENHOFEL, W. H., and MCKELVEY, V. E., 1939. The sediments of Devils Lake—of southern Wisconsin: *Jour. Sed. Petrology*, vol. 3: pp. 105–121.

WANENMACHER, J. M., TWENHOFEL, W. H., and RAASCH, G. O., 1934. The Paleozoic strata of the Baraboo area, Wisconsin: *Am. Jour. Sci.*, vol.228: pp. 1–30.

WEIDMAN, SAMUEL, 1904. The Baraboo iron-bearing district (Wisconsin): *Wisconsin Geol. and Nat. History Survey*, Bull. 13: pp. 99–102.

TYPES OF PART-TIME FARMING IN NORTHERN WISCONSIN

KERLIN M. SEITZ
University of Wisconsin—Milwaukee

One of the outstanding characteristics of the agriculture of northern Wisconsin is the large proportion of farmers who combine non-farm work and farming. Since 1930, when the U. S. Census began to enumerate the number of farmers who reported "off-farm" work, approximately one half of the farmers in the seventeen northern counties have indicated such work. The purpose of this paper is to describe the types of part-time farmers, based on the kind of non-farm work combined with farming and the areal distribution of these types. Five types are found: forestry, urban, mining, recreation and miscellaneous.

AGRICULTURAL AREAS

These types of part-time farmers are found throughout the agriculturally occupied land of northern Wisconsin[1] (Fig. 1). The spotty, broken and spidery shapes of the agricultural areas reflect the lack of large areas of good soils and the open network of transportation. The main railroads go around—not through—northern Wisconsin.[2] There are five north-south railroads for the 250 mile east-west dimension of the area and two for the 120 mile north-south distance. The highways are equally few in number and few are of first class quality. The major highways which have been built recently connect the larger cities but avoid the older agricultural settlements. Secondary roads extend only a few miles on either side of the highways and often become lanes.

The bulk of the better agricultural land in terms of physical properties and transportation is in southeastern and southwestern northern Wisconsin. The irregular north-south band of agricultural land in the west central part of the area extends along a major highway and railroad route from Ashland on Lake Superior southward. There is a sizable area of agricultural land in the northwest around Superior-Duluth where there are heavier clay soils and good local markets. Elsewhere, agricultural areas are scattered and broken.

[1] Agriculturally occupied land is land which has at least one farm per square mile.
[2] Circular #160, Dept. of Ag., 1931, p. 36.

The blank spaces on the map are areas not used agriculturally by either part or full-time farmers. Much of it is "wild" i.e., uninhabited, and in most, agricultural occupance is prohibited by zoning or governmental ownership (forests). The parts of four Indian Reservations in northern Wisconsin are classed as non-agriculturally occupied and are excluded from consideration.

On Figure 1, the areas are shown in which a particular type of part-time farming is dominant. This is compiled from information gained in some seven hundred field interviews. Of these interviews in northern Wisconsin, 74% are of part-time farmers, 16% full-time farmers and 10% non-farmers. From the 1950 Agricultural Census[3] it is estimated that there are 15,134 farms in northern Wisconsin and that 51%, or 7,688, report "off-farm work". Thus interviews with 520 part-time farmers and 112 full-time farmers represent samplings of better than 4% of all farmers and almost 7% of the part-time farmers. Of the part-time farmers, 60% are in forestry, 23% urban, 3% recreation, 2% mining, and 12% miscellaneous.[4]

The Forestry Type

The forestry type of part-time farming is found throughout northern Wisconsin and is the type found in the greatest number. This dominance is strikingly depicted by the map (Fig. 1). From Burnett County in the west, eastward to the Rhinelander-Tomahawk urban concentration in east central northern Wisconsin and northward to Lake Superior, the forestry type of part-time farming is dominant. The exceptions are the urban type concentrations near Superior in the northwest and other small cities and a small recreation type concentration near Spooner. East and south of the Vilas County recreation area and the Rhinelander-Tomahawk urban type concentration, the farmer who does woodswork is dominant, with the exception of small urban type concentrations around the cities.

Why the dominance in these areas? It is in these areas where there are few opportunities other than forest work to combine with farming. Other types of part-time farming become more prevalent as other non-farm work becomes available. Near cities and large villages (both incorporated and unincorporated) urban work is available and in areas where the recreation business is well established or in Iron County around the iron mines of Hurley and Montreal, non-farm work other than forestry is at hand. In all spots

[3] *1950 Census of Agriculture*, U. S. Dept. of Commerce, Bureau of the Census, Washington, D. C.

[4] The interviews were obtained in the summer of 1950 & 1951 and since that time there has been a decrease in the number of farms in the area. The author feels, however, that the proportion and distribution of types have not been radically changed.

where other types of part-time farming are dominant, a few forester-farmers are found.

To an observer, northern Wisconsin is a land of forests. A drive along any of the roads reveals miles of forested land broken only in spots where clearings have been hacked out of the woods. Not one county which lies wholly within the area has less than 60% of its total land area in forest cover. Three, Price in the north central, Vilas in the north central, and Washburn in the west, have over

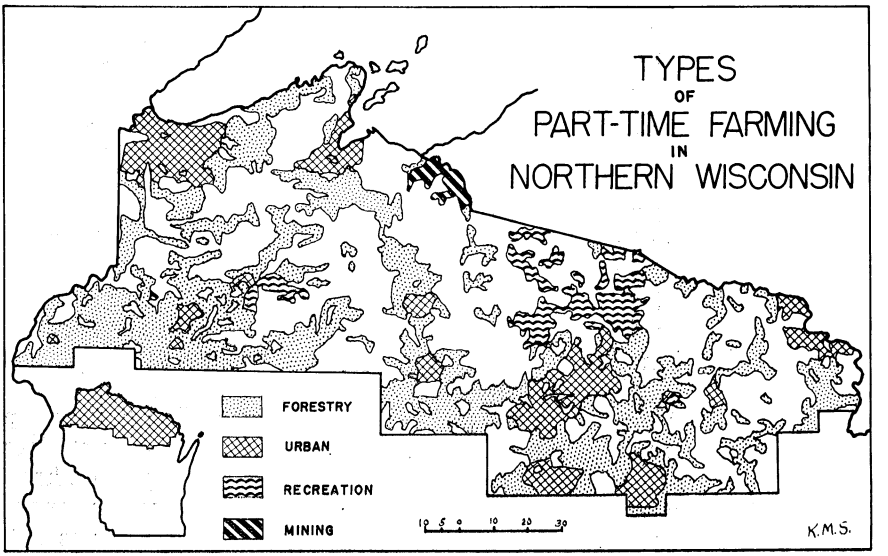


FIGURE 1.

80% in forests.[5] The large percentage of land in forest cover is deceptive because the types of forest and their quality range from virgin pine and northern hardwoods to brushy aspen regrowth.

The forester-farmer makes use of the large amount and variety of forests in many ways. He may work on his own land or he may buy "stumpage"[6] on private, county or federal land. Most farmers prefer one of these because they are their own bosses and can arrange their hours to suit themselves. However, other farmers work as woods laborers because they prefer the cash wages to the risks of self-employment or they do not possess the capital and experience to set up their own operations.

[5] Wm. W. Morris, *Classification of Woodland Cover of Wis.*, Wis. Land Econ. Survey, 1930–39, Madison, Wis. and *County Ag. Statistics Series*, Wis. Crop and Livestock Reporting Service, State Capitol, 1947, Madison, Wis.

[6] Stumpage is the sale of standing trees for conversion into timber products.

Pulpwood is the chief product of the forest and a single individual can handle its harvest. However, two man teams are more effective. Popple (aspen) is the most common tree cut although it does not command the best price per cord. Spruce and balsam pay better but are not as abundant. It is possible to cut pulp throughout the year, but the best time is in late fall and winter when the frozen ground and swamp makes it easier to skid the logs, and the insects do not torment the woodsman. Since winter is the slack season on the farm, forest work fits well into the farm schedule. After the morning chores, the farmer can spend the rest of the day in the woods and return in time for night milking.

Somewhat similar to pulp cutting but not as profitable is the production of "bolts" for other uses. Bolts do not require trees of as great size as pulp and, therefore, the smaller trees may be used. Cheese boxes, excelsior and chemical wood are made from these bolts.

Saw timber is generally the product of the large timber company. This is because of the high cost of equipment and the large investment required to obtain land with good stands of merchantable timber. Production of saw timber from public land requires cash deposits for stumpage which are excessive for the ordinary farmer. However, a farmer may work for a timber company in winter for cash wages.

There are two major groups of the forestry type. The first group is, or has the capacity to be, agriculturally self-sufficient yet does some woodswork in order to add to farm income. These people have over forty acres of cultivable land plus pasture and seven or more milk cows.[7] The requirement of seven or more milk cows is not always met but if they have the cropland and pasture to carry the required herd they are considered as belonging to this group. Of the 311 forestry type of part-time farmers interviewed, 187 are self-sufficient or potentially self-sufficient. Most of these are in the southeastern and southwestern parts of the study area where agriculture is better established but they are found throughout the whole area.

Over a third of the farmer-forester type are in the second major group, the forest-dependent part-time farmer. These farmers have less than forty acres of cultivated land and fewer than seven milk cows. Their forestry income represents a third or more of their total income. Some express their desire to clear enough land to be able to maintain a self-sustaining agricultural unit but most have been happy to have a minimum of farm work and to depend for a large share of their living from forest work. Most of this group of

[7] These criteria were determined after consultation with county agents on the minimum requirement for a self-sustaining dairy farm in the area.

the forestry type and the urban type share a common attitude toward farming, i.e., it is secondary. Their farm activity is directed toward subsistence. Farmers from this forest-dependent group have been more apt than the self-sufficient group to hire out for cash wages, because they can leave their farms more easily.

The farmer who depends upon the forests for a sizable part of his livelihood and operates his independent forest enterprise usually lacks capital and has poor collateral for credit. In order to purchase stumpage, he borrows from buyers who, in turn, expect the farmer to sell to them. The arrangement is much like sharecropping in the South. In addition, in order to obtain cash, the small independent logger sells his logs or bolts as soon as they are cut. This, added to the small volume and lack of knowledge of markets, precludes classification (veneer, lumber and pulpwood) by him to obtain the maximum value.

The forestry type of part-time farmer, whatever the group, exists only because the forests exist. Remove the forests or deny him the direct use of them by selling stumpage to large operators and over half of the forestry type could continue as self-sustaining agriculturalists with a smaller annual income. About one third who now depend on forestry would be forced to enter the labor market as seasonal laborers or leave the area, as most do not have the interest nor drive to become full-time farmers. If a change in stumpage policy permitted persons with capital to harvest the forest in large units, many in both groups of the forestry type part-time farmers could become woods laborers. This change would be resented by most of the part-time farmers, because of a loss of their freedom to plan and coordinate their agricultural and forestry activities.

If the greater efficiency of handling forest land in large tracts is shared by increased wages, the change in policy would benefit the part-time farmer who hires out as a seasonal woodsworker. The part-time farmer, because of slack winter farm activities, is the ideal person to meet the seasonal demand for labor in forestry. Otherwise, migratory labor would have to be brought into the area and the benefits of the forests would be siphoned out of the area.

The wide distribution of the forests with the many job opportunities created by their harvest and the seasonal complementary work pattern of farming and forestry, make it easy for the farmer who wants supplemental work to combine forestry and farming. These present factors plus a history of a land use pattern of a forest and farming combination from the early days of exploitive lumbering to the present, help explain why it is not surprising that the forestry type of part-time farmer is the most numerous in northern Wisconsin.

The Urban Type

Spotted like raisins in a pudding are the urban type of part-time farmers in northern Wisconsin. The urban type is a poor second numerically to the forestry type but accounts for 23% of the part-time farmers interviewed. Near each of the thirteen cities and larger villages are part-time farmers whose non-farm work is in the urban center. This phenomenon is common throughout Anglo-America.[8] Between the concentrations within the area there are noticeable differences in such matters as the relationship of the size of the concentration to the population of the city or the kind of work done by part-time farmers. The only characteristic common to each concentration in the area is small amount of farming carried on by this type of part-time farmer. Of the one hundred eighteen interviews, only twenty are of farmers with self sufficient farm units.[9]

The urban work of part-time farmers may be classified into two types: those found in most Anglo-American urban centers, such as services, trades and non-regional industries; and the regional industries of the area. Regional industries are considered to be: pulp mills, fuzz[10] mills, saw mills, iron ore docks and boat works. Most of those interviewed, seventy five out of one hundred eighteen, were employed in service jobs, trades or non-regional industries. However, with the exception of Duluth-Superior, which is so much bigger than the other centers, those with regional industries have the larger concentrations of part-time farmers. Thus, some of the smaller centers which possess large regional industries have larger groups of part-time farmers of the urban type than do larger centers with few, if any, regional industries.

A number of reasons for this can be given: 1) the large forest product industries offer more employment than the usual urban industries; 2) the season characteristics of forest-dependent industries make employment available at slack periods in the farm work schedule; 3) the regional industries in the area are located in the least favorable places for agriculture.

One of the largest concentrations of urban type part-time farmers is near the largest center of population, Duluth-Superior, which draws farmers from most of northern Douglas County, the northwestern county in the area. These twin ports have ore shipping facilities, a steel plant, a refrigerator manufacturing plant, as well as numerous wholesalers and service industries. The concentration extends about thirty miles from Superior, but most of the regular daily commuters are within a fifteen to twenty mile radius of their

[8] *Part-time Farming in U. S.*, U. S. Census, 1935, p. 90.
[9] Forty acres plus pasture and seven cows.
[10] Cellulose fiber used to make pressed board.

work. Few of those interviewed were employed by regional industries. Only three out of fourteen have farms that could approach self-sufficiency, but this low degree of farm activity is characteristic of the urban type as a whole.

Rhinelander and Tomahawk in east-central northern Wisconsin are twenty-three miles apart but their functions are similar, and their concentrations of part-time farmers coalesce into one area. Despite the vast difference in population between Duluth-Superior and Tomahawk-Rhinelander, the northwestern concentrations of urban part-time farmers and the east central one are about equal in size, numerically and areally. The two east-central cities have large pulp and paper mills. There are many small cleared areas with a house and garage along the highways. All of these are not occupied by part-time farmers but are rural residences of urban workers. The part-time farmer has more land but usually not much more of it is cleared than the rural resident's whose lot is only one or two acres. In twenty interviews, only six had farms that could be self-sufficient.

South of Rhinelander-Tomahawk, near the southern edge of northern Wisconsin, are the cities of Merrill and Antigo. Antigo lies about thirty miles east of Merrill. Although each is larger than Rhinelander, neither has as large a concentration of urban part-time farmers as does Rhinelander. There are no large regional industries in either Antigo or Merrill. The agriculture in the areas around both cities is better than in most places in northern Wisconsin.

The urban concentrations on the northeastern edge of the area in Florence and Marinette Counties are dependent on Iron Mountain (Michigan) and Niagara for urban work. Iron Mountain had an auto body plant in 1950 that manufactured wooden bodies for station wagons and convertibles.[11] Also, a number of metal fabricators are there. Niagara has a pulp mill.

Ashland, the only other large city, is somewhat similar to Duluth-Superior in its function as a port but it has a much smaller hinterland. Iron ore from Hurley is shipped to the lower Great Lakes from Ashland. Also, pulp wood is received from Canada for shipment to pulp mills farther south in the state. On the west, Ashland's concentration of urban part-time farmers joins that of Washburn to form a continuous area. At Washburn, a small county seat, pulp is also imported. But of more importance in work opportunities is the powder plant located to the south of the city.

The smaller centers shown on the map are mostly county seats or large villages with forest product industries. Grantsburg in the

[11] With the change to all metal types the plant was sold in 1952 and converted to the manufacture of other wood products by the new owners.

southwest has a population just under one thousand and no industries. East of Grantsburg, Spooner-Shell Lake has more than a local trade function. This is a resort center with many service establishments. Shell Lake, in addition to being a county seat, has a boat factory where small boats are made for local use. Hayward, farther to the east in Sawyer County is both a county seat and a recreation center.

Park Falls and Phillips, in central northern Wisconsin west of Tomahawk-Rhinelander, are examples of small urban centers with regional industries and a high number of urban part-time farmers. Park Falls has a pulp and paper mill, while Phillips is a county seat and agricultural market center with a fuzz mill, planing mill and flour mill. Most of the part-time farmers in these areas work in one of the regional industries.

The last two centers, Crandon and Lacona, are east of Tomahawk-Rhinelander. The larger, Crandon, is the county seat of Price County and has a small excelsior plant. Crandon's agricultural area is small and poor. Since it is located close to Rhinelander, its trade area is restricted by the larger city. Laona, an unincorporated village, is east of Crandon and half its size. Yet, it has more urban part-time farmers and a larger concentration around it than Crandon. The village has a large furniture plant. All examples of the urban type of part-time farmer found in this concentration are employed in the furniture plant.

The urban type of part-time farmer is much more dependent on his non-farm job than most of the forestry type. Few could live off their land as commercial farmers because they lack enough cleared land. Nor could they feed themselves as subsistence farmers, because they lack farming experience and equipment. With full employment in the nation and high demand for forest products, the urban part-time farmer in northern Wisconsin is well off. A depression or a curtailment in regional industries would be more serious for the urban type than other part-time farmers. This type, together with the group of the forestry type of part-time farmers that depend mainly on woodswork for their livelihood, would become relief problems. They do not now use their land to support themselves even at a subsistence level. The urban type of part-time farmer, though the most vulnerable to hard times, need not be. He has land and the knowledge is available. A program to combine these into a part-time farming system that can stand the shock of depression needs formulation.

Mining and Recreation Types

The number of mining and recreation types of part-time farmers in northern Wisconsin is small. Of all the part-time farmers interviewed, 2% were of the mining type and 3% of the recreation type.

The combination of mining and farming is today restricted to the one area of iron mining, Hurley in north-central northern Wisconsin. In spite of the large recreation business in northern Wisconsin, the recreation type is few in number because of the difficulty of combining it with farming.

The dominance of the mining type is local and the division between it and the other types is marked. In the north-central area, no mining farmers were found outside of the Hurley concentration. In all the other types of part-time farmers, the boundary between dominant areas is a transition zone. There were four mining type part-time farmers interviewed outside of the one concentration around Hurley. They work in a quarry of a roofing granule company in Marinette County in the northeast. However, there were not enough to form a concentration, as there were many more of the forestry type present in this area.

Some of the farms of the mining type part-time farmers are of considerable size and include large herds of cattle. Not quite half of those interviewed in the Hurley area had self-sufficient agricultural units. The rest use their land merely to help reduce living costs for shelter and food. Some own as much as forty acres but have only ten to fifteen cleared. Some keep a cow, others do not. A few chickens and a garden enable the mining-farmer to provide some of this food for less cash than buying it at the store.

Most of the farmers in this group receive the largest share of their income from work in the mines and look upon their farms as something to fall back on when mining is slack or played out. The homes, although not pretentious, do not have the hovel appearance found in the West Virginia and Pennsylvania coal districts, and the owners are not as bitter about their living conditions. The prosperity of the iron mines has been passed on to the miners in good wages and steady work.

The importance of maintaining domestic sources of iron ore will probably keep the mines in operation. The State Planning Board estimated in 1939 that the life of the reserves of high grade ores was twenty five years and suggested a study of ways to extend the reserve by beneficiation of lower grades of the Gogebic Range.[12] Little has been done to implement this suggestion but with the experience in beneficiation in Minnesota, the low grade reserves in the Gogebic Range should become more valuable and their exploitation can be expected. Under present conditions, mining could continue until 1964. If the low grade ores are used, it could continue for a much longer time.

The future of this type of part-time farmer appears better than the previously discussed types even though many do not have

[12] Wisconsin Planning Board, Bul. #7, pp. 63–64.

enough cleared land to be self-sufficient. However, it is the recognition by these farmers that their present prosperity is dependent on the continued operation of the mines which makes them receptive to improvement of their farming. This recognition and attitude plus past experience with reduced mining operations indicate that they would readily adjust to future fluctuations of employment in mining. This would be done by expanding their farming operations even if for some it would mean subsistence agriculture.

Recreation and farming mix about like oil and water. Resorts need lakes, trees, organized pleasures and transportation facilities. Most of these are the antithesis of the farmer who doesn't need the lake, clears the land for fields and has no experience in the organization of commercial recreation. The result has been that outsiders buy out farmers holding favorably located lake sites or seek sites in non-farm areas to place resorts. The farmer is left with the chance to work in the resort as a handyman, guide or caretaker, if he remains. Yet, even here, because the season of tourists and field activities coincide, farmers do not seek this employment. Some have found ways to supply the needs of resorters directly by raising and selling chickens, eggs, vegetables and berries. A few are in the bait business. However, the vacationer, because of the irregular supply and quality of food from local farmers, trades at the urban store which may buy some things locally, but which is largely tied to the national marketing organizations.

The rarest combination is the man who actually runs a recreation business and farms along with it. Some have land that is ideally situated to do this. In most cases, they depend upon another member of the family to service the recreation facilities. The only exceptions to this are a few winter resorts for skiing and other snow sports which are found near Cable, fifty miles southeast of Superior. However, these resorts are not numerous enough to show as a dominant area on the map.

The largest area of dominance of the recreation type is the recreation region of Vilas County, the northern county of east central northern Wisconsin. The recreation area extends southward into Oneida County, but here—because of other and better opportunities for work, such as in the Rhinelander paper mills—few part-time farmers are in recreation. In the west, Wisconsin's second recreation region, Hayward, does not show a corresponding concentration of recreation part-time farmers. Of course, there are some recreation type part-time farmers, but it is not the dominant type because of other work, mostly woodswork, and because the recreation development is less highly organized.

Three small concentrations result from local development of resorting opportunities. One is west of Hayward. Another is near

Crandon in Forest County but it is much like the Vilas area as most of the recreation activity is organized by non-farmers. The third is in Oconto County where farmers have lakes and flowage sites. This area is still in the process of development and the present owners want to maintain it and profit from the future expansion. Yet, if it follows the pattern of other highly developed recreation areas, the farmers will soon sell out.

The classification of recreation type of part-time farmer includes only those farmers who are directly concerned with the recreation business. The indirect influence of recreation is undoubtedly of consequence. A farmer may sell his products through normal channels, and these products may supply the recreation industries with goods; yet he is not a recreation type part-time farmer. However, the farmer who sells his farm produce directly to the tourists or resorts is classified in the recreation type. Similarly, urban service jobs of a farmer may be supported by the recreation trade, but such a part-time farmer is not a recreation type. The combination of farming and recreation work is not easy to make. To do so, the farmer must either reduce his farm operation, or be favored by an ideal arrangement of facilities, or have a member of his family who can run the recreation side of the combination. Most farmers are not able to make the combination, or prefer not to do so.

The Miscellaneous Type

The miscellaneous type represents about one-eighth of the part-time farmers interviewed. However, they are scattered throughout northern Wisconsin and are nowhere dominant. The occupations found combined with farming are traveling salesmen, craftsmen who service non-urban sections, milkmen and truck drivers who serve rural creameries and schools, railroad section hands, meter readers for rural electric lines, and insurance salesmen. Also, there are in this type a sizable number of elderly farmers who are too old to carry on a full-time farm operation. Many of these are partially supported by pensions or by children, live on small holdings and do a minimum of farming to help sustain themselves. Some have returned to old homes or have sought cheap places for retirement.

THE HISTORY OF RYE IN WISCONSIN FROM 1850 TO 1955

ROSS L. PACKARD
Crop Reporting Service, United States Department of Agriculture, Washington, D. C.

Rye is of relatively minor importance from the standpoint of Wisconsin's total agricultural economy. Nevertheless, this crop has played an important role on many farms in the state, especially on the sandy soils in the central area. During the early years of settlement of Wisconsin, rye was grown as a bread grain more generally throughout the state because many settlers from central Europe were accustomed to using it in their native counties. A large proportion of the rye was utilized as a food during that period, while at present the crop is used largely as a feed grain for livestock or for pasture and green manure. Only a very small portion of the Wisconsin rye crop is now used in the manufacture of flour for bread. Shands (1956) has observed that the demand for rye bread is declining.

Less than 5,000 acres of rye were grown in Wisconsin in 1850 and most of the acreage was in the south and southeastern counties, with Washington County providing more than one-half of the state total. An average of less than 1 percent of the land in farms in Wisconsin was used for the production of rye during the 20-year period 1850–70. Rock, Manitowoc, Washington, Marquette, Adams, Waushara, and Portage were the important rye producing counties in 1870.

The rye crop had expanded into the west-central district by 1880, and there were further increases in other parts of the state. The heaviest acreage concentration, however, was in the central sandy area. The acreage of rye reached 300,000 by 1893 with nearly every county of the state reporting some being grown and the concentration in the central part of the state had become more pronounced. The Wisconsin acreages, yields, and production of rye from 1866 to 1955 are shown in Table I.

Moore and Leith (1921) writing in 1921, recommended rye for sandy soil because: (1) it conserved soil fertility; (2) prevented soil blowing; (3) was one of the best companion crops; (4) it afforded a good pasture and soiling crop; and (5 it was valuable food for people and feed for livestock.

TABLE I

RYE, ACREAGE, YIELD PRODUCTION
WISCONSIN, 1866–1955[1]

YEAR	ACREAGE IN THOUSANDS	YIELD PER ACRE	PRODUCTION IN THOUSANDS
	(Acres)	(Bushels)	(Bushels)
1866	86	14.0	1,204
1867	86	14.5	1,247
1868	86	14.5	1,247
1869	90	15.0	1,350
1870	87	11.5	1,000
1871	90	15.0	1,350
1872	90	14.5	1,305
1873	98	13.0	1,274
1874	105	13.0	1,365
1875	105	14.0	1,470
1876	120	13.5	1,620
1877	175	14.5	1,538
1878	195	15.0	1,925
1879	170	13.5	1,295
1880	163	14.5	2,364
1881	164	14.0	2,296
1882	173	14.0	2,422
1883	171	14.5	2,480
1884	174	14.0	2,436
1885	176	12.5	2,200
1886	173	12.5	2,162
1887	226	12.5	2,825
1888	282	15.0	4,230
1889	275	15.5	4,262
1890	272	15.0	4,080
1891	265	12.0	3,180
1892	285	14.5	4,132
1893	300	15.0	4,500
1894	308	14.0	4,312
1895	380	13.5	5,130
1896	440	15.5	6,820
1897	365	14.5	5,292
1898	410	14.5	5,945
1899	362	14.5	5,249
1900	387	14.5	5,612
1901	385	14.0	5,390
1902	390	16.5	6,435
1903	320	14.0	4,480
1904	290	14.5	4,205
1905	320	14.0	4,480
1906	325	15.0	4,875
1907	275	16.0	4,400
1908	310	16.0	4,960
1909	339	14.5	4,916

TABLE I—Continued

Year	Acreage in Thousand[1]	Yield Per Acre	Production in Thousands
	(Acres)	(Bushels)	(Bushels)
1910	345	13.0	4,485
1911	480	14.5	6,960
1912	460	15.0	6,900
1913	480	14.0	6,720
1914	460	14.0	6,440
1915	420	15.0	6,300
1916	375	12.5	4,688
1917	410	13.0	5,330
1918	436	13.0	5,668
1919	529	13.0	6,877
1920	475	13.2	6,270
1921	410	12.5	5,125
1922	535	11.8	6,313
1923	365	12.8	4,672
1924	333	13.7	4,562
1925	256	11.5	2,944
1926	256	11.5	2,944
1927	238	12.7	3,023
1928	167	10.5	1,754
1929	188	11.4	2,143
1930	194	12.0	2,328
1931	175	11.0	1,925
1932	254	11.0	2,794
1933	226	9.0	2,034
1934	210	7.4	1,554
1935	314	12.5	3,925
1936	210	10.0	2,100
1937	336	13.5	4,536
1938	322	13.0	4,186
1939	228	10.3	2,348
1940	182	14.0	2,548
1941	142	11.0	1,562
1942	135	11.5	1,552
1943	109	9.5	1,036
1944	98	8.7	853
1945	95	12.0	1,140
1946	76	11.5	874
1947	87	12.0	1,044
1948	92	12.0	1,104
1949	92	12.0	1,104
1950	92	13.0	1,196
1951	97	12.0	1,164
1952	58	12.0	696
1953	46	12.0	552
1954	42	13.0	546
1955	44	12.5	550

[1]Courtesy of Wisconsin Crop Reporting Service.

The first World War created a demand for bread grains and the rye acreage was expanded to record levels during and immediately following the war. All areas of the state grew more rye at that time and the acreage exceeded half a million, with the most concentrated production in the light sandy soils of the central and western counties. The rye acreage in Wisconsin had reached 529,000 by 1919 and a record of 535,000 acres were harvested in 1922. As the rye acreage increased during World War I, yields per acre also increased because much of the new acreage was on better soils than are found in central Wisconsin, where rye was usually grown before the war. The acreage for the state as a whole dropped off quite sharply after 1922, as the demand for bread grains subsided, but the decline was less rapid in the central area.

There was a general increase in rye acreage throughout the state from 1935 to 1938, excepting in the central and eastern districts. During the next few years the rye acreage declined steadily, reaching 76,000 by 1946. Shands (1956) stated that part of the reason for the decline in rye was due to an unfavorable price situation. In addition, rye is not as suitable for feed as some of the other small grains. Only 44,000 acres of rye were harvested in 1955. Even with this low acreage, rye continues to be an important feed crop on farms in the central sandy plain.

In examining the average yield per acre of rye in Wisconsin for the years 1866 to 1955, as shown in Table I, an interesting difference from other crops can be noted. Rye yields during the last 20 years averaged lower than when the crop was first grown in the state. This does not necessarily imply that the new varieties of rye which have been developed were lower yielding; in fact, most were superior in yields. However, rye can grow and produce a crop on less productive soils than can some crops. On soils where many crops would fail or produce very low yields, rye is dependable as a crop, although yields are lower than if fertility levels are higher. Thus, the yield provided by rye grown in some of the less productive soils of the state can probably be considered a tribute to the development of superior varieties by plant breeders.

There is likely to be little change in Wisconsin rye acreage in the future. Rye will probably continue to be used on sandy soils where little or no fertilization is practiced. At the present time (1956) Imperial and Adams are the rye varieties being recommended for Wisconsin farmers. Adams developed by Shands, was released in 1953. Tetra Petkus may find use for silage and with high fertilization it could produce good yields. However, under such conditions wheat might compete successfully.

Rye Varieties

Information relating to the types and varieties of rye that have been grown in Wisconsin is more limited than for other small grains. There are fewer varieties to begin with, because cross pollination makes it difficult to maintain varietal purity. Data appearing in Table II show the types and varieties of rye at the State Exhibitions and Fairs from 1853 to 1913. Prior to 1900 awards were given just for rye, then for eleven years for spring and winter rye. Wisconsin Pedigree rye was first listed in 1913. Yields per acre during that period varied from a low of 11.5 bushels in 1870 to a high of 16.5 bushels in 1902.

TABLE II

Rye Types and Varieties Receiving Premiums at the State Exhibitions and Fairs, 1853–1913

Year	Type or Variety
1853	None
1855, 1870–73, 1875–6, 1880–83, 1888–1891	Rye
1901–11	Spring Rye, Winter Rye
1912	Winter Rye
1913	Spring Rye, Wisconsin Pedigree Winter Rye, Any other Winter Rye

The earliest testing of rye by the Wisconsin Experiment Station was in 1900, when Moore (1900) included Prolific in his trials. Other varieties tested in the years 1900 to 1907 are shown in Table III.

TABLE III

Rye Varieties Under Test
Wisconsin Experiment Station, 1900–07

Variety	Individuals Conducting Tests	Years Reported
Ivanoff	Moore and Stone	1905–07
Minnesota Nos. 1, 2	Moore and Stone	1905–07
Minnesota No. 32	Moore and Stone	1905–06
Olds Mammoth Spring	Moore and Stone	1907
Petkus	Moore	1901–02
Prolific (Spring)	Moore	1900
Schlansted	Moore	1901–02
	Moore and Stone	1904–07

Moore (1902) tested Schlansted and Petkus for the first time in 1901. Both are German varieties secured by the Bureau of Plant Industry from Europe in 1900 and sent to the Wisconsin Experiment Station for trial purposes. These were the best European ryes for breadmaking. Petkus outyielded Schlansted and was also the hardiest.

Moore and Stone (1907) made the following statement concerning rye in 1907:

> "For seven years variety tests have been conducted with fall rye and an attempt made to breed a pedigreed variety that would surpass other varieties in point of yield and flour production. Two new varieties have been bred from the Schlansted and Petkus foundation that promise fair for the future. These varieties will go into the increase plots in 1908."

TABLE IV

VARIETIES OR TYPES OF RYE BEING PRODUCED FOR SALE BY MEMBERS OF THE WISCONSIN AGRICULTURAL EXPERIMENT ASSOCIATION

YEAR	VARIETY OR TYPE
1910	Winter Rye, Spring Rye
1911–12	Pedigree
1913–17	Pedigree Nos. 1, 2
1918	Pedigree
1919–20	Wisconsin Pedigree Winter Rye
1921	Wisconsin Pedigree Rye, Rosen
1922	Pedigree Nos. 1, 2, 12.19, Rosen
1923	Pedigree Nos. 2, 408, 12.19, Rosen
1924	Pedigree Nos. 1219, Rosen
1925–27	Pedigree, Rosen
1928	Rosen
1929	Pedigree, Winter Rye
1930	Pedigree Winter Rye, Ped. No. 2, Rosen
1931	Pedigree Nos. 20, 69, 70, 1, 59, 12.19, Rosen
1932	Pedigree 6, (White Rye), Ped. 12.19
1933	Pedigree No. 6 (White Rye), Ped. 12.19, Wisconsin Pedigree
1934	Pedigree No. 6 (White Rye)
1935	Pedigree No. 6, Pedigree No. 5, Rosen
1936	Pedigree No. 6, White, Pedigree No. 5, White Spring Rye
1937	Pedigree No. 6
1938	Pedigree No. 5, Pedigree No. 6
1939	Imperial (Pedigree No. 6) Rosen
1940–42	Imperial (Pedigree No. 6), No. 5 White, Rosen
1943–55	None

The first dissemination of pedigree ryes was made in 1910 to the members of the Wisconsin Agricultural Experiment Association (Moore and Leith 1921). About 200 members tested these varieties the first year, and 125 conducted tests in 1911. The varieties or

types of rye which were produced for sale by members of the Association from 1910 to 1942 are listed in Table IV. Rye seed has not been listed for sale by members of this Association since 1942.

Leighty (1916) reported that Petkus, Schlansted, Ivanoff, and Dean gave good results in Wisconsin in 1916. Wisconsin farmers purchased 162 bushels of Rosen Rye seed from Michigan sources in 1918 and 1919 (Spragg 1921).

Delwiche developed Pedigree No. 12.19, a selection from Schlansted, at Ashland and this variety was first listed for sale by members of the Wisconsin Agricultural Experiment Association in 1921 (Moore, 1921). Martin and Smith (1923) listed Petkus, Schlansted, Ivanoff, Dean, and Pedigree No. 12.19 as being grown in Wisconsin in 1923. Imperial was developed by Leith (1956). Delwiche, Albert, and Bohstedt (1940) reported in 1940 that Pedigree 12.19–A, Rosen and Imperial were well adapted to conditions at Sturgeon Bay, Marshfield, and Ashland. Imperial grew well at Hancock and Madison, but Rosen showed susceptibility to winter injury. Adams was first released to farmers in Wisconsin in 1953 (Anon. 1953) and it performed satisfactorily in 1954. It is much like the parent variety, Imperial.

Summary

Farmers were growing less than 5,000 acres of rye in Wisconsin in 1850. The largest acreage of rye ever grown in Wisconsin was the 535,000 acres recorded in 1922. The rye acreage had expanded as a result of increased food demands due to the first World War. Shands stated that the decline since 1922 has been due to the low prices for rye compared to other grains and to the fact that rye is not as desirable for feed as some of the other grain crops. Rye is still an important crop on some of the farms in the central sandy plain. Because rye is now grown on less favored situations, yields have averaged lower in recent years than when the crop was first grown in the state.

The future of rye in Wisconsin will be largely dependent upon its utilization on the light sandy soils in the central area.

Varietal improvement and maintenance of pure strains of rye is difficult because it is a cross pollinated crop. Moore tested one spring rye variety in 1900 and two winter varieties were tested in 1901. Pedigree ryes were first disseminated to farmers in 1910. Pedigree No. 12.19, developed by Delwiche, was released to farmers by 1921. Imperial was developed by Leith, and has been an important rye variety in Wisconsin for many years. Adams was first released to farmers in Wisconsin in 1953 and it performed satisfactorily in 1954.

LITERATURE CITED

ANON. 1953. Field Crop Varieties in Wisconsin. *Wis. Ext. Ser. Cir. 463.*

DELWICHE, E. M., A. R. ALBERT and G. BOHSTEDT. 1940. Winter Rye, Growing and Feeding. *Wis. Ext. Ser. Cir. 301.*

LEIGHTY, C. E. 1916. Culture of Rye in the Eastern Half of the United States. *U. S. D. A. Far. Bul. 756.*

LEITH, B. D. 1956. *Personal Communication.* Madison. April 18.

MARTIN, J., and R. W. SMITH. 1923. Growing Rye in the Western Half of the United States. *U. S. D. A. Far. Bul. 1358.*

MOORE, R. A. 1900. Experiments with Grain and Forage Crops. *Wis. Agr. Exp. Stat. 17th Ann. Rpt.:* 227–238.

———. 1902. Experiments with Grains and Forage Plants. *Wis. Agr. Exp. Stat. 19th Ann. Rpt.:* 217–240.

——— and B. D. LEITH. 1921. Wisconsin Rye. *Wis. Agr. Exp. Stat. Bul. 326.*

——— and A. L STONE. 1907. Experiments with Grain and Forage Plants, 1907. *Wis. Agr. Exp. Stat. 24th Ann. Rpt.:* 336–400.

SHANDS, H. L. 1956. *Personal Communication.* Madison. April 12.

SPRAGG, F. A. 1921. Rosen Rye. *Mich. Agr. Exp. Stat. Spec. Bul.* 105.

ARTS AND LETTERS

THE CASE OF SHAPIRA'S DEAD SEA (DEUTERONOMY) SCROLLS OF 1883*

MENAHEM MANSOOR
Chairman, Department of Hebrew and Semitic Studies
University of Wisconsin

A. Background.

In 1883, Moses Wilhelm Shapira, a Polish Jew who was converted to Christianity and settled in Jerusalem as an antique dealer and "agent to the British Museum," offered for sale to the Museum fifteen leather fragments containing portions from Deuteronomy, including the Decalogue.[1]

The fragments, wrapped in linen, were found by an Arab in caves overlooking Moujib,[2] in the vicinity of the Dead Sea. The circumstances[3] of the finding tally almost exactly with those of the Qumran discoveries. The text was written in archaic (Phoenician) Hebrew script, similar to but not identical with the script used in the Mesha stone,[4] and exhibited significant variations from the Masoretic text.[5]

---

*This writer wishes to acknowledge his indebtedness to Miss Mary Ann Fruth, a graduate student in the Department of Speech and research assistant in the Department of Hebrew and Semitic Studies at the University of Wisconsin, for assisting in research and preparing the manuscript for publication.

[1] A great portion of the text appears twice. Two-thirds of the text was in fairly good condition. H. Guthe. Fragmente einer Lederhandschrift enthaltend Mose's letzte Rede an die Kinder Israel. Leipzig, 1883, p. 63. For detailed contents see footnote 183.

[2] The Biblical river Arnon, also known as the Wadi Moujib, cuts across Moab running near the ancient city of Dibon, and empties into the Dead Sea.

[3] See next section on "External Evidence."

[4] As we shall see later, in the section discussing the script, almost all the 1883 scholars who actually inspected the original document suggested dates ranging from the period of the Captivity, the Maccabean period, and even the first two centuries A.D. (The Standard, August 14, 1883.)

[5] All the important variations are discussed in the section on "Internal Evidence."

Ginsburg[6], acting for the British Museum, transcribed and translated about two-thirds of the texts, which were published in the contemporary, leading newspapers and journals. The French scholar, Clermont-Ganneau[7], after a brief examination, branded the Manuscripts as a forgery. Several of the objections produced as external evidence, if acceptable, may equally apply to the Qumran scrolls[8], such as the claim that no fragment can be preserved for over 2000 years in as damp a country as Palestine[9]; the fact that the fragments were sewn together, and that the manuscripts were found wrapped in linen[10].

Shapira was distraught. He committed suicide a few months later in Holland[11], and the whole "incident" was almost forgotten. Unfortunately we are yet unable to trace the manuscripts themselves[12].

---

[6]Christian David Ginsburg, 1831-1914. Famed Massoretic scholar who edited and published editions of many Hebrew MSS. Ginsburg's familiarity with the Phoenician script of the Shapira MSS. stemmed from his work on the Mesha Stone, prior to his publishing a most elaborate account of that monument written in English. He was a Jewish convert.

[7]Charles Clermont-Ganneau, 1846-1923. A noted French Orientalist, instrumental in discovering the Mesha stone in 1870, and author of a number of volumes dealing with the archaeological exploration of Palestine. Ganneau was well-known as a critic of suspected forgeries and frauds and claimed the honor of revealing the fraudulant nature of the Moabite pottery connected with Shapira, as well as the famous "tiara of Saitapharnes" owned by the Louvre.

[8]In the opinion of this writer the authenticity of the Qumran scrolls is unquestionable.

[9]One of Claude R. Conder's main arguments against the authenticity of the document was that no leather manuscript could exist for more than 2000 years "... in the damp atmosphere of a country which has a rainfall of twenty inches." (The Times Weekly Edition, August 24, 1883, p. 9)

[10]Strong objection to the document was raised because of Shapira's account about the existence of the linen. "The mention of the linen seems somehow a mistake since [even] believers in leather can hardly be expected to assign equal staying power to mere flax." (The Times Weekly Edition, August 22, 1883, p. 12) For a complete account of these objections see below.

[11]According to information received from the Population Registry in Rotterdam, Moses Wilhelm Shapira died on March 9, 1884, at the age of fifty-one. This is the only document in which the full name of Shapira is given.

[12]See section below on "The Whereabouts of Shapira's Scroll."

Among the recent Qumran finds[13] there are several Pentateuchal fragments, especially of Deuteronomy[14], also written in Archaic Hebrew script[15], though admittedly of later date[16]. In the summer of 1956, the present writer spent several weeks at the British Museum studying among other things the eighty-two page dossier[17] on this scroll. It is clear from this dossier that it was mainly the internal evidence which prompted Ginsburg, Sayce[18], Neubauer[19], and other scholars to reach their decision. By no means

---

[13] For full details see P. Benoit, O.P. "Editing the Manuscript Fragments from Qumran." Biblical Archaeologist XIX, December 1956; or, in its original French version, "Le travail d'edition des fragments manuscrits de Qumran." Revue Biblique LXIII, 1956, pp. 49-67.

[14] Frank M. Cross, (BASOR, no. 141; 1950, p. 111) referring to the single copy of the Book of Chronicles found in Cave IV, points out that this manuscript is found on a three-inch strip of leather; parts of six lines and two columns are preserved. He also points out that the most popular books among the sectarians, to judge from the number of copies preserved in Cave IV, are Deuteronomy--13 MSS; Isaiah--12 MSS; and Psalms--10 MSS. Some will note that these same books figure most frequently in New Testament quotations from the Old Testament. The scrolls in Paleo-Hebrew are virtually all Biblical, including the five Pentateuchal manuscripts and some fragments from Job.

[15] Several Pentateuchal fragments have been found in 1Q, 4Q, (for instance Gen. 6, 13-21; Lev. 8, 13), written in Paleo-Hebrew script, again of much later date. "There is no reason to date [the paleo-graphical series of MSS. discovered in Qumran] outside the normal range of Qumran materials in the square-letter script." P.W. Skehan's report in BA XIX, 1956, no. 4, p. 86.

[16] The inscription on Shapira's Deuteronomy is similar to but not identical with that on the Mesha Stone (ninth century B.C.). For the date of the scripts of Shapira's document see below chapter on script.

[17] British Museum, Add. 41294. Papers Relating to Shapira's Forged Manuscript of Deuteronomy. This dossier contains relevant, though incomplete, papers relative to M.W. Shapira's allegedly forged MSS. of Deuteronomy, consisting chiefly of some of the original letters from Shapira to Walter Besant, Secretary of the Palestine Exploration Fund; to E.A. Bond, Principal Librarian of the British Museum, and to Dr. Christian D. Ginsburg, who was appointed to report on the Manuscript for the British Museum. The dossier does not contain the original MSS., but happily there are reproductions in photograph and lithograph of the text prepared by Ginsburg. Most valuable also are several contemporary European newspaper clippings on the heated controversy.

[18] A.H. Sayce, 1846-1933. British Orientalist and Professor of Assyriology at Oxford. One of the foremost contemporary authorities on Oriental scholarship.

[19] A. Neubauer, 1832-1907. British Semitic scholar born in Hungary. In 1868 he became associated with the Bodleian Library, where he subsequently became sub-librarian. He was reader of Rabbinical literature at Oxford from 1886-1900 and published a number of books, one being a catalogue of the Hebrew MSS. in the Bodleian Library.

did the opinions of all scholars and experts of the day condemn the MSS. as a forgery[20]. On August 13, 1956, a preliminary report of this writer's study of the Shapira case was published in the form of an interview[21] and was subsequently reproduced in some of the leading newspapers in several countries.

Following the publication of this report, but before this writer was able to publish a documented article on the subject, Oskar K. Rabinowicz[22] and M.S. Goshen-Gottstein[23] strongly criticized the re-opening of the case, each concluding categorically that the Shapira document was a forgery[24]. There are good reasons, however, to

---

[20]It is regrettable that the scholars who have recently objected to my re-opening the case did not see fit to refer to any of the reports in favor of the Shapira documents. (See Gottstein, Rabinowicz; notes 22 and 23 below.)

[21]The New York Times. August 13, 1956, pp. 1, 6.

[22]Oskar K. Rabinowicz. "The Shapira Forgery Mystery." Jewish Quarterly Review XLVII, 1956, pp. 170-182. (Rabinowicz further published two articles on the subject in the Jewish Chronicle, London, August 9th and 16th, 1957, respectively.) Rabinowicz mainly repeated the arguments advanced in 1883. He concluded with a sweeping statement in support of S. Zeitlin's views on the Qumran Scrolls. See footnote 32.

[23]"megillôt qumrān veziyyûf sēfer debārîm šel šappîrā." Hā'āres. December 28, 1956, Tel Aviv. Gottstein, while in essence following Rabinowicz's 1883 arguments, raised an important question involving the paleographic issue, to be discussed later. A similar item was published by him in the Jewish Chronicle of Febraury 15, 1957. Again, he published an article in the Journal of Jewish Studies, "The Shapira Forgery and the Qumran Scrolls," VII, Nos. 3 and 4, 1956, pp. 187-193. The latter Journal was published only in July 1957.

[24]Perhaps it is relevant to point out here that this writer has never made a claim to the effect that Shapira's Deuteronomy is not a forgery. It was J. L. Teicher ("The Genuineness of the Shapira Manuscripts." The Times Literary Supplement, March 22, 1957) who wrote that he had reached the "inescapable conclusion that the Shapira manuscripts were genuine and that their contents are most fittingly described as representing the Book of Deuteronomy, which was re-drafted for liturgical and catechetic purposes in the Jewish Christian Church." Obviously, apart from raising the question of re-examining the Scroll, the present writer cannot be held responsible for J. L. Teicher's conclusion on the genuineness of the Shapira manuscripts.

believe that, for the sake of true scholarship, the whole case merits re-examination. It was in this spirit that the writer read a paper before the Society of Biblical Literature and Exegesis[25] and another one at the joint Midwest meeting of that Society and the American Oriental Society.[26] At both meetings the members received a sixteen page mimeographed pamphlet containing documents, quotations, and sources relating to the subject under review. It was at these meetings that an attempt was made to refute the arguments of O.K. Rabinowicz, as well as those advanced in 1883. Several eminent scholars[27] have since written to this writer encouraging him to pursue the matter further. J. Philip Hyatt, President of the Society of Biblical Literature and Exegesis, in his presidential address to the ninety-second meeting, expressed the belief that the Qumran discovery might eventually lead to the authentication of the Shapira documents.[28] S. Yeivin[29], reviewing the finds of Qumran IV, independently called for the re-examination of the Shapira document in the light of the Qumran discoveries.[30]

The purpose of the present paper is to attempt to analyze and refute the evidence--both internal and external--advanced not only by the scholars of 1883 but also by M.H. Goshen-Gottstein and O.K. Rabinowicz.

---

[25] "The Case of Shapira's Dead Sea (Deuteronomy) Scroll of 1883," read at the ninety-second meeting, held at the Union Theological Seminary in New York City, December 27-28, 1956.

[26] "Further Evidence Relating to the Case of Shapira's Deuteronomy," at Dubuque, Iowa, April, 1957.

[27] Out of courtesy and respect to these eminent scholars this writer refrains from referring to their names, which may be obtained on request by any would-be investigators of the Shapira case.

[28] See also L. Philip Hyatt, "The Dead Sea Discoveries: Retrospect and Challenge." JBL LXXVI, 1957, p. 3.

[29] Noted Israeli archaeologist and director of the department of Antiquities in Jerusalem.

[30] Hā'āreṣ. April 20, 1956.

This writer wishes to reiterate that at no time has he made any claim that the Shapira documents are authentic.[31] He leaves such decisions to more qualified and competent scholars to re-examine the case and reach a new decision in the light of our present more advanced knowledge of paleography and Biblical archaeology. Furthermore, this writer will not in the least feel unhappy or disappointed should competent scholars today re-examine the case and re-establish the forgery on a sounder scholarly basis.

The most startling statement in Rabinowicz's article[32] is his intimation that the Qumran Scrolls might be a forgery too. His conclusion is as follows:

> If it should be possible to prove--as is indicated in John Hillaby's report--that these fragments are textually similar to or in some parts even identical with certain scrolls discovered since 1947 at Qumran, then a mystery of unparalleled importance would be woven around the latter, and thus justify to a great extent what Professor Zeitlin of Dropsie College Philadelphia has been claiming about the Dead Sea Scrolls on the basis of internal evidence.

The motive which has prompted Rabinowicz to embark upon a "holy war" against this writer is quite appreciated in this light.

---

[31] Gottstein, op. cit., p. 187, quoting John Hillaby, correspondent of the New York Times, attributes the following to me: "My impression is that there is a good chance of this scroll [viz. The Shapira Scroll] emerging as a genuine one. It is quite feasible that Shapira might have suffered a great injustice seventy years ago, and that even if his Deuteronomy did not date from King Josiah's times it might have been copied by one of the members of this Qumran sect." This quotation by Gottstein is correct as far as it goes; however, this quotation originally belongs to Theodor F. Meysels, of Jerusalem. (See Jerusalem Post, November 20, 1953.) It was only natural for this writer to entertain the possibility of the Shapira document emerging as a genuine one, but certainly not the "only possibility," as Gottstein infers.

[32] JQR, op. cit., p. 182.

The External Evidence.

B. The Discovery.

The following is an account of the discovery and descriptions of fragments, as related in Shapira's own handwritten letter to Professor Herman Strack, of Berlin[33], and in Shapira's own handwritten account to the British Museum.[34]

> I am going to surprise you with a notice and a short description of a curious manuscript, written in old Hebrew, or Phoenician letters upon a small strip of embalmed leather, and seems to be a short unorthodox book of the last speech of Moses in the plain of Moab....
>
> In July 1878, I met several Bedouins in the house of the well-known Sheikh Mahmud el Arakat, we came of course to speak of old inscriptions.[35] One Bedouin asserted that the antique brings blessedness to the place where it lays, and began to tell...the following....

---

[33] The original letter in its entirety is found in the above-mentioned British Museum Dossier, fol. 1, and is dated "Jerusalem, May 9, 1883." The writer has made very few changes in grammar and style.

[34] "A Few Notes as a Preface to the Manuscript of Deuteronomy." British Museum Dossier, pp. 26-32.

[35] It was only natural for Shapira to discuss inscriptions, seeing that he was an "agent for the British Museum." It is relevant to say here in passing that Shapira in this capacity had sold a large number of ancient authentic rabbinic and Arabic documents which are still in the possession of the Museum. Guthe, the well-known German scholar who was the first to carry out intensive study of the Shapira documents states in his book (op. cit., p. 1) that he had visited Shapira's antique shop several times "to look at several Hebrew and Arabic MSS., especially concerning the Bible, which Shapira had bought in Yemen and which he had sold in the meantime partly to the Royal Library in Berlin and partly to the Library of the British Museum in London." A number of manuscripts were at that time purchased by Mayor Adolf Sutro of San Francisco, according to a letter recently received by this writer from the librarian of the San Francisco public library. On Shapira's arrival in London, several reports appeared in the contemporary press stressing that he was a distinguished member of the Hebrew-Christian community. The Jewish Chronicle of London, August 10, 1883, p. 10, reported that in Jerusalem Shapira had become a pillar of the London Mission and that as a leading antique dealer in Jerusalem he used to acquire great numbers of old MSS. from Arabs in South Palestine and sold them all over Europe. Some of these documents were of great importance such as the beautiful MSS. of Maimonides' Commentary on the Mishna which he sold to Berlin. As O.K. Rabinowicz himself points out, (op. cit., JQR, p. 173) this made possible the editing of the whole work of the philosopher. In fact, the announcement about the edition of the Mishna Torah on the basis of Shapira's MSS., giving him full credit for it, was made in April 1884--eight months after his fragments had been declared a forgery and one month after his suicide in Rotterdam. (ibid., p. 174) Ginsburg, in a letter published in the London Times, August 27, 1883, and addressed to E.A. Bond, principal librarian of the British Museum, dated August 22, 1883, reporting on the forgery, pointed out that in November, 1877, the British Museum purchased from Shapira a large number of ancient Pentateuchal scrolls from Yemen.

> Several years ago, some Arabs had occasion to flee from their enemies and hid themselves[36] high up (in caves) in a rock facing the Moujib.[37] They discovered there several bundles of very old rugs. Thinking they may contain gold, they peeled away a good deal of cotton or linen and found some black charms and threw them away; but one of them took them up and since having the charms in his tent, he became a wealthy man, having sheep, etc....[38]

Only the goat and the jars are missing here to show the striking similarity with the circumstances of the Qumran original discovery of Cave One.

Shapira's account goes on:

> We marvelled of the dryness of the place. The Arabs told us that no rain are able to approach the place because the north and south rocks sheltered it from rain. We thought at that time that such a dry land may preserve for us the oldest documents, being like the Egyptian soil.[39] I therefore took an interest in the story.... with the help of Sheikh Arakat, an Arab brought me [i.e., Shapira] slowly all I now possess, which seemed to me to belong to three different documents--one nearly complete, one a very little wanting, and of one I have only a very little piece and much decayed.

Some scholars doubted the truthfulness of Shapira's account as fantastic and the fruit of his imagination. Yet today, in the light of the Qumran account of the discovery of Cave One, Shapira's story does not sound so incredible.

According to Guthe's[40] description of the manuscript, there were sixteen strips of leather whose breadth varied between 7.6 and 9.7 centimetres. Their lengths, however, were of greater variations. Five strips were only fifteen to eighteen centimetres long; the others consisted of two, three, four, or five connected layers, each of which had the length mentioned above so that strips up to eighty or ninety centimetres in length were found. In addition there were several smaller pieces.

---

[36] "...in order to escape the persecution of the Turkish government." B.M. Dossier, p. 26.

[37] According to Shapira's account to Guthe, Bedouins of the East Jordanian tribes were forced by the Wali of Damascus to recognize Turkish rule which they hated. So they escaped to a cave, supposed to be between Aroer and Wadi-l-Moujib. There they found a black bundle next to a pile of old linen. (*op. cit.*, p. 5)

[38] These three excerpts are from the Dossier, p.1.

[39] From a letter from Shapira, Dossier, p. 2.

[40] *Op. cit.*, p. 2.

C. The Role of the German Scholars.

In a memorandum addressed to Ginsburg,[41] Shapira stated that upon receipt of the Manuscripts in 1878, he had made copies[42] and had sent them to Konstantine Schlottmann.[43] Shapira went on to say:

> Schlottmann wrote that they were fabrications and blamed me for calling them a sacred text...and wrote in similar terms to the (German) consul at Jerusalem, Baron von Muenchausen, and desired him to prevent me from making the find public.

Shapira placed the fragments in a Jerusalem bank upon receiving Schlottmann's opinion. However, he soon began to consider the German's case more critically. He stated:

> I began to reconsider Schlottmann's objections and found that they were partly grounded on mistakes I had made in deciphering the writing. I felt better able to judge them myself because I had had more experience in manuscripts. It was before Easter of the present year that I re-examined them, and deciphered them a second time. Professor Schroeder, Consul in Beyrout, saw them in the middle of May, 1883, and pronounced them genuine.[44] He wanted to purchase them. I took the writings to Leipzig at the end of July to have them photographed. Professors there saw them. Professor Guthe, who intends

---

[41] Dated August 7, 1883, and reprinted in the Athenaeum and Academy, both of August 11, 1883, pp. 179 and 99, respectively. It is also reproduced by Rabinowicz in the JQR, op. cit., p. 174.

[42] This may account for the observation made by his daughter (pseudonym Myriam Harry) in her book, La Petite Fille de Jerusalem, Paris, 1914: "Son père copiait ces lettres vingt fois, cent fois....cherchant de nouvelles combinaisons; et, chaque fois qu'il établissait un mot ou complétait une phrase, il exprimait sa joie." p. 31. Gottstein in the space of one page, JJS, op. cit., p. 189, makes several contradictory observations: (a) "It cannot be maintained with certainty that Shapira was involved in the forgery himself." (b) "That he /Shapira/ was versed in the art of skillfully writing Paleo-Hebrew letters is beyond doubt." (c) "It is possible that his desire to prove his learning...drove him to being involved in the forgery, which by the way, could not be accomplished by one person." Again, Gottstein (ibid.) describes Shapira's daughter as a person who "idealized her father"; in the same breath, Gottstein uses the French quotation to prove that Shapira was training himself for the forgery. The general view expressed by most of the contemporary writers was that Shapira himself was not the forger.

[43] A theologian and Professor of Old Testament at Halle.

[44] According to Shapira's account to Guthe, Dr. Schroeder, the German consul in Jerusalem, inspected the leather strips in May 1883, and had no doubt concerning their genuineness. Guthe adds, "It is undoubtedly certain that Schroeder had seen the manuscripts in Jerusalem and is inclined to consider them genuine. (op. cit., p. 7)

> to write about them, believes in them. The manuscripts have been smeared with asphalt originally as a kind of embalment. They became subsequently further darkened by the use of oil and spirit. The oil was used by the Arabs to counteract their brittleness, and to prevent their suffering from wet.[45]

According to Rabinowicz,[46] Guthe finished his investigation on July 6[47]; four days later Shapira appeared in Berlin and offered the fragments for sale to the Royal Library. One would expect that Guthe would have warned the Royal Library and later the British Museum about the forgery but nothing was heard from him. Moreover, Richard Lepsius, keeper of the Royal Library, decided to accept the offer. The Times correspondent in Berlin reported to his paper[48] that Lepsius

> ...at once convened a Committee of the most learned of his colleagues to examine into their /the fragments'/ nature and value. This committee consisted of Professor (August) Dillmann, of the Hebrew Chair; Professor (Eduard) Sachau, the distinguished Orientalist; Professor (Adolf) Ermann, another scholar (prominent Orientalist); and Dr. (Moritz) Steinschneider, who in the years between 1852 and 1860 compiled the valuable catalogue of Hebrew books, etc. in the Bodleian Library at Oxford. ...The Committee met at the house of its convener, Professor Lepsius, on the 10th July last; while Mr. Shapira, of Jerusalem, was waiting in expectant trepidation in an adjoining room, spent exactly one hour and a half in a close and critical investigation into the character of the goatskin wares. At the end of the sitting they unanimously pronounced the alleged codex to be a clever and impudent forgery. There was some thought of calling in a chemist to look at the matter from his particular point of view; but so satisfied were the Committee with the general internal evidence against the presumption of the antiquity of more than

---

[45] Memorandum from Shapira to Ginsburg, op. cit.

[46] JQR, op. cit., p. 178.

[47] The result of Hermann Guthe's work appeared in Leipzig in September 1883, under the title Fragmente einer Lederhandschrift enthaltend Moses letzte Rede an die Kinder Israel. Rabinowicz, in JQR, p. 175, gives an incorrect description of Guthe's work when he writes: "This booklet contains almost 100 pages--4 for the Introduction and 94 for the text--reproduces the entire wording of the Shapira fragments in one column--There are also some facsimiles of the MSS. at the end of the book...." A more accurate description will read as follows: "This booklet contains 94 pages--2 for the Introduction, 40 for the text, and 52 pages are devoted to description and discussion of the MSS. and the texts. There are no facsimiles at all of the MSS. and the book has only one page containing a table of the forms of the Phoenician alphabet." Moreover, the text in Guthe's book does not cover all the Shapira fragments.

[48] On August 28, 1883. It is worthy to note that although the correspondent reported on events which took place on July 10th, his dispatch was published in the Times only after Clermont-Ganneau's conclusion against the authenticity of the document. The Times in the meantime published Ginsburg's transcriptions and translations of almost two-thirds of the text.

2000 years claimed for the strips, that they deemed it unnecessary to call for further proof.[49]

Rabinowicz claims that the German scholars knew that the scroll was a hoax. If so, why did they not warn their British colleagues? Surely they knew what was going on in the British Museum.[50] In the strong words of the Athanaeum:[51] "If the professors detected the forgery why should they have offered to buy the fragments? And while they read in German and English newspapers the sensational news from London, why did they keep quiet? Not a word of warning to the British Museum!" The article also doubted that Dr. Lepsius, "with the limited opportunity he had of examining them, came to a decided opinion about them." Nonetheless, the German savants did not share their knowledge with the English scholars. One naive excuse advanced was that these learned gentlemen were on vacation.[52] Why did all the German scholars--some of whom wanted, nevertheless, to purchase the document[53]--wait until Clermont-Ganneau had made his decision and only then join the band-wagon?

---

[49] It is interesting to note that the London Editors of the Times pointed out that, not withstanding their verdicts, the Berlin scholars were willing to acquire those fragments at a price Shapira could not accept. Rabinowicz in JQR (see note 22) remarks, "This made him [Shapira] think that the MSS. might after all have been genuine, for why should scholars be willing to purchase forgeries?" and that he therefore brought them to London to try his luck with the British Museum.

[50] Professor Albert Socin of Tuebingen also confirmed, but a year later, (in Zeitschrift des deutschen Palaestina-Vereins, Leipzig, 1884, pp. 240-241,) that a whole committee of important scholars in Berlin recognized the forgery immediately, long before it created such a stir in England.

[51] September 1, 1883, p. 275.

[52] A. Neubauer, The Athenaeum, September 8, 1883.

[53] The Times, which had reported the Shapira controversy in a thorough and objective manner, often consulting experts on the subject, apparently instructed its correspondent in Berlin to look into the authenticity of the offer by the Berlin scholars to buy the fragments from Shapira. This was confirmed in the Times of August 28, 1883. The ingenious reason given for the purchase was to enable the German professors to study and exhibit to their students "an example of what could really be done in the way of literary fabrication." (ibid.) Rabinowicz, in JQR, XLVII, 1956, p. 178, conveniently confuses the events chronologically without giving sources or documentations and naively concludes triumphantly, "One of the most striking facts

(Continued next page, please.)

D. Shapira's Offer of the MSS. for One Million Pounds Sterling Not Rejected.

Shapira offered his Deuteronomy scroll for sale to the British Museum authorities asking one million pounds for it. The fact is that the offer was not turned down even after several days of examination of the document, not only by Ginsburg but also by a group of experts who met at the office of the Palestine Exploration Fund for the sole purpose of inspecting the scroll.[54] Moreover, a number of fragments were put on display, and on August 13, Mr. Gladstone, the British Prime Minister, paid a special visit to look at them. One of the London newspapers[55] reporting the Prime Minister's visit to the British Museum remarked that he was seen "chatting" with both Shapira and Ginsburg and that he had expressed an astonishment at the close similarity of the Manuscripts to the Moabite and the Siloam stones. The paper went on to say:

> The battle which is now waxing hot among Orientalists will be the renewal of the old war of the Moabite stone. The question is partly one of paleography. Obsolete words and words regarded as late Hebrew appear. Among those who hold that the Manuscript is genuine, the divergency of opinion as to the date is very great. Some 8th century, some the time of captivity, while a third party places it to be the Maccabean period.

Had the British Museum scholars been convinced that Shapira's documents were a forgery, they would have neither displayed them to the public nor troubled the Prime Minister to come and inspect them.

---

[53] (cont) with regard to the finality of the finding that the fragments were a forgery is that the scholars in Germany and England arrived at their conclusions independently." Just that, German scholars who knew about the forgery several weeks before their British colleagues kept silent about it.

[54] In his autobiography, Sir Walter Besant, one of the persons present at this meeting, comments that the MS. was examined "amid such excitement as is very seldom exhibited by scholars." Besant also mentions that one of the learned gentlemen, a professor of Hebrew "...exclaimed with conviction, 'This is one of the few things which couldn't be a forgery and a fraud.'" Sir Walter Besant. The Autobiography of Sir Walter Besant. New York: Dodd, Mead, and Co., 1902, pp. 161-162.

[55] The London Standard, August 14, 1883.

E. Ginsburg's Reluctance to Reach a Decision.

For almost three weeks Ginsburg, the expert on behalf of the British Museum, had been publishing transcriptions and translations from Shapira's Deuteronomy.[56] Almost three-fourths of the entire text with translation was published in the London Times during the period. Had he thought the whole thing was a forgery, what was the purpose of publishing the texts? It took Clermont-Ganneau only a few moments (sic!) to reach his sensational conclusion that the document was a forgery.

Two weeks after the arrival of the Manuscript in the British Museum we read:

> Dr. Ginsburg is still busily engaged at the British Museum in deciphering Mr. Shapira's latest antiquarian find; and the reticence Dr. Ginsburg displays leads many to put faith in the original assertion that these scraps of leather are hundreds of years older than the Christian era. It is argued by these believers that, if the skins had been forgeries, such an acute scholar as Dr. Ginsburg would have been able long before this to have detected the fraud.[57]

---

[56] Ginsburg's translations appeared in the London Times of August 10, 17, and 22; and in the Athenaeum for August 11, 18, and 25. Many other newspapers copied the translations for the enlightenment of their own readers.

[57] Report to the Liverpool Daily Post, August 16, 1883, from its correspondent in London.

F. The coup de grace.

The coup de grace in the external evidence was dealt primarily by Clermont-Ganneau[58] and was repeated in Ginsburg's first report[59] to Bond: "The narrow slips of leather on which /Shapira's text/ is written are cut off from the margin of Synagogue scrolls."

Clermont-Ganneau, in his devastating conclusion, admitted that he had entertained in advance most serious doubts as to the authenticity of the documents.[60] His decision was reached only after a glance at two[61] or three fragments, grudgingly permitted by Ginsburg,[62] and only for a few minutes.[63] Clermont-Ganneau added that he could easily forge another scroll which "would make a fitting sequel to the Deuteronomy of Mr. Shapira," adding sarcastically that his "would have the slight advantage over it of not costing quite a million sterling." Clermont-Ganneau's supercili-

---

[58]The Times, August 21, 1883.

[59]Dated August 22, 1883, and published in the Times August 27, 1883.

[60]Upon his arrival in London, Clermont-Ganneau, in his letter to the Times, published on August 15, writes: "I will not conceal the fact that I entertained in advance serious doubts as to their authenticity."

[61]The painstaking scholar Guthe (op. cit., p. 2) tells us that when Shapira came to see him in Leipzig in June 1883 with a view to examining the document, he (Guthe) told him that no conscientious scholar could reach a conclusion until he had "acquired a perfect knowledge of the entire manuscript...and this is a labour which would take weeks or even months." It took Clermont-Ganneau only a "few moments," Neubauer--less than a week (even without seeing the document), and Ginsburg about twenty days, to brand the document as a forgery.

[62]All accounts indicate that there was no love lost between these two scholars.

[63]Clermont-Ganneau writes, "I set to work with the meagre means of information at my disposal: (1) The hasty inspection of two or three pieces which M. Ginsburg had allowed me to handle for a few minutes on my first visit; (2) the examination of two fragments exposed to public view in a glass case in the manuscript department of the British Museum, a case very ill-lighted and difficult of approach, owing to the crowd of the curious pressing round these venerable relics." (Times, August 21, 1883.)

ous attitude was met with hostility by some of the British press,[64] and apparently the Daily News was not prepared to accept Clermont-Ganneau's conclusion at face value. The newspaper sent its own unnamed expert to examine and report on the scholar's conclusion. His verdict reported in the Daily News[65] stated:

> ...the portion of the Deuteronomy manuscript examined by the present writer was written on leather of a thicker character, differing very considerably from that usually employed in synagogue-rolls. Moreover, it is questionable whether on a purely speculative business it would have been worth while to mutilate and spoil a valuable roll. M. Clermont-Ganneau's evidence is also vitiated by the strong prejudice which he confesses he had previously entertained.

---

[64] Nearly every London newspaper took the chance to attack the French scholar, often with no attempt at subtlety. The Echo (August 23, 1883) commented that "...the flippant offer of a French archaeologist to provide us with an entire Pentateuch of similar apparent antiquity is about equal in value to Dr. Lardner's promise that he would swallow the first steamship that succeeded in traversing the Atlantic." The Manchester Guardian (September 6, 1883) remarked that Ganneau had "shown the hand of the critic a little too soon for British notions of fair play." When a controversy arose regarding the original discoverer of the forgery the press leaped to the defense of Ginsburg and accused Clermont-Ganneau of bad faith and falsification. The Daily News (August 27, 1883) commented caustically on the Frenchmen "whose special function it is to discredit Mr. Shapira's antiquities...." By the end of October, however, Ganneau was being pitied, and the Nation (October 25, 1883) reassuringly published its view that the persecution of Ganneau resulted from a failure on the part of Ginsburg and that "English newspapers...endeavored to disentangle /Ginsburg/ by accusing the Frenchman of acting from a preconceived notion and anti-Biblical prejudices, of haste in forming his decision and greater haste in making it known, of making use in his discovery of the fraud previous hints by Dr. Ginsburg, etc...."

[65] August 22, 1883.

G. The Whereabouts of Shapira's Document.

In an article to the Jewish Chronicle on the subject,[66] the present writer remarked, "The scroll may be lying in some repository of the British Museum[67] which, however, denies possession;[68] may have been thrown out long ago, or may have been returned to the Shapira family."

In this connection it was stated[69] that in July, 1884, Shapira's widow wrote to the Museum inquiring about the documents of her late husband.[70] The present writer also remarked that there was no indication in the dossier of a reply having been sent or of the fate of the documents.

Both Gottstein[71] and Rabinowicz[72] have attempted to exploit this remark. Gottstein, with baffling over-confidence and sarcasm[73] claims, "Mansoor seems to have overlooked some pertinent facts when he states that a reply was sent to Shapira's

---

[66] M. Mansoor, "Shapira's Dead Sea Scroll." December 28, 1956, p. 13.

[67] This claim was first advanced by Theodor Meysels in the Jerusalem Post, November 20, 1953.

[68] This writer wishes to put on record that the British Museum authorities have done everything possible to extend the facilities of the Museum to him, including the making of several photographs and a microfilm of the entire dossier. He has never doubted the statement by the British Museum that they believed the Shapira document was returned. This writer only stated that he could find no written record in the dossier to this effect.

[69] M. Mansoor, loc. cit.

[70] The relevant evidence is in folio 25 of the British Museum dossier (Add. 41294) dated July 7, 1884: "Dear Dr. Ginsburg: Mrs. Shapira in a letter just received asks to have sent to her a letter of recommendation of her late husband from Lepsius and a similar one written by myself which she states are in your hands.... She inquires after the Deuteronomy fragments and says she found two small pieces among her husband's papers and sent them to Professor Schlottmann./ Signed E.A. Bond."

[71] JC, op. cit., pp. 14-15.

[72] JC, August 16, op. cit.

[73] "We can answer with absolute certainty," "beyond any doubt," "there is no doubt whatsoever," "every scholar can rest assured and sleep soundly at night," "it is an obvious fake," to quote only a few (JC, op. cit.) Gottstein's article a few months later in the JJS (op. cit.) is moderate in tone. (See also note 80 below.)

widow. In fact, we find a note to the effect that she afterwards submitted the material to the German scholar, Schlottmann, for further study."[74] In view of the document quoted above,[75] Gottstein's statement is clearly misleading, all the more so since he does not refer to the sources. All the letter states is that "two small fragments"[76] were sent to Schlottmann. Surely Mr. Bond, the Curator of the British Museum, would not have written such a letter to Ginsburg had the MSS. been returned by that time. In view of the one million pound sterling demanded by Shapira, this fact could not have escaped his mind. Furthermore, the "further study" by Schlottmann, mentioned in Gottstein's statement above is pure conjecture. There is nothing to support it. Building up his conjecture, Gottstein, referring to Schlottmann, remarks[77] that he "had already played a doubtful part in inducing the Berlin Museum to buy [through Shapira] the well-known 'Moabite pottery fakes,' and Shapira had got in touch with him before he came to England." Gottstein's implication is clear: Schlottmann was perhaps the first scholar, as early as 1878, (i.e. five years before Shapira came to London) to denounce the document as "obvious forgeries, because they contradicted the Bible."[78] Shapira himself, in a memorandum addressed to Ginsburg[79] writes, "Schlottmann wrote that they were fabrications and blamed me for calling them a sacred text."

---

[74] JC, loc. cit.

[75] British Museum Dossier, fol. 25, Add. 41294.

[76] Shapira brought only fifteen strips to the British Museum. (Times, August 3, 1883; Athenaeum, August 4, 1883.) According to Guthe (see note 40) Shapira had at least sixteen strips. This explains the fact that Mrs. Shapira found two fragments among her husband's papers after he had committed suicide. Gottstein's arguments in the JC (op. cit.) and in the JJS (op. cit., p. 191 n. 19) are far from convincing, whereas Rabinowicz's statement on this subject (JC, August 16, 1957) is irrelevant in the light of Guthe's evidence. (For the entire contents of the strips, see note 183.)

[77] JC, loc. cit.

[78] Letter from Shapira to Dr. Strack, May 9, 1883. British Museum Dossier, fol. 2.

[79] August 7, 1883. Published in the Academy, August 11, 1883, pp. 99-100; The Athenaeum, August 11, 1883, p. 179.

Having built up his conjecture, Gottstein concludes "with absolute certainty" that "there is no doubt whatsoever that in 1884 the British Museum returned the Scroll."[80] Here too Gottstein's conclusion is fully endorsed by Rabinowicz.[81]

Let the following facts speak for themselves: (a) Mr. Bond's letter (dated July 1884) to Ginsburg inquiring about the documents.[82] (b) Shapira left London in ignominy in September 1883 obviously without the MSS. In Clermont-Ganneau's book[83] we read that a re-examination of the documents[84] by a number of scholars, including Clermont-Ganneau himself, took place at the British Museum in January, 1884. (c) Finally, the most relevant evidence in this connection is the following excerpt from A.R.C. Carter's book:[85]

> After the exposure he (Shapira) wrote a piteous letter of regret for the trouble and unrest which he had caused, and he thankfully accepted a few pounds from the British Museum for his once "priceless" manuscript to be kept as a warning to others. With this small sum he went to Amsterdam and died by his own hand in an obscure inn.

This last evidence certainly supports the evidence given in (a) and (b) above.[86]

---

[80] It is perhaps relevant to state that despite his initial overconfidence Gottstein had not a word to say about the whereabouts of the MSS. in his subsequent JJS article (op. cit.).

[81] JC, August 16, 1957.

[82] See above, note 53.

[83] Les Fraudes archaeologiques en Palestine, Paris, 1885, pp. 254 ff.

[84] Obviously Clermont-Ganneau by re-examining the documents at the British Museum in 1884 indicated that he was not certain that his condemnation of the documents was "indisputable" as he had thought six months earlier.

[85] A.R.C. Carter, Let Me Tell You. London: Hutchinson and Co. Ltd., 1940. A whole chapter, pp. 216-19, is devoted to the Shapira case. Mr. Carter, who is happily still with us, was born in 1864, so he was about twenty years old when the Shapira "indident" took place. Since 1894 he has been editor of the Year's Art and a regular contributor to the Daily Telegraph on art and literature.

[86] In a private communication from Dr. Cecil Roth, of Oxford (dated June, 1957), it is stated that fragments from Shapira's Deuteronomy were exhibited in London by the Quaritch firm. It is referred to as "Item 2091 in the Catalogue of the Anglo-Jewish Historical Exhibition, Royal Albert Hall, London, 188." Further inquiries in this direction have failed to produce further results as to the whereabouts of the document.

H. Character of the Script.

A significant feature of the investigation was the fact that no objection or suspicion about the script itself was voiced against the document by the scholars of 1883; especially by those who had examined the original strips. On the contrary it seems that both Ginsburg and Guthe were favourably impressed by it. Ginsburg himself stated:[87]

> The writing of the Shapira MSS. seems not to be a picked alphabet, but current, and this is in favour of the genuineness of the document. It is pretty clear that, whatever the age of the leather, the writing must either date from somewhere about 600 B.C. or from A.D. 1880.

The Standard[88] said:

> Among those who hold that the MSS. are genuine...some incline...to the period of Captivity, while a third party places the documents as late as the Maccabees.

This view was given support in the Saturday Review which was able to report[89] that "the latest estimate is that they are of the Maccabean period."

Gottstein's Inaccurate Argument on Paleography.

Gottstein's main contention[90] is that the forger "imitated Paleo-Hebrew monumental letters, i.e. letters used on inscriptions (or coins). Neither he nor any scholar in the 1880's could know--and this decisive fact seems to have escaped Mansoor's notice--that a written Paleo-Hebrew document exhibits altogether different characteristics."

Perhaps Gottstein should be referred here to a statement on the subject by an authority. W.F. Albright's classical work[91] contains an important statement which clearly refutes Gottstein's. The statement reads, "Palestine itself has yielded a

---

[87] Athenaeum, August 4, 1883.

[88] August 14, 1883.

[89] August 18, 1883.

[90] JJS, op. cit., p. 189.

[91] The Archaeology of Palestine. Penguin edition, p. 221.

number of Aramaic ostraces from Samaria, Tell Far'ah, and elsewhere, written in exactly the script and language of Jewish papyri and ostraces of the fifth century B.C. which have been found in Egypt."

While the above observation speaks for itself, archaeological finds also contradict Gottstein's statement.

Yohanan Aharoni, who headed the 1955 expedition to Massada, conducted under the auspices of the Hebrew University, the Israel Department of Antiquities, and the Israel Exploration Society, reported[92] among other things that "two Hebrew inscriptions were found...inscribed in black ink on a potsherd and on a fragment of papyrus...written in the square script found on the Dead Sea Scrolls."

Elsewhere in the Jewish Chronicle[93] Gottstein categorically declares that the manuscript is "an obvious fake" on paleographical data. Here again Gottstein should be reminded of W.F. Albright's general observation[94] that "The paleographic criteria are insufficient to establish their dating beyond doubt."

It should be borne in mind that the character of the script in Shapira's document is not exactly that of the Mesha or Siloam inscriptions, as is generally assumed. After spending several months studying the texts Guthe pointed out[95] that at least seven Hebrew letters ב , ד , ו , ז , כ , צ , ק are different from those in the Mesha inscription while four others (מ , נ , פ , ת) display a minor deviation. Moreover, Guthe found at least three letters (כ , מ , נ) with a "consistent difference" from the Siloam inscription.[96]

---

[92] As reported in Israel Digest, April 20, 1956.

[93] op. cit., April 19, 1957, p. 15.

[94] op. cit., p. 221.

[95] op. cit., p. 65.

[96] ibid.

It is also significant that Guthe remarks[97] that "the symbols collected from Hebrew seals and coins yield the most numerous and closest similarities. The forms for the Hebrew letters א , ב , ג , ד , ה are found most faithfully on Hebrew coins, whereas the letters ו , ז , ח , ט offer the best parallel with those on old Hebrew seals." Another revealing observation by Guthe[98] is that Shapira's script contains three letters ע , כ , ף in entirely new form. Hence, Guthe[99] (who nevertheless condemned the document as a forgery on internal evidence) observes, "the writing therefore does not lack certain features which become especially appealing only after prolonged occupation with the manuscript."

Perhaps it is appropriate to finish this section on the character of the script with Guthe's own conclusion:

> In spite of the differences mentioned,...the impression of uniformity predominates so much that I am now able to write the same symbols with an oriental reed pen on leather without effort /or/ hesitation....In this experiment I was surprised to observe that the sharp corners and the pointed angles of the letters can be produced without any difficulty on a piece of leather which has been smoothed for writing. This characteristic is apt to arouse a prejudice in favor of the manuscript.
>
> As I have reported in my "Ausgrabungen bei Jerusalem"[100] I am in possession of several reproductions of really forged or still to be forged inscriptions which inhabitants of Jerusalem showed me. Their letters however were with few exceptions so faulty and strange that a rewriting from memory would have been impossible. With those common forgeries this manuscript has doubtless nothing to do. Compared to those the manuscript makes a so-to-speak distinguished impression.

A full facsimile of the alphabet is given in Guthe's work.[101]

---

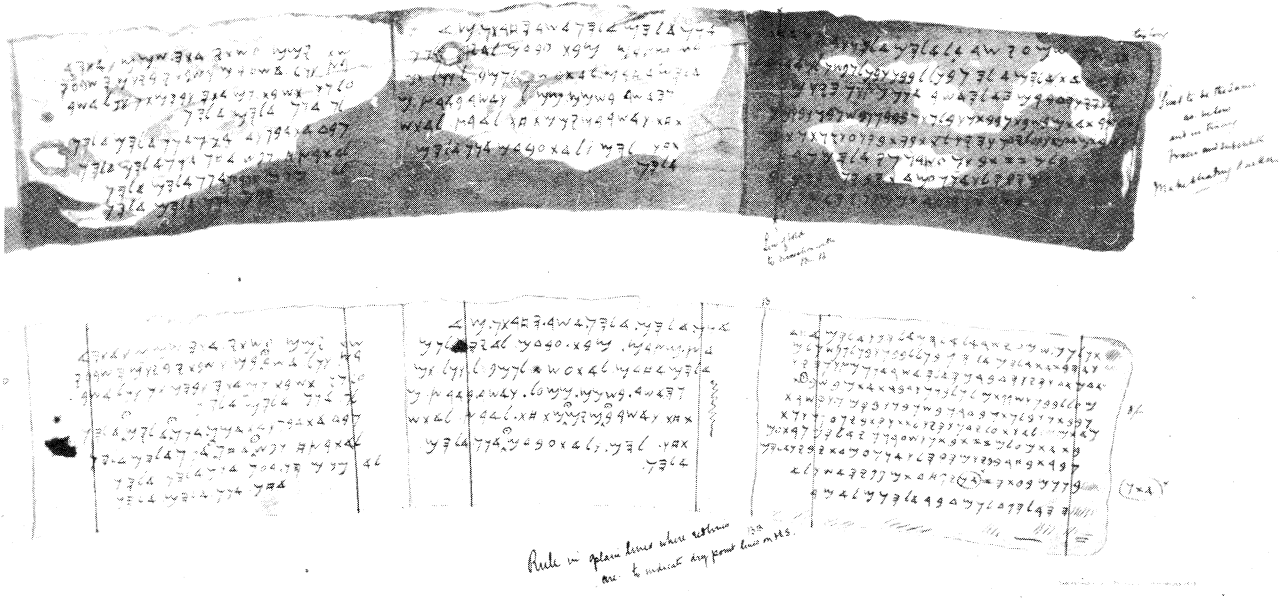
[97] *op. cit.*, p. 66.

[98] *ibid.*

[99] *ibid.*, p. 62.

[100] The separate edition, Leipzig, 1883. p. 174.

[101] *op. cit.*, p. 94.



The upper section is a photographic reproduction from the Shapira Scroll; the middle and left columns are portions of the Decalogue. The lower section is a facsimile of the upper part. (From British Museum dossier, Add. No. 41294, by courtesy of the British Museum.)

I. The Internal Evidence.

It is most significant that both Neubauer and Ginsburg became convinced that the manuscripts were a forgery, not on the basis of external evidence but mainly on internal evidence.[102] Again, Rabinowicz states,[103] "But it was on internal evidence that Professor Guthe came to the conclusion that the fragments were a forgery." He further points out[104] that the Rev. Albert Lowy[105] was "one of the first in England to repudiate the genuineness" of the document and that "it was the voice of Professor Neubauer and his extensive analysis in the Academy[106] that sounded the death knell for the Shapira fragments." This statement, therefore, constitutes the argument par excellence of Rabinowicz.

---

[102]Rabinowicz, JQR, op. cit., p. 173: "Certainly, these external findings were important, but it was on the internal evidence that the Shapira fragments were finally proclaimed a forgery without any shred of doubt." See also Ginsburg's enumeration of his conclusions based on internal evidence, in his report to Bond of the British Museum, dated August 21, 1883. Again, in the Academy, September 8, 1883, pp. 161-62, we read that Guthe's condemnation of the forgery is based upon internal evidence.

[103]JQR, op. cit., p. 176.

[104]Rabinowicz, JQR, op. cit., p. 179.

[105]The entire statement relating to Rev. A. Lowy, to whom Rabinowicz refers, is found in The Proceedings of the Society of Biblical Archaeology, November, 1883. Vol. VI, Fourteenth Session. (Published at the Offices of the Society, Bloomsbury, W.C., 1884, p. 5.) The report given in the proceedings is typical of the unscholarly treatment of the subject. For the sake of reference it is reproduced here in full: "The Rev. A. Lowy, at the request of the President, made some remarks on the well-known forgeries called the Shapira MS. He stated that in the month of August, when he saw the reproduction in the Athenaeum of some portions of the alleged ancient text, he had no hesitation in mentioning before a large audience that a most daring fraud had been committed by some unscrupulous speculators. The forger had eliminated from the text nearly all the vavs and yods which serve as matres lectionis, in order to bring his work in harmony with the ancient Phoenician inscriptions. But he had forgotten to be consistent. For example, Sihon was written with a yod after the samech. The interpolations were suggested by the Samaritan system of garbling the text of the Pentateuch. The innovations introduced by the forger were ridiculous." As an example Mr. Lowy observed that it could be noticed that the forger, in his search after the sensational, had parodied some of the verses in Deuteronomy, ch. xxvii, where curses are pronounced upon the commission of such and such a sin. The forger had introduced new benedictions by the insertion of phrases in which it is said, "Blessed is he who shall not [commit such and such a sin]". The interpolations were in many instances specimens of bad Hebrew and bad logic, and in all instances specimens of bad faith. It is significant to note that the Rev. Lowy "definitely proved" that the Mesha Stone was also a forgery! (A. Lowy, "The Apocryphal Character of the Moabite Stone." Scottish Review IX, April 1887, pp. 215-245.

[106]August 18, 1883, p. 116. Neubauer's views were also published in the Academy, August 25 and September 8, 1883.

The absurdity of the whole argument is that Neubauer's articles are far from extensive and are written for the layman. The articles are undocumented. Rabinowicz in his articles[107] has simply reproduced the arguments, incorrectly in some instances.[108]

This writer has been conducting research for over a year on all the available material published in the contemporary newspapers and periodicals.[109] An attempt will be made to quote, where possible, not only the arguments advanced by Ginsburg, Neubauer, and Guthe against the authenticity of the document, but also those recently advanced by Gottstein and Rabinowicz, and to analyze them in the light of our knowledge today. The writer leaves it to the reader to reach his own unbiased conclusion.

---

[107] op. cit., p. 174. See also, Jewish Chronicle, August 9, 16, 1957.

[108] For such errors, see notes 110, 111, 121, 124, 128, 129, 131, 132, 142, and 148.

[109] Over 70 books, articles, and reports relating to the Shapira document have been consulted. A copy of the relevant bibliography is available on request.

J. Main Arguments Advanced Against the Document.

(1) "...we are struck by the verb החרתך , 'I liberate thee.' The usual verbs employed for liberating from Egypt and from the house of bondage in the historical as well as in the prophetical books of the Bible are either יצא in the Hiphil form (as the received text has it here) or פדה . The roots חרר or חור [110] are not used as verbs in the Old Testament, but only in the Targum and in the Talmud, and then not in the Hiphil form[111] or with the particle מן ."[112]

While the statement is correct, the argument is not valid. We find derivatives of these roots: חרים hŏrîm "free born, nobles" at least ten times in the Old Testament.[113] Moreover the root is used in Aramaic in Aphel: אחרר נה "I shall liberate her."[114]

Neubauer's argument is rather dubious. Can one say that the Siloam inscription of the seventh century B.C. is a fake because the word נקבה "hole" (from the Biblical root נקב) is not found as a noun in the Old Testament? Again, the word תכמים "bowels," "inward part," "midst," is found at least four times in the Qumran writings[115] but not in any other Hebrew text. Can we reasonably condemn the Qumran writings because תכם or its derivative is not found in the Old Testament or elsewhere in Hebrew literature?[116]

---

[110] Erroneously, Rabinowicz writes that the root is חרה which is impossible here. See JC, op. cit., August 16, 1957.

[111] Rabinowicz, loc. cit., following Neubauer, asserts that this verb is not used in Aramaic in Aphel form. This is incorrect. It is found at least once in Targum Y. to Gen. 16:2 (See M. Jastrow's Dictionary s.l.).

[112] Neubauer, loc. cit. (see note 106 above.)

[113] I Kings 21:8,11; Isa. 34:12; Eccl. 10:17; twice in Jer. and seven times in Neh. (see S. Mandelkern's Concordance s.l.).

[114] Targum Y. to Gen. 16:3. The verb was quite common in the Targum, Midrash, and Talmud. Also found as Hebrew inscription in coins שב לחר ישראל "second year to the liberation of Israel." Cf. S. Zeitlin, The Dead Sea Scrolls and Modern Scholarship., p. 45.

[115] IQS iv. 20; IQH xxxix. 28; xli. 4; and Qumran Cave I 36.14.2.

[116] For a comprehensive discussion of the word branded a scribal error by several scholars see M. Mansoor, "Studies in Hodayot-IV" JBL, lxxvi; 2, 1957, pp. 147-8, and Y. Yadin. JBL (1955), pp. 40-43.

(2) "In the Second Commandment the document reads ושבתי for ואשבת."[117] Neubauer rightly argues that the form is ungrammatical. That an expression in a text is ungrammatical, cannot be brought as evidence against the authenticity of the document. We all are aware of the numerous ungrammatical expressions in the Old Testament and the Qumran texts.

(3) It is further argued by Neubauer that "the root שבת does not mean 'to rest' but 'to cease from work,' and in this sense only it is found in the Old Testament."[118] He adds that the verb נוח should have been used. This is a pointless argument. The text used in the document reads: ושבתי ביום השבעי על כן תשבת גם אתה ובהמתך The verb שבת in this sense is used regularly in the Old Testament. Cf. שבת מכל מלאכתו Gen. 2:3; וביום השביעי תשבת Exod. 23:12;34:21 and several other instances.[119] Neubauer concludes that the "forger made a blunder in not leaving the root נוח as in the received text."[120]

(4) Shapira's document is also condemned by Neubauer because "the word ought to be repeated according to Classical Hebrew: Exod. 17:31 [and] 32 and elsewhere." This is a surprising statement on the part of Neubauer, whose argument is repeated and supported by Rabinowicz[121] who, in turn, did not check the validity of such a statement. He asserts that the text should have read גם אתה וגם בהמתך and hence the charge that Shapira's Hebrew is "unclassical" and "ungrammatical." While it is correct to say that the repetition of גם is required in accordance with Biblical usage, its absence surely cannot constitute a proof against the relevant

---

[117] Neubauer, loc. cit.

[118] Ibid.

[119] See also Gen. 2:2; Exod. 16:30; Lev. 26:34,35.

[120] Neubauer, loc. cit.

[121] "The Shapira Scroll," Jewish Chronicle, August 16, 1957, p. 13. "In classical Hebrew one would expect a repetition of גם in this commandment instead of גם אתה ובהמתך."

text. A mere glance in the Concordance would have sufficed. There are numerous passages in the Old Testament[122] where גם is not repeated, e.g. Exod. 34:3 גם הצאן והבקר Est. 4:16 גם אני ונערותי and Eccl. 8:16 כי גם בימם .

ובלילה (5) Shapira's text in the fourth Commandment reads לא תרצח נפש אחך .

Now, Neubauer argues, "Here a clumsy use has been made of the Chaldean paraphrase."[123] This writer sincerely fails to see his point. In the words of Rabinowicz, Neubauer's proponent, in the JQR[124], "...the word נפש in the Fourth is used in a way utterly unparalleled in Biblical usage." As is the case in all the short Commandments, the compiler of Shapira's text paraphrased this Commandment too. This writer does not accept Neubauer's verdict as to the "utterly unparalleled in Biblical usage." We find ורצחו נפש in Deut. 22:26, and בנפש אחיו אשר הרג in II Sam. 14:7. The latter is certainly in accordance with Biblical usage and can be favourably compared with Shapira's text. The use of the preposition ב in Samuel should not raise any insurmountable difficulty, for the irregularities in the use of prepositions in the Old Testament is not uncommon. The same can be said in respect to the Qumran texts.

Yet, Rabinowicz in his JC articles[125] surprisingly declares, "It was this phrase which convinced a group of scholars in Berlin at first glance that they had

---

[122] See also Deut. 28:61; II Kings 17:41, et. al.

[123] Neubauer, loc. cit.

[124] op. cit., p. 179, and in the Jewish Chronicle, op. cit. Here too, Rabinowicz has not checked his sources when he reproduced the text in the JC. Had he checked the facsimile in the British Museum dossier, he would have observed that Shapira's text contains neither את nor י in נפש . (A reproduction of part of the Decalogue is published in the Journal of Jewish Studies, VII, 1956, p. 187, where this writer's statement may be readily verified.)

[125] JC, op. cit., p. 13.

been presented with a forgery." To authenticate his statement, Rabinowicz relies on a passage published in the Athenaeum[126] by Neubauer: "If I remember rightly, there occurred a passage in there, 'Thou shalt not kill the person of thy brother,' which Professor Dillman and I considered quite sufficient for the recognition of a forgery." Thus, these two eminent scholars condemned the Shapira document as a forgery on this basis. Is this true scholarship?

(6) Neubauer also objects to Shapira's paraphrase of the Fifth Commandment, "Thou shalt not commit adultery with the wife of thy neighbour."[127] He contends that the forger merely copied Lev. 20:10 איש אשר ינאף את אשת רעהו being the same text used by the scribe of Shapira's Deuteronomy.

(7) Shapira's Sixth Commandment reads: לא תגנב הן רעך . Neubauer maintains that " הן is not found in the Pentateuch, the word חיל being employed there instead of it in the sense of 'wealth'." Rabinowicz adds his blessing to this statement by writing in the JQR[128] that " חן (sic!) is equally unbiblical" and refers to Gen. 34:38 and Deut. 8:17. This writer leaves it to the judgement of the readers as to the validity of this point. הון is commonly used in the Bible as "wealth". In this sense it appears three times in Psalms, four times in Ezekiel, once in Song of Songs (הון ביתו), and sixteen times in Proverbs. Can Rabinowicz justify his comment that הון is unbiblical? Yet, this is one of the arguments advanced in 1883 in condemnation of Shapira's text.

(8) Shapira's Seventh Commandment contains the expression לנשא שמי לשקר "to him who taketh My name falsely." Neubauer points out that here the expression לנשא is rabbinical; in Classical Hebrew we would expect לאיש אשר ישא .

---

[126]September 8, 1883, p. 306.

[127]Neubauer, loc. cit.

[128]op. cit., p. 179. By mistake, again, Rabinowicz substitutes חן for הן .

The usage of לנשא is certainly Classical Hebrew. In the Decalogue alone we have several such forms,[129] not to mention the very numerous illustrations in the Old Testament.

(9) The document's Ninth Commandment contains the expression "false testimony" for עד שקר "false witness" in Deut. 5:20. The variant reading שקר for שוא should cause no difficulty, for the parallel version of the Decalogue in Exodus 20:16 also uses שקר, as in Shapira's, and not as the Deuteronomic version. Moreover, seventeen MSS. read שקר in the Deuteronomic version, and not שוא.[130]

Neubauer's main contention, however, is that עדת is rabbinic.[131] This is questionable. First עדות "testimony" is more appropriate here than עד. ("Thou shalt not bear false testimony [rather than 'witness'] against thy neighbour." The word עדות "testimony" is found in this sense at least six times in Psalms.[132] Again, according to Kittel,[133] the Versions render testimonium (עדות?)[134] for the עד in the Decalogue.

---

[129] Cf. Deut. 5:9 לשנאי ; 5:10 לאהבי ולשמרי מצותי . Rabinowicz quotes 5:9 but overlooks 5:10. In his JQR article (loc. cit.) he regards the use of לנשא (l^{e}nōsē) a "grave grammatical error." Rabinowicz transcribes as lenossey. The cannot be doubled here. See also JC, loc. cit.

[130] Cf. Biblia Hebraica, ed. R. Kittel, Stuttgart, 1954, p. 271

[131] Whereas Neubauer was content to say that עדת is Rabbinic, Rabinowicz in his JQR article (op. cit., p. 179) commented that it is "not Biblical Hebrew." After reading my refutation of his assertion in the JC (April 19, 1957, p. 20) he "mitigated" the issue with this statement: "Thus, while the phrase appears nowhere in the Bible, the very phrase is, on the other hand, used for expressing "false testimony" in the Talmud, Succah 29a. It is therefore correct to state that עדת in the Shapira texts is not Biblical but rabbinical." (JC, op. cit., p. 13)

[132] Psalms 78:85; 80:1; 81:6; 119:88; 122:4. In the JC article of April 19, 1957, p. 25, this writer stated: "The word is עדות, meaning 'testimony,' and is more appropriate here than עד. It is found mainly in the later books of the Bible at least six times." When Rabinowicz attempted to refute this statement, he wrote in JC (August 16, 1957) as follows: "For עדות appears seven times (not in the latter books')--the Psalms." This writer used the word "later" and not "latter"; moreover, he stated "at least six times."

[133] Cf. Biblica Hebraica, p. 109.

[134] Cp. Exod. 20:16.

Here, Targum Onkelos, too, renders סהדותא דשקרא for עד שקר, clearly "a false testimony" and not "a false witness," thus in agreement with Shapira's text. All the versions could not have invented a word when the translations were made. This does not imply that Shapira's text is superior or more authentic; on the other hand, this deviation from the Massoretic text cannot be taken as an evidence against the authenticity of the document.

(10) Another argument raised by Neubauer, and blindly reproduced by Rabinowicz in the JQR[135] is that "Jehovah is used at the beginning of a document which is elsewhere entirely Elohistic." Gottstein[136] of the Hebrew University leads his readers to believe that the text presented "a pure 'Elohist' document of the Book of Deuteronomy." He, too, at the time of writing had not checked his sources. Shapira's text is not purely Elohist. Neubauer, too, is wrong in making this claim, for the Hebrew tetragrammaton, Yahweh, occurs in the Shapira text at least twice, at the beginning and at the end.[137] However, this 'hoax'[138] was used as one of the evidences against the document.

(11) In his JQR article,[139] in summarizing Neubauer's objections to the authenticity of Shapira's Deuteronomy, Rabinowicz writes, "That the word עיר is written plene contrary to the custom in early inscriptions." This is indeed an important argument against Shapira's document. Now, the word ער "city" appears in the

---

[135] op. cit., p. 179.

[136] The full statement reads: "Indeed, we can only smile when we see how a clever forger intended to hoax Bible critics of the day by producing a pure 'Elohist' document of the Book of Deuteronomy." "The Dead Sea Scrolls and the Shapira Forgery." Jewish Chronicle, February 15, 1957, p. 15.

[137] See Hermann Guthe, op. cit., p. 22... יהוה אל כל בני...and the last verse on p. 62 על פי יהוה . Surely a forger who would embark upon such a task would not have made such serious omissions at the beginning and at the end of the text.

[138] In M. Gottstein's wording.

[139] loc. cit.

document twice in the singular but in each case it has the defective spelling, in conformity with orthography in early inscriptions. Nowhere does it occur with Yod, (עיר), as Neubauer and Rabinowicz first claimed. In the meantime enough damage has been done to discredit the document on this score, too. This careless statement provoked a justified attack on Neubauer by the Daily News[140] which claimed that he had made statements against the Shapira Scroll without ever seeing the documents themselves. This state of confused and careless 'scholarship' is clearly reflected in the fact that Neubauer, in The Academy[141], blames Ginsburg for this error and corrects himself.[142]

---

[140] August 22, 1883; see also the Academy, August 18, 1883. Neubauer here admits that he was convinced the scroll was a forgery before he saw it.

[141] August 25, 1883. Neubauer writes: "I see from the published text of the first two chapters of Deuteronomy, according to the Moabite sheepskins, that ii. 9 has Ar and not ir; why is it, then, translated by city, and not as Ar? City as a conjectural rendering of the last word may be right in an exegetical commentary, but not in a faithful reproduction of a new text. Such a method leads to misunderstanding." Neubauer later calls attention to some of Ginsburg's "other blunders."

[142] Rabinowicz presumably relied on Neubauer who relied on Ginsburg who made the incorrect statement. Rabinowicz reproduces Neubauer's false claim about the plene spelling of עיר as evidence against the document. Nowhere in that article does he refer to the fact that it was subsequently corrected by Neubauer. He does so in his JC article of August 9, 1957, p. 13, only after having read this writer's reply to Gottstein in the JC (April 19, 1957, p. 20). Even here, Rabinowicz declares that nowhere in his article did he regard עיר "city," written plene, with a Yod as the main argument against the genuineness of the Shapira document. "In fact," Rabinowicz continues, "after including it as a part of the statement made by Neubauer and quoted as such in my article, I did not refer to it further at all; for I am aware of the correction made subsequently by Dr. Neubauer on that point." (JC, op. cit., August 9, 1957, p. 13) To begin with, Rabinowicz did not quote but summarized Neubauer's objections but the general picture is quite disturbing. It seems that Rabinowicz quoted Neubauer that עיר was written plene, was aware of the subsequent correction, but he did not subsequently inform his readers about it; yet the plene form was a weighty argument against the authenticity of the document.

(12) Another careless statement, subsequently corrected,[143] was published by Ginsburg[144] to the effect that the combination אלהם אלהך does not occur in the Old Testament and hence, he concluded, its presence in Shapira's text was caused by a forger. In fact, two identical combinations plus two very similar ones are found in Psalms.[145] Despite the corrections, enough prejudice has been spread by these incorrect statements.

(13) Ginsburg, in his report to the Principal Librarian of the British Museum,[146] after having stated that "the compiler of the Hebrew text was a Polish, Russian, or German Jew, or one who had learned Hebrew in the North of Europe," remarks that Jews there[147] pronounce alike the letters ת t and ט ṭ. Ginsburg goes on to state, "This accounts for the otherwise inexplicable spelling in this document of the word rendered 'frontlets' in our Authorized Version." He points out that the word לטטפת "frontlets"[148] in Deut. 6:8 is spelled לתתהת, "thus betraying not only the ignorance of the scribe but also the nationality of the compiler."[149] It

---

[143] This correction has escaped my notice in the reply which was published in the Jewish Chronicle, April 19, 1957. This writer is indebted to Rabinowicz for drawing his attention to this fact. (JC August 9, 1957, p. 13)

[144] The Athenaeum, August 18, 1883, p. 206.

[145] Psalms 45:8 משחך אלהים אלהיך
48:15 כי זה אלהים אלהיך
50:7 אלהים אלהיך אנכי
67:7 יברכנו אלהים אלהינו

[146] Dated August 22, 1883. Published in the Times on August 27, 1883. It is also found in the British Museum dossier.

[147] i.e. in Poland, Russia, or Germany.

[148] JC, August 9, p. 13.

[149] As explained by Rabinowicz, JC, op. cit., p. 13. This is rather a surprising observation by a scholar like Ginsburg who had done a great deal of work on the Massoretic text. (See next paragraph.) Here, Rabinowicz, as in the other instances, quotes the 1883 arguments by Neubauer and Ginsburg against the authenticity of the scroll, yet he shifts the responsibility of the errors which he quoted to these two authors.

is admitted that this is a gross error but certainly in the light of the textual history of the Massoretic Text this is not "inexplicable."

To begin with, one would obviously expect an ignorant scribe from Northern Europe to confuse his "gutturals" more so than the letters ת and ט ; but this is not the case in Shapira's text. Secondly, we find the same "inexplicable spelling" in the Old Testament, in the Qumran texts, and elsewhere. Is Rabinowicz, who endorses Ginsburg and Neubauer's views, prepared to condemn (חלילה!) several books of the Old Testament because of the following "scribal errors," also committed because of the similarity of their phonetic value?

In II Chron. 10:18 we read הדרם for אדרם in the parallel passage of I Kings 12:18; in Jeremiah 52:15 האמון for ההמון as in the parallel passage of II Kings 25:11; in I Chron. 13:12 we read היך for איך in II Sam. 6:9 in the parallel account. The Jewish compilers (of the Massoretic text) who made these errors were certainly not Hungarian Jews who usually confuse the ה and א .

Again in I Sam. 17:7 we find רחץ as ketfb and ורץ as Qerf as read by LXX and Vulgate. An Oriental Jew will normally not confuse his gutturals and surely the Biblical scribe cannot be of Polish or Russian origin. The argument here is that such errors were common.[150] Kennicott[151] refers to their variant readings in the Pentateuch, where ת and ט are confused: cf. Gen. 4:7 M.T. לפתח -Var.K.לפטח ; Exod. 7:4 M.T. בשפטים -Var.K. בשפתים ; Gen. 33:14 M.T. לאטי -Var.K. לאתי.[152]

Again we find that the Samaritan scribes also confused these two letters: Gen. 15:10 M.T. בתרו Sam. Pent. בטרו ; Deut. 12:3 M.T. ונתצתם -Sam. Pent, ונטצתם .[153] In 1QIs[a] 26:12 we read תשפוט for M.T. תשפת .

---

[150] There are numerous similar scribal errors cited by A. Sperber, "Hebrew Based Upon Biblical Passages in Parallel Transmission." HUCA, XIV, 1939. pp. 153-249.

[151] Vetus Testamentum cum variis lectionibus. 2 vols. Oxford, 1776-80. The variant reading is here designated Var. K.

[152] It is left for the reader to guess the nationality of this scribe.

[153] For more illustrations, cf. A. Sperber, op. cit., p. 166.

(14) Using the same argument,[154] Ginsburg points out that חבל in Deut. 3:4[155] is found as כבל in Shapira's. "Hence, when the compiler[156] of the text dictated to the scribe the word חבל , the latter spelled it כבל ." Ginsburg and Rabinowicz, who reproduces this argument, conclude that this error is impossible unless the copyist was a Polish or German Jew who pronounces ח as כ without a Dagesh.

The validity of this argument is dubious. The letter כ at the beginning of a word assumes the stronger sound k and it is therefore unlikely that a scribe will begin a word with כ when the sound is ח . Even a Polish ignoramus is unlikely to make such a mistake.[157]

But a careful examination of the photographic reproduction of the text in the British Museum dossier[158] will clearly indicate that the reading is not חבל but גבל (for גְּבָל equals גְּבוּל "border," "territory.")[159] In Shapira's document both כ and ג are almost identical in this Paleo-Hebrew script: ל and ל respectively.[160] Moreover, even if we read it as כבל there is a possibility that

---

[154] In his above-mentioned report. See above, note 146.

[155] חבל ארגב "the region of Argob."

[156] Presumably a Jew from the North of Europe.

[157] Gottstein apparently subscribes to this view too when he writes that the "mistake כבל ארגב (sic!) would be impossible!" op. cit. JSS, 1956, p. 190. ארגב in Gottstein's article is probably a misprint for ארגב and so is הוצאתי for הוצאתיך on p. 191. This writer, however, admits the use of מנסחהן in Shapira's for the M.T. מנסכיהן is a gross scribal error, but such errors existed in the M.T., cf. כנלתך in Isa. 33:1 (1Q Isa. ככלותכה)

[158] See above, note 17.

[159] גבול implies not only "boundary" but also "territory" (enclosed within boundary). In this sense it is employed in Deut. 2:4 and 19:3 and in numerous other passages. (See W. Gesenius, A Hebrew and English Lexicon of the Old Testament. Oxford, 1952, p. 148.) If so, גבול ארגב is a variant reading of חבל ארגב both meaning "The territory of Argob."

[160] This can clearly be seen from (a) H. Guthe's facsimile of the script, given in his book, (op. cit., p. 94), and (b) the reproduction of the text in the British Museum dossier. See also "Character of the Script" in this article.

this interchange is due to a partial assimilation of ג and כ . This peculiarity is quite common in the Semitic languages,[161] in the Samaritan Pentateuch[162] and possibly in the word אגזרי in 1QIs[a] 13:19 (for M.T. אכזרי "cruel.")[163]

(15) Neubauer argues that the זולתי "except" in Deut. 1:36 is changed in Shapira's documents to בלתי , because the latter is "certainly less emphatic."[164] This is hardly convincing. Does any reader believe that the following verses in the M.T. will become more emphatic if we substitute זולתי for בלתי ?

הילכו שנים יחדו בלתי אם נועדו	Amos 3:3
היתן כפיר קולו ממענתו בלתי אם לכד	Amos 3:4
לא תראו פני בלתי אחיכם אתכם	Gen. 43:3
זבח לאלהים יחרם בלתי ליהוה לבדו	Exod. 22:19

(There are other numerous illustrations from the Old Testament.) The reason for the use of בלתי is to be sought elsewhere. בלתי was probably a word more commonly used than זולתי . It occurs over eighty times in different forms whereas זולתי occurs only sixteen times. The argument can be advanced that the scribe believed he was rendering a service to his readers by employing a more frequently

---

[161] In Aramaic גיף (Y. Ketubboth vi. 31a) and כיף (Koheleth R. to verse 11,1) for "shore of sea or river." Cf. Ugaritic gp ym (C. Jean, "Dictionaire des Inscriptions Semitiques de l'Ouest, s.l.); Place name "Kezib" is found in the Mishna as כזיב (Halla iv. 8) and גזיב (Y. Halla iv. 8); Heb. געה , Aram. כעא "call out," "bellow;" in Syriac ܟܥܐ and ܓܥܐ both forms are used; Heb. כחד and Arab. جَحَدَ gahada, "to deny" (a right); "disown;" Aram. כנפא equals גנפא "wing." (Cf. M. Mansoor, "Linguistic Aspects of the Qumran Texts." JSS III, no. 1, 1958, pp. 40-55.)

[162] Gen. 14:23 M.T. שרוך -Sam. Pent. שרוג ; Gen. 21:23 M.T. לנכדי -Sam. Pent. ולנגדי . (For more illustrations cf. A. Sperber, op. cit., p. 165.)

[163] Not necessarily a scribal error as some writers asserted. Cf. S. Zeitlin, "The Hebrew Scrolls Once More and Finally." JQR, XLI, p. 30 (1950-1951). These and other scribal errors in Shapira's Deuteronomy refute M. Gottstein's contention in "The Shapira Forgery and the Qumran Scrolls." (JJS 1956, p. 191,) that such "textual types" do not occur in the Qumran texts.

[164] The Academy, August 25, 1883, p. 130.

used word. A similar tendency is observed in the Qumran version of the Isaiah scroll. The copyist deliberately used more common words for less common ones: יאירו for יהלו in Isa. 13:10; שולים for שבל in Isa. 47:2.

Ginsburg records a similar charge against the document in his report to the Principal Librarian of the British Museum,[165] pointing out that the forger substituted מעלם (mē'ōlām) for לפנים . Again, Gottstein categorically states that[166] "...not even one of the many peculiarities of the Qumran scrolls can be found in the Deuteronomy scroll." This is clearly not valid.

(16) Rabinowicz, referring to Neubauer, states[167] that "Another proof of the ignorance of the compiler can be found in the omission to notice the transposition of the two letters in the predicate applied to God, which, instead of saying ויאנף ("He was angry") declares ויבאף ("He committed adultery"). Ginsburg testified that the compiler must have been very shrewd. Can we really believe that he would make such a defamatory mistake deliberately?

This type of transposition of letters, especially in the presence of laryngeals, is made easier by the lack of vowel signs and is therefore not uncommon. We witnessed the same phenomenon in the Samaritan texts and in the Qumran texts.[168]

---

[165] Dated August 22, 1883. Published in the Times on August 27, 1883. It is also found in the British Museum dossier.

[166] op. cit., JJS (1956), p. 190. Gottstein (p. 191) also refers to the "impossible יבעל עם in the paraphrase of Deut. 27:21 instead of ישכב עם ." We know that this type of "grammatical deviation" is found in the Qumran texts, as stated above.

[167] JC, op. cit., August 9, 1957.

[168] Several writers have already pointed out this peculiarity in both the Samaritan and the Qumran writings. For numerous illustrations see M. Burrows, "Orthography, Morphology and Syntax of St. Mark's Isaiah Manuscript," JBL (1949), pp. 195-214; G.R. Driver, The Hebrew Scrolls, London, 1951; M.H. Gottstein, "Studies in the Language of the Dead Sea Scrolls," JJS, 3 (1953); H. Yalon, "Lileson Ham-Megillot Hag-Genuzot," Sinai (1950), pp. 267-293, Jerusalem; P. Kahle, "Zur Aussprache des Hebraischen bei den Samaritanern," Festschrift A. Bertholet, Tubingen, 1950; and M. Mansoor, "Linguistic Aspects of the Qumran Texts," JSS III, no. 1, 1958, pp. 40-55.

THE SHAPIRA MS. OF DEUTERONOMY.

This concludes the original and the translation of the MS. as far as it was necessary for the continuity of the narrative. The rest of the slips either contain duplicate matter or are undecipherable. It will be seen that we have here nearly the whole of Deuteronomy in an abridged form.

ויאמר אלהים אלי שלח אנשים לרגל את יעזר וילכד [את] יעזר ונשב בערי האמרי. ויצא עג מלך הבשן לקראתנו למלחמה ונברא עד לא השאר לו שרד ונלכד מאתם ששם ער כל כבל הארבב בצרת חמה דלתם ובריחם. לבד מערי הפרזים הרבה מאד מכל ערי הכשר וכל הגלעד וכל הבשן עד סלכה ואדרעי . . . . ארץ רפאים . . . גם הוא כי עג מלך הבשן מיתר הרפאים נשאר. ונפן ונסע נגבה ונשב מול בת פעה. ויצאו בעת ההוא בנת מאב ונשי מדין לקראתכם ותקראן [ל]כם לאכל מזבחהן ותאכל מזבחהן ותשתו מנסכהן ותשתחו לאלההן ותזנו את נשי המדינם ותעמדו לבעל פעור ביום ההוא וחרה אף אלהים עלכם ויגף בכם בעת ההוא נגפה גדלה ושלחתי ככם אנשם ללחם את המדינם והכתם אתם לפי חרב ושברתם מאתם שבי הרבה למאד ותעצר הנגפה. ואתי צוה אלהם בעת ההוא ללמד אתכם חקם ומשפטם לעשתם בארץ אשר עברם שמה לרשתה. והשמרו לכם לא תספו אל מצותו ולא תגרעו ממנו. והשמרו לכם פן תשכחו ועשתם לכם פסל ותמנה תבנת כל סמל אשר בשמם מכעל ואשר בארץ מתחת ואשר בכם מתחת לארץ. וחרה אפי בכם וחשכרתי את[כם מהרה מן הארץ הטבה ההוא. וידע . . . היום ו[שמ]רת את חקתו ומצותו לטען ישב לכם ו[למען] תארכו ימם על האדמה אשר אלהם אלהיך נתן לכם. שמע ישראל אלהם אלהינו אלהים אחד ואהבת את אלהם אלהיך בכל לבבך ובכל נפשך לאחד. ואד והיו הדברם האלה אשר אנך מצוך היום על לבבך ושננתם לבנך ודברת אתם בשבתך בבתך ובלכתך בדרך ובשכבך ובקמך וקשרתם אתם לאות על ידך והיו לתטפת בין עינך וכתבו[תם] על מזוז בתך ושעריך כי אלהים כרת עמך ברת בחרב ביום הקהל ואנך עמדתי בין אלהם וב[ינכם] . . . . בעת ההוא כי פחדתם כפני האש ולא . . . . ההד להגד לכם דבר אלהכם לאמר . . . . . .

(Here follows the Decalogue already printed, *Athen.* No. 2911.)

. . . . שמע ישראל אתם עברם היום את הירדן לבא לרשת גוים רבם ועצמם ערם גדלת ובצרת חמה לא תאמרו בלבבכם רבם חמה הגוים האלה לא נכל להרשם לא תרא מהם זכר את אשר עשה אלהם לפרעה ולכל מצרם כן יעשה אלהם לכל אויבך כי אלהם הוא העבר לפנך אש אכלה הוא הוא ישמדם וירכיעם מהרה לפנך . גם את ת . . צרעת ישלח אלהם בם עד אבד יאבד הנשתרים הנשארים מלפנך רק אם ושמרו את מצותו ומשפטו וחקתו אשר אנך מצוך היום וידעת היום כי לא בצדקתך אלהם אלהיך נתן לפנך את הארץ הזאת לרשתה כי עם קשה ערף הוא מן היום אשר יצאת ממצרם עד היום מסרם היתם את אלהם אלהיך . בחרב ביום עלתי ההר לקחת את שני לחת האבנם ועלהם כתבם כל הדברם אשר דבר אלהם עמכם בהר מתך האש ביום הקהל . . . . קצפתם את אלהם ועשתם לכם עגל מסכה ואתנגל לפני אלהם בהר הבער כאש . . . ושני לחת בידי ואראה חמאתכם והשבר את שני לחת לעיניכם ואתפלל בעדכם בעת ההוא ארבעם יום וארבעם לילה . ובתבערה ובמסה ובקברת התאוה מכרם היתם את אלהכם . בעת ההוא אמר אלהם אלי פסל לך שני לחת אבנם כראשנם ועלה אלי ההרה ואעל ההרה ושני [ח]לחת בידי . ויכתב אלהם על הלחת שני עשרת הדברם אשר דבר אלכם בהר ביום הקהל ויתנם אלי והנם בארן אשר עשתי ובקדש ברנע באמר אלי אלהם עלי ורשו את הארן מכרם היתם את אלהכם ולא עלתם ולא שמעתם בקלו ויאמר אלהם להשכרכם ואתפלל בעדכם בעת ההוא ארבעם יום וארבעם לילה ב נדכם ו ישמע אלהם בם בפעם ההוא ולא השחת אתכם כרנע לא בצדקתך אלהיך נתן לך כח לעשת חיל . . . [רק חשק אלהם] באבתכם לאהבה אתם ויבחר בזרעם אחריהם מכל העמם. [כי אלהם] אלהכם הוא אלה[י] אלהם ואדני האדנם האל הגבר והנרא [הוא ת]הלתך הוא אשר עשה אתך את הגדלת ואת הנראת. בשבעם נפש ירדו אבתכם למצרם [ו]עתה הית לעם עצם ורב. כי אך [אם] תשמרו[ו את] כל המצוה אשר אנך מצוה היום לעשת לאהבה את אלהכם ללכת בכל דרכו ובכל החקת. והרש אלהם את כל אנשי המקם כל אשר תדרך כף רגלכם בו. לא יתיצב א[ש] לפנכם כי פ[חדכם ובו אכם יהיה על פני כל הארן אשר ת]דרכו בו. ראה אנך נתן לפנכם היום ברכה וקללה את הברכה אם תשמע אל מצות[י אשר] אנכי מצה אתכם היום ואת הקללה אם לא תשמע אל מצות יהוה אלהי[כם] וסרתם מהדרך אשר אנך מצה אתכם היום [ולה]לך אחרי אלהם אשר לא ידעתם. כי יב[יאך יהוה אלהי]ך אל הארן אשר אתה בא שמה לרשתה ונתת את הברכה על הר [גרזם] והקללה על הר עבל הלא [המה] בעבר הירדן דרך מבא השמש בארן הכנעני [נ]ד בגלגל אצל אלני מרא. ואלה יעמדו על הר עבל] ראובן זבולן [ו]גד אשר דן ונפתלי. ואלה יעמדו על הר גרזם שמעון ויהודה ויששכר כנשה ואפרם ובנימן. ועמדו הלוים נגד הר גרזם [ו]ענו ואמרו בקל רם [ב]רך האיש אשר יעשה אלהם אלהנו ולו לבדו ישתחו ואתו לבדו יעבד ועגו כל העם] ואמרו אמן . ברך האי[ש אשר יקדש את י]ום השבעי וישבת בו ועגו כל העם ואמרו אמן . [ברך האיש] מכבד אבו ואמו ועגו כל העם ואמרו אמן . ברך [ה]איש אשר לא יקם ולא יכד את נפש אחו ועגו אמן . ברך האיש אשר לא ישכא את אשת רעהו ועגו כל העם ואמרו אמן . ברך האיש אשר לא ע[ה] את רעהו ועגו [כל העם ואמרו אמן . ב]רך האיש אשר לא ישבע ב[שמ]י לשקר ועגו כל העם ואמרו אמן . ברך האיש אשר לא יכחש ול[א י]שקר ברעהו ועגו כל העם ואמרו אמן . ברך [האיש] אשר לא נשא עינו אל ח[ר]כש רעהו ועגו כל העם ואמרו אמן . ברך האיש אשר יאהב את ר[ע]הו [ועגו] כל העם ואמרו אמן . ברך האיש אשר יקם את כל דברי התרה ה[זאת ל]עשת [א]תם ועגו כל העם ואמרו אמן . ויספו הלוים ויענו [ויאמרו ב]קל רם ראה אם שמע תשמע בקל אלהך לשמר לעש[ת א]ת כל כצותו ובאו עלך כל הברכת האלה ברך אתה בעיר ברך אתה בשדה ברך מנאך ושארתך ברך פרי בטנך ופרי אדמתך שנר [א]לפך ועשתרת צאנך ברך אתה בבאך וברך אתה בצאתך יתן אלהך את איבך נגפם לפנך יצו אלהם את הברכה בכל מעשה ידך וקבך אלהם לו לעם קדש וראו כל עמי הארן ויראו מכך יפתח אלהים לך את השמם להת ב[טר] ארצך בעת[ו ו]ה[ל]ות גוים רב[ם ואתה ל]א ת[לוה והית [למעלה] ולא תהיה [למטה . . . מה . . . . [א]בתכם . . . . [ו]יסבו הלו[ם את פנה]ם ב[גד הר עבל ויענו [ויאמ]רו [ב]קל ר[ם] ארר ה[איש אשר [יעש]ה פ[סל ו]מסכה מעש[ה י]ד[י חרש וענו כל העם ו[אמרו אמן כ]ארר אי[ש אשר יעשה מלאכה בינם השבעי לחללו וענו כל העם ואמרו אמן כ]ארר מקלה אבו ואמו וענו כל העם ואמרו אמן . ארר מכה רעהו בסתר וענו כל העם ואמרו אמן . ארר האיש אשר יקרב אל כל שאר בשרו ואשר ינאף את אשת רעהו ואשר יבעל עם כל בהמה וענו כל העם ואמרו אמן . ארר מ[כ]ם בנב רעהו וענו כל העם ואמרו אמן . ארר האיש אשרי ישבנו בשמי לשקר וענו כל העם ואמרו אמן . ארר לקח שחד להע[ד עד]שקר בעכתו וענו כל העם ואמרו אמן . ארר האיש אשר י[שא עינ]ו אל אשת רעהו ואל בתו ואל אמ[תו] ולכל אשר לו וענו כל העם ואמרו אמן . ארר האיש אשר ישנא את אחו בלבו וענו כל העם ואמרו אמן . ארר האיש אשר לא י[ק]ם את כל דברי התור[ה הזא]ת לעשת אתם וענו כל העם ואמרו אמן . ויס[פו הלוים לקרא בקל רם ויאמרו והיה אם לא תשמע בקל אלהך [ל]שכר לעשת את כל מצותו ו[חקתו ובאו עלך כל הקללת האלה ארר אתה בעיר וארו[ר] אתה בשדה ארר [ט]נאך ושארתך ארר פרי בטנך

A paper from The Athenaeum, August 18, 1883, reproducing the transcription of portions of the Deuteronomy fragments.

E. Würthein also refers to such cases as Isa. 9:18 M.T. נעתם and 1QIs[a] נתעם ; Isa. 32:19 העיר and 1QIs[a] היער , etc.[169]

(17) The fact that Shapira's text uses the word רע "neighbour" once instead of אח "brother" as in the remaining three times is also taken as internal evidence against the scroll. Is there any criterion in Hebrew or in the Old Testament relating to the use of רע and אח synonymously? The Pentateuch alone uses these two words as synonyms scores of times. Why neither some of the 1883 scholars nor Mr. Rabinowicz explained what was wrong with the usage of either word meaning "brother" or "neighbour" is mystifying.

(18) One of the "minor slips" in the document, according to Neubauer,[170] is the use of the singular in the remaining part of the Decalogue. Some of the verbs cited are תענו for תענה and תשתחו for תשתחוה . This so-called irregularity occurs in the text with ל"ה verbs only. Rabinowicz, in referring to the analysis of the text made by Neubauer and Ginsburg, explains[171] that this was intended by the forger to be the second person singular from the root ענו , "in imitation of the archaic form on the Moabite Stone, where it occurs twice."[172] Rabinowicz, however, fails to point out that תשתחו , which occurs in the document, does not appear in the Moabite Stone. It seems that anything that did not suit the purposes of Ginsburg and Neubauer has been regarded either as an imitation of the Moabite

---

[169] E. Würthein. The Text of the Old Testament. English Edition, Oxford, (1957), p. 72. See also Z. Ben-Hayyîm, Studies in the Traditions of the Hebrew Language. Madrid, 1954, p. 89.

[170] Cf. Rabinowicz, JQR, op. cit., p. 179.

[171] op. cit., JC, August 16, 1957.

[172] It is interesting to note that Ginsburg in his translation of the text in the London Times, August 8, 17, 1883, used the singular throughout. Guthe also did not regard this as an error.

Stone or as a clever fabrication by the forger.[173] The same charge had been applied to the separation of the words in the Decalogue and the insertion of a full stop after every word, "exactly as it is in the Moabite Stone, which here was obviously imitated."[174]

(19) In sum, Rabinowicz in his articles in the Jewish Chronicle[175] overlooked[176] the fact that in December 1956[177] before a gathering of about three hundred Bible and Semitic scholars, and again in April 1957,[178] this writer refuted most of the arguments advanced by Neubauer, Ginsburg, Clermont-Ganneau, and those repeated by Rabinowicz. By suitable documentation[179] it was also pointed out that Rabinowicz made at least ten errors in his 1956 contribution to the JQR.[180] Most of

---

[173]The following is a typical instance: In the Fourth Commandment, the clause למען יאריכון ימיך is absent in one of the Shapira fragments but appears in the duplicate. Ginsburg, in his report, argues that the forger cleverly suggests the "existence of a different recension." (In his report to E. A. Bond, published in the Times, August 27, 1883.) It is worthy to point out that here in the following excerpt from the Decalogue למען ייטב לך ולמען יאריכון ימיך the Exodus version has lost the first clause למען ייטב לך though it is preserved in LXX.

[174]*op. cit.*, JC, August 9, 1957.

[175]August 9, 16 respectively. Rabinowicz writes (August 16) "It is significant that in his lengthy attack against everybody who regards the texts as a forgery, Professor Mansoor refers to one single criticism only and keeps completely silent on all others."

[176]For in a letter to the Editor of the JC (April 19, 1957) this writer referred to the Annual Meeting of the Society of Biblical Literature.

[177]At the ninety-second meeting of the Society of Biblical Literature and Exegesis held at the Union Theological Seminary in New York (December 27-28). See also "Proceedings, Dec. 27-28, 1956," JBL (1957) LXXVI, Part I, p. i.

[178]At the joint mid-west meeting of the SBLE and AOS held in Dubuque, April, 1957.

[179]At both meetings a sixteen page pamphlet was distributed to the members. It included an abstract, Ginsburg's conclusions, Rabinowicz's objections in the JQR, the Decalogue, parallel texts, excerpts from the document, the refutation of internal evidence, Guthe's facsimile of the Phoenician alphabet, and finally an extensive bibliography spread over three pages. All quotations and sources referred to in the papers were documented. Copies of these pamphlets were sent at the time to some of the leading scholars in the United States, Israel, and Europe including W. F. Albright, S. Mowinckel, G. R. Driver, E. Vogt, H. H. Rowley, and the Editor of the Jewish Chronicle.

[180]*op. cit.*

these errors have been mentioned above. Surely Rabinowicz could not have expected this writer to produce all these documentations in the Jewish Chronicle.[181]

K. Contents and Nature of Texts.

(20) It is important to bear in mind that this new text is greatly compressed, occupying less than a third of the space taken up by the corresponding text in the Old Testament. It also contains the same text twice.[182]

The corresponding text in the Old Testament as given by Guthe[183] is as follows:

Deut. 1:1,5,7,8-9,19,20; Num. 14:21ff; Deut. 1:34ff; Deut. 2:24-37; 3:1a; 2:17-23; Num. 21:31-33; Deut. 3:1b, 2-11; Num. 25:1-8; 16-18; Num. 31:1-20; Deut. 4:3,14,2, 23,39-40; Deut. 6:4-9; 5:2; 5:5-19; Exod. 20:19; Deut. 5:25; Deut. 9:1; 7:17-19; 9:3; 7:20; 9:6-11; 9:22; 10:1-4; 9:23-25; 10:15-17; 10:21-22; 11:22-29; 27:11-14; 28:1-13; 27:14-26; 20:15-20,25,37,43-44,63; 31:1-6.

The sequence of the texts is significant. The selection of the Deuteronomical texts is a logical one, the theme of which being Moses' last speech to the Israelites before his death.[184]

It can be summarized as follows: First there is an historical survey of the experiences of Israel in the desert. Here Moses mentions that, at Beth Pe'or, after the victory over the Midianites, he had received from Elohim the injunction to teach the Israelites laws and rules which they were to observe in the land about to be conquered. This is followed by the Decalogue. Then a series of blessings and curses

---

[181] In fact, after Rabinowicz's allegations a thirteen page article was sent to the Jewish Chronicle, the Editor of which justifiably thought the article too long for a reply in a non-professional weekly.

[182] Guthe, op. cit., p. 63.

[183] Ibid., pp. 22-62.

[184] A fuller analysis is given in Guthe's work, ibid., pp. 86 ff.

is given to the people by Moses. Finally Moses indicates that Joshua will be his successor as the leader of the people into the Promised Land. The main emphasis seems to be the love of only one God and of His commandments. All the remaining material in the canonical text is--whether deliberately or not--excluded.

It is clear that Shapira's Deuteronomy displays a skilfully abridged manual compiled from Deuteronomy with interpolations from other books of the Pentateuch with Moses' last speech as a theme. It is also probable that the "Dires de Moise"[185] is a similar compilation. In these Qumran Deuteronomic texts we find interpolations from Leviticus, Numbers, just as is the case with Shapira's text.

Shapira's Decalogue.

(21) Another main internal argument against the document was given in Ginsburg's report[186] to Bond, in respect to the form of the Decalogue. It reads as follows:

> Taking for granted that because the canonical text already contains two recensions of the Decalogue no insurmountable objection would be raised against a third recension provided it exhibited the Biblical precepts, the forger manifestly made the Ten Commandments the groundwork of his text. Accordingly he not only modelled the Decalogue after the pattern of Leviticus XVIII and XIX, but derived his additions from those chapters. Thus the refrain, 'I am God, thy God,' which he inserted ten times is simply a variation of the longer refrain, 'I am the Lord your God' which occurs exactly ten times at the end of the ten precepts or groups of precepts, Leviticus (XVIII, 2,4,30; XIX, 2,3,4,10,25,31,34). Again, what is here the seventh commandment is made up from Leviticus XIX, 12, while the additional tenth commandment is simply Leviticus XIX, 17."

Several other scholars such as Neubauer published similar conclusions. Again this is not unusual. We find two recensions of the Decalogue in the M.T. itself; the Samaritan version again manifests some differences from the M.T. The Decalogue was an important and well-known text, hence it must have contained several

---

[185] Qumran Cave I, pp. 91-94.

[186] See note 165.

variations. This can be confirmed by comparing the versions. The combinations presented by Shapira's form of the decalogue do not seem to harmonize with any plan that is likely to have occurred to a forger.

It seems more plausible to assume that the passage of the Decalogue, for instance, reads more like a paraphrase, like part of a manual of instruction for popular use, than as a recension of part of the Bible.

An analogy may be seen in the Nash Papyrus[187] which contains a somewhat damaged copy of the decalogue in a form which follows partly Exod. 20:2 ff. and partly Deut. 5:6 ff., followed by Deut. 6:4 f."This arrangement shows that we have here not a fragment of a Bible scroll, but a short collection of texts for liturgical, edifying, or educational purposes."[188] Albright,[189] in 1937, declared, on the basis of paleographical indications that it was of Maccabean origin.[190] It is interesting to note here that the sixth and seventh commandments appear in reverse order and that the second portion from Deuteronomy, mentioned above, is introduced by a phrase not in the M.T., but found in LXX.

The practice of interpolations or insertions from other Pentateuchal books was not unknown in the Qumran texts. Frank M. Cross, Jr., in his report[191] observes, "Additions of so-called 'Samaritan' type are often found; thus after Num. 27:23 there is an insertion taken from Deut. 3:21, which occurs otherwise in the Samaritan tradition...." Again, we read in that report[192] that "Deut. 5:28-29 is combined with Deut. 18:18-19 followed by Num. 24:15-17 and Deut. 33:8-11."

---

[187] First published by S.A. Cook in the Proceedings of the Society of Biblical Archaeology (1903), pp. 34 ff.

[188] E. Wurtheim, op. cit., p. 24.

[189] W.F. Albright, "A Biblical Fragment from the Maccabaean Age: the Nash Papyrus." Journal of Biblical Literature, LVI, 1937, pp. 145-176.

[190] P. Kahle assigns it on internal grounds to the time before the destruction of the Temple in A.D. 70. See E. Wurtheim, loc. cit.

[191] "Editing the Fragments from Qumran." Biblical Archaeologist, XIX, December 1956, pp. 75-96. See report of Frank M. Cross, "Cave 4 of Qumran (4Q)", p. 83.

[192] Ibid., see report of John M. Allegro, p. 92.

The present writer believes that, in the light of recent discoveries and of what has been stated above, neither the internal nor the external evidence, so far as yet published, supports the idea of a forgery. Therefore, this writer firmly believes that there is justification in his suggestion for a re-examination of the case.

Perhaps it is appropriate to conclude with the words of The Echo,[193] "From the moment that the discoveries were declared to the world there was an eagerness in many quarters, quite inconsistent with the true spirit of criticism or scholarship, to stigmatize them as forgeries."

> "The freedom to ask questions, to search for truths through careful and honest inquiry and to teach the results of such inquiry is the heart and core of one great freedom of mankind."*

---

[193] August 23, 1883.

*From a public address on academic freedom by Dr. E.B. Fred, President of the University of Wisconsin, delivered on February 15, 1957. This writer wishes to express his thanks to the University Research Committee in the Graduate School for making this research possible.

WHOLENESS OF EFFECT IN *THE GOLDEN BOWL*

JOHN J. ENCK
University of Wisconsin, Madison

The Golden Bowl contains the fascinations and puzzles which distinguish an *Alterswerk*. To the extent that an assured master accomplishes seemingly impossible feats with structure and idiom its uniqueness renders defining precisely what he achieves, quite apart from an evaluation, the more hazardous. Although some passages sound so idiosyncratic that they verge on self-parody, the novel, if nearly a summary, does not recapitulate a balanced total from earlier titles. The familiar reveals heretofore undetected implications; the new defies timeworn categories; the whole looks simultaneously constructed and irregular, designed and free. Increasingly during the past several years articles about aspects of *The Golden Bowl* have by extracting one strand, perhaps, forced themselves to distort these intricate proportions. In the preface James cautions the reader, "Their chronicle strikes me as quite of the stuff to keep us from forgetting that absolutely *no* refinement of ingenuity or of precaution need be dreamed of as wasted in that most exquisite of all good causes the appeal to variety, the appeal to incalculability, the appeal to a high refinement and a handsome wholeness of effect."[1] As the façade of James' style grows more polished, the efforts to subordinate elements of the story in proper sequence multiply for a critic. With *The Golden Bowl,* in the basic terms of plot and cast, James confines himself most rigorously, and, on the other hand, by his perennial game of hiding how much anyone knows, he rarely hints so extravagantly. The sonorous prose belongs fully to the late period, but it veers frequently toward the luxuriance of poetry. The ultimate novel he completed offers the not unexpected paradox of exhibiting Jamesian traits and ending up not quite Jamesian. A commentator must try to relate story, characters, style, and themes separately with an awareness that they eventually fuse into almost an unbreakable unity. Whatever its final implications, it started and grew in a tested manner.

"Taking his single precious germ he meditated upon it, let it develop, scrutinized and encouraged, compressed and pared the developments until he had found the method by which he could dram-

[1] Henry James, *Novels and Tales,* 26 vols. (New York, 1907–1917), XXIII, p. vii. All quotations from the New York Edition will hereafter follow parenthetically in the text. When the same title has two volumes, the volume is in Roman and the pages in Arabic numerals.

atize it, give it a central intelligence whose fortune would be his theme, and shape it in a novel or a story as a consistent and self-sufficient organism."[2] Without any danger of oversimplification, the central conflicts of *The Golden Bowl* fit into a paragraph. Adam Verver, a widower and an American collector commanding unlimited wealth, lives in England with his daughter Maggie, engaged to Prince Amerigo. This match has been engineered largely by Mrs. Assingham. Shortly before the wedding Charlotte Stant, an American friend of Maggie's, turns up. Charlotte has had an affair in Italy with the Prince; it terminated chiefly because neither had money enough to permit them to marry. The Prince accompanies Charlotte when she shops for a wedding present. They find a glass bowl encrusted with gold; because a crack mars it and because a less recherché gift will not do, she purchases nothing. After the marriage Maggie, sensing Verver's loneliness without her, arranges for him to marry Charlotte. Soon Maggie with her son spends most of her time in her father's company; inevitably Charlotte and the Prince renew their affair. Maggie herself happens upon the bowl and buys it. When the worried dealer calls to explain the flaw, he identifies Charlotte and the Prince from their previous expedition. Maggie discusses the discovery with Mrs. Assingham, who deliberately breaks the bowl. Neither violence nor others can rescue Maggie. By a series of delicate maneuvers she persuades Verver to return with Charlotte to the United States while she and the Prince remain in Europe.

Besides the four principals, only two others of any importance participate in the story. Mrs. Assingham and her husband, a retired colonel, at times watch the scene like a Greek chorus which speculates extensively but not very brightly on what it observes and at others nearly like the stage manager of a Chinese play who manipulates the actors while remaining apart from their troubles. James himself expected to compose a *nouvelle* when he mentioned in his notebook, "Meanwhile in my path stands—appears at least to stand—brightly soliciting, the idea I jotted down a year ago, or more, and that has lain there untouched ever since."[3]

The structure of this long novel, divided into two parts, further complicates its enigmas. The first volume, "The Prince," assigns Amerigo the duties of the recording intelligence; the second, "The Princess," more rigorously calls on Maggie to see and deliberate. The six books, three in each volume, run to different lengths. Time gives the illusion of flowing evenly through many reveries, but James, as usual, glosses over the more obvious events, such as mar-

[2] R. P. Blackmur, *The Lion and the Honeycomb* (New York, 1955), p. 247.
[3] *The Notebooks of Henry James*, edd. F. O. Matthiessen & Kenneth B. Murdock (New York, 1947), p. 187.

riage ceremonies and the Principino's birth. The subjective analyses have fostered diametric views about the reliability of observers and details which they suppress or ignore. Nominally Maggie, whose quietness triumphs, would appear the heroine, but Jean Kimball's article proclaims Charlotte, "Henry James's Last Portrait of a Lady."[4] She fails to enlist an ally, Joseph J. Firebaugh, who outdid her in declaring, "All Charlotte's wonderful possibilities are to be subordinated to the service of an ideal of perfect and absolute beauty. Charlotte with her great power for passion is to suffer the induration of being moulded into a gilded image in the temple of pure art."[5] The father and daughter, suspiciously devoted to each other, emerge staid sinners against spontaneity. Verver suffers not only because of his possible rôle as a puppeteer, indirectly controlling the rest, but also as a capitalist. "But quaint or not, James believed in the moral fineness and sweetness of the old-time simpler American, and believed, too, that even if Mr. Verver was a billionaire, he could still be colored by those qualities."[6] Probably no one has yet championed the Prince without qualifications, although he sometimes sinks allegorically to "not Columbo. Amerigo, the false discoverer of the Americans. . . . He is the somewhat rotten apple, the worm-eaten fruit of the sinful ages of man."[7] Deeper in this murky realm of myth Mrs. Assingham comes a cropper. "Fanny, the stem, is the kind of thinking which holds the cup aloft, which relates mankind to a world materially conceived."[8] Such diversity, more ingenious than prudent, in the terms James proposed for the novel quite satisfies variety, revels in incalculability, lacks refinement, and makes a shambles of wholeness.

The prose, everybody agrees, is of a piece throughout. Formerly its cautious pace annoyed brash contemporaries. "They [the characters] are presented to one as vibrating exquisitely to every fine chord of life, as thinking about each other with the anxious subtlety of lovers, as so steeped in a sense of one another that they invent a sea of poetic phrases, beautiful images, discerning metaphors that break on the reader's mind like the unceasing surf. . . . For the metaphors are so beautifully and completely presented to the mind that it retains them as having as real and physical an existence as the facts."[9] The vogue for sorting metaphors has caught up with

---

[4] Jean Kimball, "Henry James's Last Portrait of a Lady: Charlotte Stant in *The Golden Bowl*," *American Literature*, XXVIII (January, 1957), pp. 449–468.

[5] Joseph J. Firebaugh, "The Ververs," *Essays in Criticism*, IV (October, 1954), p. 408.

[6] F. O. Matthiessen, *Henry James: the Major Phase* (New York, 1946), pp. 90–91.

[7] Myron Ochshorn, "Henry James: *The Golden Bowl*," *New Mexico Quarterly*, XXII (Autumn, 1952), p. 341.

[8] Quentin Anderson, *The American Henry James* (New Brunswick, New Jersey, 1957), p. 333.

[9] Rebecca West, *Henry James* (New York, 1916), pp. 110–112.

James, who yields his share of beasts, gardens, money, and oceans.[10] The findings may produce some usable results, but his figures of speech generally lack the sudden shocks which render metaphysical poetry dramatic. In the novels he demonstrates how to dramatize the material, to relate description and characters so that no detail lacks relevance.[11] The metaphors extend such preoccupations and seldom clash with them. Particularly after he dictated from drafts his mind isolated the crucial nuance in refinements of resemblance rather than the violence of contrast. *The Golden Bowl,* proliferating into nearly eight hundred pages, has variety, but the riches of behavior and thought relate to a narrow compass. Phrases, grudging as they are, from the earlier complaint offer revealing clews: "break on the reader's mind . . . real . . . as the facts." The correspondence between the literal and figurative language, so close that the entire volume ebbs with a beat between prose and poetry, may provide one way of apprehending wholeness. As Wallace Stevens observes about the bowl in an earlier context:

> *Or ever*
> *the silver cord be loosed, or the golden bowl be broken, or the pitcher be broken at the fountain, or the wheel broken at the cistern—*
>
> . . . These images have a special interest, as a group of images in harmony with each other. In both prose and poetry, images come willingly but, usually, although there is a relation between the subject of the images there is no relation between the images themselves. A group of images in harmony with each other would constitute a poem within, or above, a poem. The suggestion sounds euphuistic.[12]

This patterned imagery, its euphuistic prominence lacking the complications, inherent in human agents and susceptible of moderately disinterested judgments, conveniently falls around two topics which James treated throughout his career. They may serve as impersonal "reflectors" to place the characters and the significance of their conduct. For convenience one might label them the tourist and the museum or, more broadly, in their usual terms, the international episode and the work of art. In this last volume the magnificence attendant upon travel and aesthetics transcends being an adjunct of life and becomes, nearly, a mode of living. Random examples underline differences: the grandeur of Verver's acquisitions and the futile copies which Newman commissions from Mademoiselle Noémie; Amerigo's lineage, filling a room in the British

[10] For studies which include discussions of imagery, *inter alia,* see: Miriam Allott, "Symbol and Image in the Later Work of Henry James," *Essays in Criticism,* III (July, 1953), pp. 321–336; R. W. Short, "Henry James's World of Images," *PMLA,* LXVIII (December, 1953), pp. 943–960; Dorothea Krook, *"The Golden Bowl," Cambridge Journal,* VII (September, 1954), pp. 716–737; Priscilla Gibson, "The Uses of James's Imagery: Drama through Metaphor," *PMLA,* LXIX (December, 1954), pp. 1076–1084.

[11] Aspects of James' dramatization beyond style appear in P. N. Furbank, "Henry James: the Novelist as Actor," *Essays in Criticism,* I (October, 1951), pp. 404–420.

[12] Wallace Stevens, *The Necessary Angel* (New York, 1951), p. 78.

Museum, compared with Prince Casamassima's; the abundance of pieces at Fawns set beside the precision of furnishings in Poynton; Maggie's growing strength opposed to the failing Milly Theale; the stakes which Charlotte might win balanced against Madame Merle's ambitions.[13] The list extends into many ramifications. Appropriately, James' earliest memory was glimpsing from a carriage window the Place Vendôme, not only the buildings around a fashionable square in a foreign capital but also its column decorated with bas-relief made of cannon melted down from loot taken by Napoleon.[14] The museum and the traveler represent extremes: its works of art connote order, the permanent, perhaps transcendence, but, also, the dead; the wanderer, his encounters including museums, represents life, discontinuity, chance, and, sometimes, chaos. The photographs which comprise the frontispieces of the New York Edition bear out this scheme; the first volume has the shop displaying the bowl and the second a town house but most prominent is a carriage. Even these ultimate images, however, oppose less than they complement each other. Without pretending to completeness or denying the validity of other figurative patterns, a selected list indicates values in *The Golden Bowl.* These speculations have spun out quite enough abstract theory because, in T. S. Eliot's memorable observation, James "had a mind so fine that no idea could violate it."[15]

The novel opens with the Prince strolling down Bond Street past shopwindows with "objects massive and lumpish, in silver and gold . . . the loot of far-off victories." (*I 3*) Maggie identifies him with these, "what they call a *morceau de musée.*" (*I 12*) Mrs. Assingham assures him that he is "practically *in* port. The port . . . of the Golden Isles." (*I 27*) The Prince has ceased wandering, and his name relates him not with the discoverer of the New World but with the Italian commemorated on maps. His family has variously distinguished itself through the ensuing centuries. Maggie, a tourist, the student of guidebooks, causes the Prince to reflect, "She had images, like that, that were drawn from steamers and trains," (*I 15*) modern transportation which distresses him. Within the first hundred pages the other characters have joined their particular allegiances. The Assinghams' marriage resembles "a kind of hymeneal Northwest Passage," (*I 36*) and when she expresses elation her cry "might have signified the sharp whistle of the train that

[13] Christof Wegelin, "The 'Internationalism' of *The Golden Bowl,*" *Nineteenth-Century Fiction,* XI (December, 1956), pp. 161–181; this article sees *The Golden Bowl* as the culmination of James' international novels but barely suggests how it transcends them.

[14] Leon Edel, *Henry James, the Untried Years, 1843–1870* (Philadelphia, 1953), pp. 81–83.

[15] T. S. Eliot, "On Henry James," reprinted in *The Question of Henry James,* ed. F. W. Dupee (New York, 1945), p. 110.

shoots at last into the open." (*I 76*) Her husband becomes the supplier of museums, for she accuses him of having "taken part in the sack of cities," (*I 83*) when with the army. Verver figuratively enters the museum by being literally a collector. He will retire eventually to his American City as its patron-custodian. Charlotte, in contrast with Maggie the tourist and Mrs. Assingham the explorer, is the uncomfortable roamer. As Mrs. Assingham describes her, "she has no home—absolutely none whatever. She's extraordinarily alone . . . . owns almost nothing in the world she tells me, but two colossal trunks." (*I 39–40*) Neither sort of image has inherently the more favorable aspect. The junk which Charlotte and the Prince reject shows the tawdry aspects of heterogeneous bric-à-brac. The counterpart of Mrs. Assingham's Northwest Passage becomes the minor figure, a Mrs. Rance, whose home looms "from afar as so lost, so indistinct and illusory, in the great alkali desert of cheap Divorce." (*I 133*) Verver himself, while a capitalist, resembled a conquistador; his cultivation of art, a discovery compared with Cortez' astonishment in Keats' sonnet, made "his feet settle." (*I 149*) Having been promptly defined, the pattern does not remain static.

As their broodings disturb them more trenchantly, an indolence juggles the characters and their symbols. After marrying Verver, Charlotte refers to herself as "just fixed—fixed as fast as a pin stuck up to its head in a cushion." (*I 256*) The Prince observes the four of them as all in one boat, "a good deal tied up at the dock, or anchored, if you like, out in the stream." (*I 270*) Here, as elsewhere, James' dialogue incorporates colloquialisms while sustaining all the traits of his narration.[16] Later Colonel Assingham mixes a metaphor while explaining Charlotte to his wife; "Gratitude to the Prince for not having put a spoke in her wheel—*that,* you mean, should, taking it in the right way, be precisely the ballast of her boat?" (*I 282*) The Colonel, as characterized by this remark, combines an odd mixture of shrewdness and confusion. When their former passion is about to overwhelm Charlotte and the Prince, she turns up like a gypsy "in a shabby four-wheeler and a waterproof," (*I 299*) and at the Prince's asking her why she has not used her own carriage, she replies, "It makes me feel as I used to—when I could do as I liked." (*I 299*) Their interview stretches out lengthily; both verge on a kind of claustrophobia. Their embrace signs their betrayal in an image of the ocean and a destruction comparable with the sack of cities. "Then of a sudden, through this tightened circle, as at the issue of a narrow strait into the sea beyond,

[16] A longer discussion of this topic occurs in: H. K. Girling, "The Function of Slang in the Dramatic Poetry of *The Golden Bowl*," *Nineteenth-Century Fiction,* XI (September, 1956), pp. 130–147.

everything broke up, broke down, gave way, melted and mingled." (*I 312*)

The first part establishes the images properly, then modulates them; the ensuing section reverses and parodies them. Charlotte, always the more aggressive, emerges socially triumphant over Maggie and has "mounted cheerfully the London treadmill," (*I 317*) so that, still in motion, she does not progress. A figure more congenial to her temperament grows weirdly overpolished, for in public between the Prince and her now exists "a mystic golden bridge . . . strongly swaying and sometimes almost vertiginous." (*I 325*) Mrs. Assingham, too, bogs down: "she must stand exactly where everything has, by her own act, placed her." (*I 341*) The Prince and Charlotte, meanwhile, seek "a meaning that their associated sense was to drain even as thirsty lips, after the plough through the sands and the sight, afar, of the palm-cluster, might drink in at last the promised well in the desert." (*I 346*) From its opening the novel has narrowed to where, although all flutters quietly, nothing rests, and everyone pulsates with uneasiness before his prospects. "Don't you think too much of 'cracks' and aren't you too afraid of them? I risk cracks," (*I 359*) Charlotte reprimands the Prince. No one at this point, Charlotte included, risks much, and Mrs. Assingham declares at the end of the volume, "Nothing—in spite of everything—*will* happen. Nothing *has* happened. Nothing *is* happening." (I *400*)

The beginning of the second volume contains one of the most strikingly subtle passages James shaped. Through a long interior monologue Maggie seeks to isolate one adequate explanation of a melancholy which she cannot define. The listed possibilities depict her stalking around and around an ornate structure, a combination of prince and billionaire, husband and father, stepmother and rival, confidante and betrayer, "some wonderful beautiful but outlandish pagoda, a structure plated with hard bright porcelain, coloured and figured and adorned." (*II 3*) While scrutinizing this image, she cannot make out where she might have entered, had she wished. Pushing deeper into the implications of this mood, she reviews her impressions "like a roomful of confused objects, never as yet 'sorted,' " (*II 14*) for she is not adept at catalogues. Her inactivity is literally true; she prefers spending time indoors with her father and her son while Charlotte and the Prince, by attending to social obligations, "held the field and braved the weather." (*II 22*) As her thoughts weave extravagant metamorphoses, the shifting images become so rich that no paraphrase can avoid oversimplifying them. She translates Charlotte into a fourth wheel, as ideally she would have appeared upon marrying Verver and completing the households. Maggie realizes dimly that the way they

live suggests her father and she rest inside a coach; "Amerigo and Charlotte were pulling it while she and her father were not so much as pushing. They were seated inside together, dandling the Principino." (*II 23*) In moments of comparative calm, regaining her former self-possession, she remains adrift, "as if she had somehow been lifted aloft, were floated and carried on some warm high tide." (*II 24–25*) Her uneasiness persists with Charlotte, "the effect of throwing over their intercourse a kind of silver tissue of decorum. It hung there above them like a canopy of state." (*II 38*) The two concepts, the nearly native one for her of floating and the alien one of being beneath a canopy, join to summarize and caricature her situation: "They had built her in with their purpose—which was why, above her, a vault seemed more heavily to arch; so that she sat there in the solid chamber of her helplessness as in a bath of benevolence artfully prepared for her." (*II 43–44*) Later she imagines the Prince's asking, "*where* for it after all are we? up in a balloon and whirling through space or down in the depths of the earth, in the glimmering passages of a gold-mine?" (*II 73*) Their passivity depresses Verver also, "as if we were sitting about on divans, with pigtails, smoking opium and seeing visions." (*II 92*) Charlotte becomes a guide for sight-seers through the collection, and Maggie reduces herself to the smallest dimensions, a microscopic insect pushing a grain of sand.

After buying the bowl and receiving the merchant, she confides in Mrs. Assingham, who appropriately takes the decisive action of dashing it to the floor where it breaks into three pieces, which Maggie must rescue. At this point the Prince enters melodramatically, and Mrs. Assingham departs in a flourish of excuses which border on high comedy. "It has since occurred to me that his [James'] novels are really remarkable for their lack of humour."[17] Perhaps not very oddly the man who satirized Victorians failed to detect that James' censure of those who substitute manners for feeling exceeds his annoyance with those who ignore conventions. Frequently, as here, he reduces them to a mechanical, and consequently ridiculous, reliance on superficial codes. This scene, like a number of others, indicates that too much solemnity has been read into James. One feels the pathos in the husband's and wife's embarrassment, but Mrs. Assingham's inadequate apologies preserve a sardonic tone. "Bedizend and jewelled, in her rustling finery," (*II 182*) for, like Catherine Sloper's, her gowns with a placid life have grown increasingly gaudy, Maggie at last becomes superior; "it was her companion absolutely who was at sea." (*II 203*) Curiously enough, in spite of all her suffering, she remembers a phrase

[17] Virginia Woolf & Lytton Strachey, *Letters*, edd. Leonard Woolf & James Strachey (New York, 1956), p. 27.

from the United States; "she was having, by that idiom, the time of her life. . . . It was as if she had come out—that was her most general consciousness; out of a dark tunnel, a dense wood, or even simply a smoky room." (*II 207*) Nevertheless, she remains in the plot quite rooted, and the pagoda around which she stalks is replaced by Charlotte, whom she depicts there as a wild animal. If, however, the images in which she had fancied herself during her perplexity stemmed from those of museums and being immured, she now braves new frontiers, like the Northwest Passage of marriage or the alkali desert of cheap divorce. She compares herself with the Holman Hunt painting of "the scapegoat of old . . . charged with the sins of the people . . . . gone forth into the desert to sink under his burden and die." (*II 234*) The smoking room suggests "a wild eastern caravan, looming into view with crude colours in the sun, fierce pipes in the air, high spears against the sky, all a thrill, a natural joy to mingle with, but turning off short before it reached her and plunging into other defiles." (*II 237*) Although facing dangers, she has returned to her element.

When she initially confronts her father with plans for his leaving—the figures the more common ones of ocean travel, she weathering the storm better than he—her announced intention is to ship him back to his American City. She can contemplate him almost with detachment in his accustomed environment, "the typical charmed gazer, in the still museum, before the named and dated object, the pride of the catalogue, that time has polished and consecrated." (*II 274*) She it is who holds the Baedeker. Charlotte, in turn, before Maggie's rising assurance, already appears to retreat across "long miles of ocean and the dreadful great country, State after State." (*II 303–304*) Charlotte's actually confronting her stirs "some echo of an ancient fable—some vision of Io goaded by the gadfly or of Ariadne roaming the lone sea-strand," (*II 307*) as the figurative merges with the literal, and the symbols resume their initial alignments. The Prince must maintain his immobility throughout the book. Maggie, her process of understanding completed only by the end of the story, feels that he chafes under his inactivity as much as she does. They agree, in her explanation, "we're doing nothing, we're doing it in the most aggravated way." (*II 325–326*) Finally, then, Maggie indirectly persuades Verver to return with Charlotte. After a last interview between the two families, she looks to glimpse the departing coach which carries her father and stepmother away, but it already has left. She and her husband remain; the novel closes with their embrace.

If, however, the images by resuming their properties comment directly upon the story, the final effect does not produce a work whole but hermetic. It transcends a series of episodes whose meshes

dangle an elaborate filigree of stylized thoughts. As much as any of James' novels, not excluding *The Bostonians, The Golden Bowl* depicts weaknesses emerging in contemporary society. James and his concerns stand less remote from the world than once they appeared to. Verver, for example, represents a temperament that had not existed when he published *Roderick Hudson.* In 1874 he reviewed an exhibition of some thirty paintings at a Boston exhibition: to range through his article for random comments:

> Roughly considered, the coming of these works was certainly something of an event, for the importation of authentic old masters by the dozen is as yet, for the American public, an unfamiliar fashion. . . . We seemed to find in it [the viewers' conduct] a mild but irresistible pathos—and we were reminded once more that we are a singularly good-natured people. We take what is given us, and we submit, with inexhaustible docility, to being treated as children and simple persons. We are vast, rich, and mighty, but where certain ideas are concerned we sit as helpless in the presence of Old-World tradition, dim and ghostly though it may be, as Hercules at the feet of Omphale. . . . It has been proved that there is no reason in the essence of things why a room full of old masters should not be walked into from an American street and appear to proper advantage in spite of what in harmonious phrase we suppose we should call its location.[18]

Verver imports pieces for his museum by the score, and Amerigo's behavior verges on the dim and ghostly at times, precisely with the connotations which James later attaches to these terms. The rules which his protagonists formulate and test refer to social realities which had developed in the later decades of the nineteenth century. In *The Aspern Papers* he had observed, "When Americans went abroad in 1820 there was something romantic, almost heroic in it, as compared with perpetual ferryings of the present hour, the hour at which photography and other conveniences have annihilated surprise." (*49*) If the Americans, with their newly founded or enlarged museums and available transportation, had literally become "the heir of all the ages," in the phrase he applies to Milly Theale, he feared that the inheritance threatened them with decadence induced equally by excessive refinement or a crude ennui. A sentiment further along in "Locksley Hall," "Better fifty years of Europe than a cycle of Cathay," with minor modifications might likewise describe his outlook. The uneasy pride in what western society on both sides of the Atlantic had accomplished made him anxious about its perpetuation.

The thirty years between the Boston exhibition and *The Golden Bowl* represented the weakening of that culture through the very values by which his fiction had lived. Just as metaphors about trav-

---

[18] Henry James, *The Painter's Eye,* ed. John L. Sweeney (Cambridge, 1956), pp. 79–87.

elers and museums touch on the wilderness and trash, so no character in *The Golden Bowl* escapes exercising a capacity for malice. The first interview between Maggie and the Prince establishes the tone when she declares life pleasant in "The world, the beautiful world—or everything in it that *is* beautiful. I mean we see so much." (*I 11*) To which he answers, "You see too much . . . when you don't, at least . . . see too little." (*I 11*) The remarks gain precision as the novel expands. Maggie lacks discrimination by gushing sincerely over authentic or jejune objects among which she numbers the Prince and the bowl. Along with the other American heroines whom James portrays she too willingly accepts an easy pragmatic standard; much implicit irony hinges on nuances of the verb "see." In her tourist's attitude she shares traits with her father, who applies "the same measure of value to such different pieces of property as old Persian carpets, say, and new human acquaintances." (*I 196*) The two lead primarily materialistic lives, happy expatriates, plutocrats in a superficial foreign atmosphere. Because of their wealth they worry about the price of nothing and, therefore, fail to grasp values. The Prince and Charlotte, in contrast, must selfishly study the price of everything, and this information at times sharpens at others distorts their values. The novel traces how affections develop among four people in differing degrees, but not kinds, of cynicism; none, however, fills the rôle of outright villain, conspiring with a codified evil. All need to learn to see essential relationships. Colonel and Mrs. Assingham remain somewhat unredeemed at the end, but their limitations render them basically comic rather than wicked because they must fall back on existing *mores* and cannot transcend them either for profit or generosity. Unlike the tales of positive horror, *The Turn of the Screw* or The Jolly Corner, *The Golden Bowl* draws all its virtues from society or art, and evil is absence or deformity. A fine understanding depends on seeing both the moment and its origins honestly in their full connections.

The reason for undertaking to master such an outlook shares the initial impulse behind travel and museums: caring enough about others and culture. Here, again, James treats an abiding theme described in Marianne Moore's brilliant insight, "Love is the thing more written about than anything else, and in the mistaken sense of greed. Henry James seems to have been haunted by awareness that rapacity destroys what it is successful in acquiring. He feels a need 'to see the other side as well as his own, to feel what his adversary feels.' "[19] Maggie, most convincingly, expresses the emotion, a nearly existential faith in love.

[19] Marianne Moore, *Predilections* (New York, 1955), p. 30.

"Because—don't you see?—I *am* mild. I can bear anything."
"Oh, 'bear'!" Mrs. Assingham fluted.
"For love," said the Princess.
Fanny hesitated. "Of your father?"
"For love," Maggie repeated.
It kept her friend watching. "Of your husband?"
"For love," Maggie said again. (*II 115–116*)

Almost alone among James' characters Maggie, and through her the rest, surmounts victimizing others or suffering permanently from their rapacity. Consequently, R. P. Blackmur, who otherwise analyzes the novel persuasively, offers an exaggerated interpretation of the end; "as Maggie applied it [her mode of love], it required the sacrifice of life itself till nothing but the created shade was left."[20] The novel concludes on the lines, "he [Amerigo] presently echoed: ' "See"? I see nothing but *you*.' And the truth of it had with this force after a moment so strangely lighted his eyes that as for pity and dread of them she buried her own in his breast." (*II 369*) Maggie has fully braved the tragic implications of his and her suffering, "pity and dread." Her sacrifices through sensibility may now create not a shade but life. The Prince can "see" here, whereas she has passed beyond surveying hastily a beautiful world. Just before this scene the Principino enters in his own right, and he "abounded, as usual, in remarks worthy of the family archives." (*II 367*)

Because Maggie endures so much she may suggest a divine charity, bordering *agapé*. From this hint the universe opens for mythic interpretations, especially some based on the senior Henry James' brooding about Swedenborg.[21] One contrast between father and son may indicate how perversely this view looks at *The Golden Bowl* upside down. In 1842 Henry James wrote to Emerson, "I am led, quite without any conscious wilfulness either, to seek the *laws* of these appearances that swim round us in God's great museum.[22] The irrational streak forming the core of much mysticism proved ultimately as congenial to the elder James as to Emerson. An impossible question has been phrased in a way to predict the sure answer. *The Golden Bowl* employs a different criterion. Everyone analyzes possibilities to become aware of what questions he dare ask of whom; even the Assinghams recognize this point, if they never quite discover how to frame proper phrases. Moreover, once

[20] R. P. Blackmur, introduction to *The Golden Bowl* (New York, 1952), p. xx.
[21] Quentin Anderson advances the view in *The American Henry James*. The title does not, but well might, signify a reading of the late novels as an allegorical melting pot. His opinions form points of departure for two articles: Caroline Gordon, "Mr. Verver, Our National Hero," *Sewanee Review*, LXIII (Winter, 1955), pp. 29–47 and Francis Fergusson, "*The Golden Bowl* Revisited," *Sewanee Review*, LXIII (Winter, 1955), pp. 13–28. A more temperate stress on religion occurs in Frederick C. Crews, *The Tragedy of Manners* (New Haven, 1957), pp. 105–112.
[22] Letter quoted by F. O. Matthiessen, *The James Family* (New York, 1948), p. 41.

the mystic grasps the law, which his question has guaranteed, it, obviously, explains phenomena, or explains them away. In all his novels James mocked anyone relying glibly on universals or his own private whims. Finally, the pietistic phrase which equates the world with god's museum has nothing to do with Verver's American City or the collection destined for it. James, always searching for *données,* worked cautiously toward generalizations but not absolutes. To impose a static paradigm denies the spontaneity on which half the structure of the novel depends. "Does it enrich our apprehension of the later novels of Henry James if we construe them as Swedenborgian allegories? . . . the purported symbolism is not conventional nor explicit nor implicit; it is, at best, conjectural; and since it obscures rather more than it illuminates, it should probably be discarded as inadmissible."[23]

Finally, to schematize the images into a codified myth violates every page of *The Golden Bowl.* Its wholeness consists, ultimately, in a partial wholeness, in seeing things as they exist, evaluating them, and, then, accepting or transforming them for their moment but not eternity. By his early review James detected nothing essentially absurd in the prediction of galleries on any American street. With this novel the eclectic nature of travel and museums represents an ultimate danger by fragmentation without losing their eminence on the heights of civilization. He further dramatizes this impression when Miss Mumby confronts the expatriate Graham in *The Ivory Tower,* whose setting is Newport. She affects him "in the supreme degree as a vessel of the American want of correspondence. Miss Mumby was ample, genial, familiar and more radiantly clean than he had ever known any vessel, to whatever purpose destined; also the number of things *she* took for granted—if it was a question of that, or perhaps rather the number of things of which she didn't doubt and was incapable of doubting, surrounded her together with a kind of dazzling aura, a special radiance of disconnection." (*78*) A cultural historian, who delighted in dramatic contrasts which James would never have risked, later hit on the bizarre extremes unavailable before World War I: *"Es werden durch Rundfunk bereits Nachtigallenkonzerte und Papstreden übertragen. Das ist der Untergang des Abendlandes."*[24] Nowhere else in fiction does the mind's deliberately using the diverse materials at hand, and no others, to gain wisdom range so minutely and conscientiously, balancing for its final triumph spontaneous surprise (travel), understanding (sight), culture (the museum), and a continuing love.

---

[23] Harry Levin, *Contexts of Criticism* (Cambridge, 1957), p. 206.

[24] Egon Friedell, *Kulturgeschichte der Neuzeit,* 3 vols. (München, 1928–1931), III, p. 569.

"The business of cultivating continuity" (*II 80*) provides *The Golden Bowl* its diametric qualities, which come out wholes. Although a novel, and therefore telling a story which moves through time, it scarcely progresses but hovers about the intricate convolutions of two uncommonly candid temperaments. The thoughts seldom seek the pretensions of philosophizing but adhere to actualities, and any deeds matter less than the myriad sensations which lead to choices. Images arise directly from the material and link together in an integrated pattern which forms an independent commentary. The subjects in both kinds of metaphors strain away from a vital sequence toward the static museum or the rootless traveler; the story itself pulls them back into their properly adjoining spheres. For all their wealth the characters belong to the society which had evolved during James' lifetime; they exhibit a few tendencies so exhaustively that they now look almost like allegories on traits just emerging before World War I. This very mixed world produces Maggie, who shrinks from no ramifications of disaster and redeems the rest, not—it must be added—without their partial assistance. The reader, consequently, has to share her generosity in allowing, indeed prizing, the weaknesses of the others. Finally, the theme depicts threats of fragmentation; its chief, and most obvious, symbol, the bowl itself, has a flaw and breaks. Nevertheless, the novel, as a work of art, overcomes the maladies it investigates; it endures in the conditions set down by James as the preface to *The Portrait of a Lady*. "Here we get exactly the high price of the novel as a literary form—its power not only, while preserving that form with closeness, to range through all the differences of the individual relation to its general subject-matter, all the varieties of outlook on life, of disposition to reflect and project, created by conditions that are never the same from man to man (or, so far as that goes, from man to woman), but positively to appear more true to its character in proportion as it strains, or tends to burst, with a latent extravagance, its mould." (*I x*) Charlotte's public comment, wrenched from context and altered in tone, on a piece in the Verver collection well sums up the effects of these strains in *The Golden Bowl*: "really quite unique—so that though the whole thing is a little *baroque*—its value . . . . is I believe almost inestimable." (*II 291*)

ARCHBISHOP LAUD AND SHIRLEY'S *THE CARDINAL*

CHARLES R. FORKER
University of Wisconsin, Madison

Sir Henry Herbert licensed *The Cardinal* for production at the Blackfriars theatre on November 25, 1641,[1] and all evidence points to the summer or early fall of the same year as the period of its composition. The political events of the time were so inauspicious for the theatrical profession that it is not surprising to find even the chief playwright of the King's Men murmuring about hard conditions.[2] Yet the topical significance of Shirley's greatest tragedy has never been seriously examined.[3]

The crisis which a year later closed the theatres until the Restoration was already gathering head in 1641.[4] The rift between King Charles and his subjects was widening every week, and political and religious tensions were hurrying the nation headlong into civil war. The Long Parliament had met and was in stormy session; as Pym's power increased in the House of Commons, the nation witnessed the trial and execution of Strafford, Lord Lieutenant of Ireland, on the charge that he had treasonably planned to subdue his own countrymen with an army of Irish Catholics. Laud, too, was impeached and sent to the Tower under a long list of charges—among them that he had deliberately betrayed England into the Scottish war and, by negotiating secretly with the pope, had planned to subvert the whole Protestant cause in Britain. The hated courts of High Commission and Star Chamber were abolished, and the "Root-and-branch" party, whose sentiments were hysterically voiced in Milton's "Apology for Smectymnuus," fulminated for the abolition of the episcopal hierarchy. During part of the year Scottish troops occupied the northern counties of England,

[1] J. Q. Adams ed., *The Dramatic Records of Sir Henry Herbert* (New Haven, 1917), p. 39.

[2] In the epilogue to *The Cardinal* Shirley refers to "the unhappy stage," anticipating his more desperate complaint six months later in the prologue to *The Sisters* that a play, "Though ne'er so new, will starve the second day." For *The Cardinal* I cite C. R. Forker, "*The Cardinal* by James Shirley, A Critical Edition with Introduction, Notes, and a Modernized Text," unpubl. thesis (Harvard, 1957); otherwise I quote from William Gifford ed., *The Dramatic Works and Poems of James Shirley*, 6 vols. (London, 1833)—hereafter cited as *Works*.

[3] Former editors of *The Cardinal*, chiefly Gifford, have noted an allusion here and there, and F. S. Boas in *An Introduction to Stuart Drama* (London, 1946), p. 376, suggests the applicability of a single passage to Laud; but no one has attached much importance to these hints. Tucker Brooke's view that the play was "doubtless . . . suggested by the contemporary career of Richelieu in France" (*A Literary History of England*, ed. A. C. Baugh [New York, 1948], p. 586) is usual.

[4] For the political background I rely heavily on S. R. Gardiner, *The Fall of the Monarchy of Charles I 1637–1639*, 2 vols. (London, 1882).

a humiliating reminder of the late war; the king himself made a state journey to Edinburgh where he was nearly reduced to begging for the funds which his own parliament at home would not vote him. The year was climaxed in October by the dramatic outbreak of the Irish Rebellion. The Grand Remonstrance (read November 22, just three days before Herbert licensed Shirley's play) followed hard upon—a rancorous summation of the nation's grievances against the policies of the entire reign. It complained of the abuse of royal prerogative, incursions on Commons' privileges, the imposition of unparliamentary taxation such as "ship money," the licensing of corporate monopolies, the dissolution of parliaments, the tyranny of the ecclesiastical courts, the disastrous attempt to force the Anglican liturgy upon Scotland, the frustrating of the Reformation (as symbolized by Laud's insistence on Arminian uniformity), and, by implication at least, the failure of the Crown to strike a single decisive blow for the cause of continental Protestantism. The bad situation was in no wise improved by the unreasoning fear of Roman Catholic subversion which gripped the nation like plague—a fear which Queen Henrietta and her suite of foreign clerics and Catholic converts had encouraged by their indiscretions.

It would be strange indeed if a playwright like Shirley, a man close to the court yet dependent upon public support, who had been attached to Strafford's household in Ireland, who had written a play on a plot supplied by the king,[5] yet who, on another occasion, fell afoul of the censor, whose works probably had to be passed upon by some vigilant member of the church authority, if not Laud himself—it would be strange if such a writer could entirely exclude from a new play all evidences of the national crisis. *The Cardinal* is, in fact, full of references which almost beg to be read as Shirley's oblique commentary on the contemporary situation.

The man who became the scapegoat for almost every popular grievance in the kingdom was Charles I's choleric, single-minded, donnish, and immensely powerful little Archbishop of Canterbury, William Laud. Even more than Strafford, whose rise to power he had materially influenced, Laud symbolized to the popular imagination the evil genius behind the throne, the wicked counselor who, by his autocratic policies, both secular and ecclesiastical, was alienating the king from his people, subverting law, religion, and justice, and plotting with Jesuitical cunning to betray his church and his government to the scarlet woman of Rome.

Laud's unpopularity was by no means confined to the Puritans, for he was hated alike by many of the nobility, to whom he repre-

[5] *The Gamester.* See Adams, *Herbert,* p. 54.

sented the alarming resurgence of ecclesiastical power, and by Roman Catholics, who feared his repressive measures. The Puritans, who, at the height of his power, had rioted at Lambeth, smashed altar rails, and put up libelous placards, rejoiced incontinently at the archibishop's imprisonment, and 1641 saw a profusion of satirical pamphlets against the prelate,[6] several of them comparing him unfavorably to Wolsey and Richelieu. When it was later discovered from Laud's diary that he had actually twice been offered a cardinal's hat, the fact that he had loyally refused did little to dispel the fantasy which had been growing stronger every day in the minds of his enemies.

Read against this background, certain passages in *The Cardinal* take on a new significance. The most unmistakable of these occurs at the end of Act II where Rosaura and the cardinal have a confrontation in which she accuses him in terms which strongly suggest the popular notion of Laud:

> *Duchess.* Would all your actions had no falser lights
> About 'em.
> *Cardinal.* Ha!
> *Duchess.* The people would not talk and curse so loud.
> *Cardinal.* I'll have you chid into a blush for this.
> *Duchess.* Begin at home, great man; there's cause enough.
> You turn the wrong end of the perspective
> Upon your crimes to drive them to a far
> And lesser sight; but let your eyes look right,
> What giants would your pride and surfeit seem!
> How gross your avarice, eating up whole families!
> How vast are your corruptions and abuse
> Of the king's ear, at which you hang a pendant,
> Not to adorn, but ulcerate, while the honest
> Nobility, like pictures in the arras,
> Serve only for court ornament. If they speak,
> 'Tis when you set their tongues, which you wind up
> Like clocks to strike at the just hour you please.
> Leave, leave, my lord, these usurpations,
> And be what you were meant—a man to cure,
> Not let in, agues to religion.
> Look on the church's wounds.
> *Cardinal.* You dare presume,
> In your rude spleen to me, to abuse the church?
> *Duchess.* Alas, you give false aim, my lord. 'Tis your
> Ambition and scarlet sins that rob
> Her altar of the glory and leave wounds
> Upon her brow, which fetches grief and paleness
> Into her cheeks, making her troubled bosom
> Pant with her groans and shroud her holy blushes
> Within your reverend purples.

[6] For a partial list of these pamphlets see J. P. Lawson, *The Life and Times of William Laud* (London, 1829), II, 404–06.

Cardinal. Will you now take breath?
Duchess. In hope, my lord, you will behold yourself
In a true glass, and see those injust acts
That so deform you, and by timely cure
Prevent a shame before the short-haired men
Do crowd and call for justice.

(II.iii.135–68)

It is interesting to set against this passage a few excerpts from speeches by "the short-haired men" themselves—the parliamentary leaders accusing Laud of treason. Harbotle Grimston on December 18, 1640 opened his address to the House with the following words:

> . . . we are now fallen upon the great Man the Arch-Bishop of *Canterbury;* look upon him as he is in Highness, and he is the Sty of all Pestilential filth, that hath infested the State and Government of this Commonwealth: Look upon him in his dependencies, and he is the only Man, the only Man that hath raised and advanced all those, that together with himself, have been the Authors and Causers of all our Ruines, Miseries, and Calamities we now groan under. Who is it but he only that hath brought the Earl of *Strafford* to all his great places and imployments? A fit Spirit and Instrument to act and execute all his wicked and bloody designs in these Kingdoms. Who is it but he only that brought in Secretary *Windebank*[7] into this place of Service, of Trust, the very Broker and Pandar to the Whore of *Babylon*?
>
> Who is it, Mr. *Speaker,* but he only, that hath advanced all our Popish Bishops?[8]

Grimston goes on to charge Laud with having "sate at the Helm, to steer, and manage all the Projects that have been set on foot in this Kingdom this Ten years last past," of having licensed such monopolies as that on tobacco, "whereby Thousands of poor people have been stript, and turned out of their Trades," and concludes with the statement that "he hath been the great and Common Enemy of all Goodness, and Good men; and it is not safe that such a Viper should be near His Majesty's Person, to distil his Poyson into His Sacred Ears."[9]

Pym in his speech of February 26, 1640/41, detailing fourteen formal charges against the archbishop, censured him for "Pride without any Moderation; such a Pride as that is which exalts it self above all that is called God: Malice without any Provocation; Malice against Vertue, against Innocence, against Piety; Injustice, without any Means of Restitution, even such Injustice as doth rob the present Times of their Possessions, the future of their Possibilities."[10]

---

[7] Sir Francis Windebank, Secretary of State, was discovered to have signed letters of grace for Roman priests and Jesuits, and rather than face his accusers fled to the continent on December 10, 1640.
[8] John Rushworth, *Historical Collections, Part III* (London, 1692), I, 122.
[9] *Ibid.,* I, 122.
[10] *Ibid.,* I, 199.

The popular comparison of Laud to Wolsey, which recurs in the propaganda of the day,[11] is especially interesting here, since the episode from *The Cardinal* quoted above bears a certain resemblance to scenes in Shakespeare's *Henry VIII*,[12] and indeed, it is quite possible that Shakespeare's churchman served as one of the models for Shirley's title character. There is heavy emphasis on the cardinal's pride and power in the later play, on his "surfeit" and "avarice," and it is hardly to be wondered at if Laud's rise from humble origin, his habit of going abroad with forty or fifty mounted attendants and ushers crying "roome roome for my Lords grace. Gentlemen be vncouered my Lords grace is comming,"[13] and his spectacular fall recalled that dramatic revolution of Fortune's wheel which Cavendish had moralized in his *Life and Death of Thomas Wolsey*;[14] indeed, Cavendish's book, though well known in manuscript, appears to have first reached print in 1641 under the title *The Negotiations of Thomas Wolsey,* its text badly garbled and distorted with an explicit parallel to Laud tacked on the end. The fall from great height is certainly suggested by Antonio's speech in Act V:

> I would this soldier had the cardinal
> Upon a promontory. With what a spring
> The churchman would leap down! It were a spectacle
> Most rare to see him topple from the precipice
> And souse in the salt water with a noise
> To stun the fishes; and if he fell into
> A net, what wonder would the simple sea gulls
> Have to draw up the o'ergrown lobster,
> So ready boiled!
>
> (V.ii.107–15)

Shirley draws the proper moral when the dying cardinal is made to say to the king:

---

[11] See especially the following pamphlets: John Browne, *A Discovery Of the Notorious Proceedings of William Lavd . . . in bringing Innovations into the Church . . .* (London, 1641); *Canterbvries Dream in which the Apparitition of Cardinall Wolsey did present himself unto him . . .* (London, 1641); *Archy's Dream, sometimes Jester to his Majesty: With a relation for whom an odd Chair stood void in Hell* (London, 1641); *The Recantation of the Prelate of Canterbury Being his last advice to his Brethren the Bishops of England* (London, 1641), p. 22; *A True Description, Or Rather a Parallel between Cardinall Wolsey . . . and VVilliam Laud . . .* (London, 1641). See also Paul L. Wiley's excellent "Renaissance Exploitation of Cavendish's *Life of Wolsey*," *SP*, XLIII (1946), 139–40.

[12] R. S. Forsythe in *The Relations of Shirley's Plays to the Elizabethan Drama* (New York, 1914), p. 187, notes the parallel between the "accusations and recriminations" of Rosaura and the cardinal (*The Cardinal* II.iii) and those of Queen Katherine and Cardinal Wolsey in *Henry VIII* (II.iv and III.i).

[13] John Bastwick, *The Letany* (London, 1637), p. 6. Thomas Fuller (*Church History of Britain,* ed. J. S. Brewer [Oxford, 1845], VI, 301) contrasts Wolsey's love of silks and satins with Laud's customarily plain dress, but the comparison, in itself, is suggestive.

[14] Compare also the anti-Laudian satire. *Fortune's Tennis-ball Or, A Proviso for all those that are elevated, to take heed of Falling, for Fortune spights more the mightie then the poore* (London, 1640).

> I have deserved you should turn from me, sir.
> My life hath been prodigiously wicked.
> My blood is now the kingdom's balm. O, sir,
> I have abused your ear, your trust, your people,
> And my own sacred office; my conscience
> Feels now the sting.
>
> (V.iii.198–203)

The last words of the play strike the same note:

> How much are kings abused by those they take
> To royal grace, whom, when they cherish most
> By nice indulgence, they do often arm
> Against themselves; from whence this maxim springs:
> None have more need of perspectives than kings.
>
> (V.iii.295–99)

It would, of course, be absurd to suggest that Shirley's play represents a consistent political allegory, but these topical overtones seem to extend farther. The king in the play is represented as vacillating and weakly dominated by the cardinal, yet the portrait is of a monarch, well meaning but misguided, and no opportunity to approve of the Stuart theory of divine right is let pass. Among the dominant traits in the cardinal's character, as Shirley delineates him, are deviousness, hypocrisy, and ambition, qualities which Laud's enemies were ever ready to attribute to him. Antonio at one point says of the cardinal, "He carries angels in his tongue and face, but I / Suspect his heart" (V.ii.89–90), and in the exposition of the tragedy, where the audience is informed of the military situation, we find the following dialogue:

> *Alphonso.* The Aragonians,
> Violating their confederate oath and league,
> Are now in arms. They have not yet marched towards us,
> But 'tis not safe to expect if we may timely
> Prevent invasion.
>
> *2. Lord.* Dare they be so insolent?
>
> *1. Lord.* This storm I did foresee.
>
> *2. Lord.* What have they but the sweetness of the king
> To make a crime?
>
> *1. Lord.* But how appears the cardinal
> At this news?
>
> *Alphonso.* Not pale, although
> He knows they have no cause to think him innocent,
> As by whose counsel they were once surprised.
>
> *1. Lord.* There is more
> Than all our present art can fathom in
> This story, and I fear I may conclude
> This flame has breath at home to cherish it.
> There's treason in some hearts whose faces are
> Smooth to the state.
>
> (I.i.57–73)

Shirley never follows up this hint of the cardinal's treason in the war, and it is obviously meant primarily as a stroke of characterization. But when one remembers that Laud had been accused the same year the play was produced of confederating with "Priests and Jesuits," of striving to make "an Ecclesiastical Division of Religious Difference between us and Foreign Nations," just as he "hath sought to make a Civil Difference between us and his Majesty's Subjects of the Kingdom of *Scotland*,"[15] and when the alarming situation in Ireland could be thought of as merely the result of a diabolical foreign policy which Laud had sponsored, the political suggestions of this dialogue seem hard to resist. "Not pale" might even be taken by an astute audience for an allusion to Laud's complexion, which was notably rubicund,[16] but if this idea seems too fanciful, one may at least admit the general applicability to the archibishop of an exchange like the following:

> *1. Lord.* Take heed; the cardinal holds intelligence
> With every bird i' th' air.
> *2. Lord.* Death on his purple pride!
> He governs all.
> (I.i.20–22)

One could go carefully through the play pointing out trait by trait parallels between Shirley's characterization of the cardinal and the popular conception of Laud by his enemies—the deceit, cruelty, anger, ambition, hypocrisy, craft, and even lust[17]—but it is sufficient here merely to note the analogy in general terms, for it is hardly likely that anything else was intended by the author. That an audience at the Blackfriars might expect such topical suggestions is, however, sufficiently clear from Shirley's prologue, which literally alerts the house to "keep your fancy active till you know, / By th' progress of our play" that the reference is *not to France,* that is, to Richelieu. This deliberately mysterious tone about the play's subject matter accomplishes a double purpose—it invites a political interpretation at the same time protecting the poet, by its noncommittal pose, from any clear charge of libel:

> A poet's art is to lead on your thought
> Through subtle paths and workings of a plot,
> And where your expectation does not thrive,
> If things fall better, yet you may forgive.
> I will say nothing positive; you may
> Think what you please. We call it but a play.
> (*Prologue,* 7–12)

---

[15] Rushworth, I, 201.
[16] See Peter Heylyn, *Cyprianus Anglicvs* (London, 1671), p. 507.
[17] Laud's arch-enemy, William Prynne, puts this uncharitable construction upon two of the archbishop's prayers (*A Breviate Of The Life of William Laud* [London, 1644], pp. 29–30).

Since the comic epilogue seems to modern taste so inappropriate, one is tempted to suggest that the motive of disguise may lie behind it as well, for it is certainly free of *political* references.

The danger entailed by unflattering allusions to Anglican policy of the time is illustrated by a Puritan account of an incident that occurred in another London theatre:

> In the meane time let me tell ye a lamentable Tragedie, acted by the Prelacie, against the poore Players of the Fortune Play-house, which made them sing *Fortune my foe why dust thou frowne on me? &c.* for having gotten a new old Play, called *The Cardinalls Conspiracie,* whom they brought upon the Stage in as great state as they could, with *Altars, Images, Crosses, Crucifixes,* and the like, to set forth his pomp and pride. But wofull was the sight to see, how in the middest of all their mirth, the Puesevants came and seazed upon the poore Cardinall, and all his Consorts, and carried them away. And when they were questioned for it, in the high Commission Court, the[y] pleaded Ignorance, and told the Archbishop, *that they tooke those examples of their Altars, Images,* and the like, *from Heathen Authors.* This did somewhat asswage his anger, that they did not bring him on the Stage: but yet they were fined for it, and after a little imprisonment got their liberty.[18]

Such an incident indicates that Laud himself would have been quick to smell a rat at any critically unfavorable representation of a cardinal, and Shirley would probably not have dared bring forth his play if the archbishop had not been safely in prison and the High Commission by this time a matter of history.

The reading of political significance into a work of art is sufficiently out of fashion nowadays to make one cautious. In any event, the theory promulgated above needs more to support it than the mere illustration of similarities between an unpopular cleric and the arch-villain of a revenge tragedy. Shirley was no Puritan, and, as a loyal Royalist who was later to fight for his sovereign in the civil war, he would certainly have had few kind words for men of Pym's or Grimston's color.[19] Besides, the popular portrait of Laud which the above details of *The Cardinal* suggest was a radical distortion of the truth which anyone of Shirley's apparently sanguine temper and informed status might be supposed to reject out of hand. How likely is it, then, that Shirley would feel so strongly about Laud, or, supposing that he did, would undergo the considerable risk of expressing his sentiments on the stage? What, in brief, could be the motive behind these covert allusions?

To begin with, we know that during this period playwrights found it so difficult to repress comment on current affairs in their plays and that the court was sufficiently sensitive on this score

---

[18] Quoted from *A Second Discovery by the Northern Scout* (1642) in Leslie Hotson, *The Commonwealth and Restoration Stage* (Cambridge, Mass., 1928), pp. 3–4.

[19] See Shirley's ridicule of the Puritan Prynne in his dedication of *The Bird in a Cage* (*Works* II, 367–69).

that censorship grew increasingly severe. Shirley himself seems narrowly to have escaped official reprimand (or worse) for his comedy, *The Ball* (1632), in which, wrote Herbert, "ther were divers personated so naturally, both of lords and others of the court, that I took it ill, and would have forbidden the play, but that [Beeston, the manager] promiste many things which I found faulte withall should be left out, and that he would not suffer it to be done by the poett any more, who deserves to be punisht."[20] If this were not enough evidence of it, there is further testimony of Shirley's independence of mind in his dedication of *The Maid's Revenge,* where he boasts that he "never affected the ways of flattery,"[21] and in the prologue to *The Brothers,* where he satirizes the strictness of the censorship laws:

> He [the poet] says the times are dangerous; who knows
> What treason may be wrapt in giant prose,
> Or swelling verse, at least to sense? Nay, then,
> Have at you, master Poet. . . .[22]

Again in the prologue to *The Example* (1634) Shirley complains about the unreasonableness of the curbs on the writer's freedom which now more than ever before "fright the cause / Of unbefriended Poesy," adding a contemptuous reference to those "that wear the purple clothes, / Robes, I should say."[23]

Contemporary allusion must have been a box-office temptation, and when one remembers the unprecedented success of Middleton's *A Game of Chess* (1624), a play rejoicing over the failure of the plan for a Spanish marriage, it is not difficult to see why Fletcher, Massinger, and Shirley all succumbed to it at various times despite the risk.[24] For Shirley, writing in 1641, when plague and Puritan pressures were making the theatrical profession most insecure, the enticement must have been even greater. What, moreover, would pacify the Puritans so well and yet remain so palatable and entertaining to the large non-Puritan audience as a play implicitly attacking Laud? His fall from power was still news, he was awaiting trial in the Tower, and he must have symbolized to Shirley and the whole theatrical profession that detested Court of High Commission whose restrictive policy had pinched before, causing poets to "suffer for their guilt of truth and arts."[25] Also with this court

---

[20] Adams, *Herbert,* p. 19. Shirley redeemed himself the following year, for Herbert commended *The Young Admiral* for its "beneficial and cleanly way of poetry" (Adams, p. 19).

[21] *Works* I, 101.

[22] *Works* I, 191.

[23] *Works* III, 282.

[24] For a famous passage by Massinger which annoyed King Charles himself because of its allusion to royal methods of exacting revenue, see G. E. Bentley, *The Jacobean and Caroline Stage,* I (Oxford, 1941), 61.

[25] Prologue to *The Example* (*Works* III, 282).

abolished and its chief inquisitor safely behind bars, the risk of offending higher powers must have seemed considerably less.

It is entirely possible, however, that motives more personal than these lie behind Shirley's hostile glances at Laud in *The Cardinal.* Though Shirley's Roman Catholicism has never been conclusively proved, it has generally been assumed from Anthony à Wood's statement about his conversion in *Athenae Oxonienses,*[26] and Laud's policy toward recusants, particularly towards the end of his primacy, must have fanned the flames of outrage anew.[27] Moreover, Shirley, as "one of the Valets of the Chamber of Queen Henrietta Maria" and a "Servant to Her Majesty,"[28] must have felt an attachment to the very element at court which had all along been most hostile to Laud. Furthermore, Shirley had been in Ireland where, as a Catholic, he must have been impressed by the onerous burdens imposed upon the natives in order to maintain what, to them, was an unwanted and heretical church.

But if Wood's account of the poet is to be believed (and modern research has tended to confirm the general accuracy of his statements), Shirley and Laud had known each other personally at St. John's, Oxford, during the latter's tenure as president of that college. He records the following anecdote:

> At the same time Dr. Will. Laud presiding that house, he had a very great affection for him [Shirley], especially for the pregnant parts that were visible in him, but then having a broad or large mole upon his left cheek, which some esteemed a deformity, that worthy doctor would often tell him that he was an unfit person to take the sacred function upon him, and should never have his consent so to do.[29]

The story is quaint enough, and yet two of the extant portraits of Shirley show the mole,[30] and we find in *Chabot* (a play by Chapman revised by Shirley[31]) a passage which sounds suspiciously autobiographical on the subject of moles.[32] Shirley left Oxford for Cambridge, eventually entering the Anglican priesthood despite Laud's

---

[26] Ed. Philip Bliss, III (London, 1817), 737.

[27] As the charges of Laud's popery grew louder, he began to crack down on Catholics with new zeal, and in 1640 he introduced a canon *"For supressing of the growth of popery"* (see Laud's *Works* [Oxford, 1853] V, 616–20). It is interesting to note that the law was particularly harsh on schoolmasters in the houses of recusants, and since Shirley had once been a schoolmaster himself at St. Albans, a post which he may have had to resign because of his conversion to the Roman Church, he could well have felt strongly on the issue.

[28] See Bentley, *Jacobean and Caroline Stage,* V, 1069.

[29] *Athenae Oxonienses,* III, 737.

[30] These portraits are reproduced in A. H. Nason, *James Shirley, Dramatist, A Biographical and Critical Study* (New York, 1915), pp. 139, 151.

[31] For the relation of this play to contemporary affairs see N. D. Solve, *Stuart Politics in Chapman's 'Tragedy of Chabot'* (Ann Arbor, 1928).

[32] Here the garrulously comic Advocate, a Polonian figure, is made to exclaim of the defendant, "branded, marked, and designed in his birth for shame and obloquy, which appeareth further, by a mole under his right ear, with only three witch's hairs in't; strange and ominious [sic] predictions of nature" (V.ii [*Works* VI, 153–54]).

advice,[33] and there remains at least the possibility of a personal animosity, though Wood gives no hint of it.

But these speculations, though entertaining, shed but little light on the issue, and if Shirley intended *The Cardinal* to refer to the fallen archbishop, simple anticlericalism and the chance for a better financial return would be motive enough. Yet it is difficult to resist the delicious irony of the strategy which they imply—a Catholic playwright tapping anti-Catholic sentiment in his audience to attack the enemy of recusants—and for a profit! Puritans and Catholics make strange bedfellows, but this is precisely the kind of ingeniousness which characterizes Shirley's dramatic plots in general and that of *The Cardinal* in particular.

---

[33] By nature Laud was inclined to be superstitious and may have felt that the mole had some occult or supernatural importance. He would seem, however, to have been contravening one of the ancient "Canons Apostolical" of the primitive church (LXXVII) which implies that physical deformity is not ordinarily to constitute an impediment to receiving holy orders: "If any one who is otherwise worthy of the Episcopate be blind of an eye, or lame of a leg, let him be made [Bishop]; for it is not a blemish of the body, but a pollution of the soul, that defiles a man" (*Index Canonum*, ed. John Fulton [New York, 1883], p. 105). On the other hand Laud may have invoked the Old Testament qualifications for priesthood here or some later canon based upon them: "For whatsoever man *he be* that hath a blemish, he shall not approach: a blind man, or a lame, or he that hath a flat nose, or any thing superfluous, Or a man that is brokenfooted, or brokenhanded, Or crookbackt, or a dwarf, or that hath a blemish in his eye, or be scurvy, or scabbed, or hath his stones broken; No man that hath a blemish of the seed of Aaron the priest shall come nigh to offer the offerings of the Lord made by fire: he hath a blemish; he shall not come nigh to offer the bread of his God" (*Lev.* 21:18–21). The Roman Church today will not ordain a man "who is so visibly deformed that his appearance causes disgust, or laughter, or great surprise to the faithful." Canon 984 of the modern Code (1917) refers to "those who have no nose, or lips, or who have an ugly cancer on the face," but the judgment as to whether a physical defect "amounts to an irregularity or not rests with the Ordinary of the candidate who wishes to receive orders." See T. L. Bauscaren and A. C. Ellis, *Canon Law, A Text and Commentary* (Milwaukee, 1946), p. 375.

A COMPARISON OF *QUINTUS FIXLEIN* AND *SARTOR RESARTUS*

BERENICE COOPER
Wisconsin State College, Superior

It is logical to suppose that Carlyle may have been influenced by Jean Paul Richter's *Quintus Fixlein* in writing *Sartor Resartus.* During the ten years before Carlyle began writing his treatise on the "clothes philosophy," he had been absorbed in the study, criticism, and translation of German literature and had devoted considerable attention to Richter in particular. In 1827, he had written for *Frazer's Magazine* a critical review of Döring's *Life of Richter;* volume III of the four volumes of Carlyle's *German Romance* is devoted entirely to Richter. In 1830, after Carlyle had begun writing *Sartor Resartus,* he wrote a second essay, "Jean Paul Richter Again," which shows his continued admiration for the author of *Quintus Fixlein.* The facts of Richter's life—his poverty, his struggle upward from an inferior social position, his giving up theology for teaching, his ultimate success in literature—are similar enough to the facts of Carlyle's life to create a bond of sympathy as a foundation for such admiration.

Theodore Geissendoerfer has argued that Teufelsdröckh is a portrait of Richter. Carlyle's description of Richter's "wild, untamed energy" resembles his description of the Professor of Things in General as "the old wild seer." Both are characterized by boundless learning, patient research, and sympathy. Carlyle's description of Richter's style bears a close resemblance to the style of Teufelsdröckh.[1]

Some of the evidence for stylistic resemblances between *Sartor Resartus* and *Quintus Fixlein* which Henry Pape has presented is very convincing, although his detailed and painstaking study of choice of words, figures of speech, tendency to quote foreign writers, similarities in grammar, punctuation, and sentence structure depends largely upon rather far-fetched, literal resemblances and not enough upon similarities of general form and philosophical content.[2]

In opposition to the thesis that Richter profoundly influenced Carlyle's style, Archibald MacMechan and J. A. Froude maintain

[1] "Carlyle and Jean Paul Frederick Richter," *Journal of English and Germanic Philology,* XXV (1926), 546–48; 548–53.
[2] *Jean Paul als Quelle von Thomas Carlyles Anschauungen und Stil,* Rostock, 1904.

that Carlyle's style was formed before he began the study of German and that it is the product of the Annandale environment. Froude cites Carlyle's own statement on the development of his style:

> . . . the most important part by far was that of nature, you would perhaps say, if you have ever heard my father speak or my mother, and her inward melodies of heart and voice.[3]

Later studies of Carlyle by Wilson and by Cazamian accept the influence of Richter in a general way.[4]

It is the purpose of this paper to show by specific comparisons of *Sartor Resartus* and *Quintus Fixlein* that in spite of general similarities in narrative form, philosophical content and literary style between these two books, Carlyle's *Sartor Resartus* is a distinctively original work and not an imitation of *Quintus Fixlein.*

A general resemblance between *Quintus Fixlein* and *Sartor Resartus* must be admitted. Each is an *Erziehungs-* or *Bildungs-Roman,* a spiritual biography, including some pedagogical matter, the love story of the hero, and much mystical philosophy applied to the criticism of the selfishness and hypocrisy of a materialistic age. The purpose of both authors is to keep living a faith in spirit and in beauty. But along with this general resemblance go specific differences in content and in form.

Attention is often called to the similarity of the narrative device in the two books. Both authors act as editors: Carlyle pretends to receive Teufelsdröckh's manuscript in six paper bags marked with signs of the zodiac; Richter is given by Quintus Fixlein some autobiographical sketches which have been filed in the pigeon-holes or letter-boxes of his child's-desk. It is reasonable to suppose that the division of *Quintus Fixlein* into fifteen letter-boxes might have suggested to the translator the suitability of a similar device for the unusual book he was planning. But Carlyle invented for himself greater editorial difficulties, for the paperbags contained "miscellaneous masses of Sheets, and oftener Shreds and Snips." Richter had an easy task of editorship, for Fixlein's manuscripts were as neatly prepared as we should expect to find the work of an author whose most interesting contribution to learning was *A Collection of Errors of the Press.*

Another difference in content and form is that *Quintus Fixlein* contains more narrative material than does *Sartor Resartus.* In the latter there are merely the biographical facts that explain the storm and stress out of which Teufelsdröckh develops his philosophy; more pages are devoted to expounding this idealistic philosophy

[3] "Preface," Athenaeum edition (New York, Ginn and Company, 1905), p. XLVII; J. A. Froude, *Thomas Carlyle* (New York, Scribner's, 1882), I, 323, 324.

[4] Louis Cazamian, *Carlyle* (New York, MacMillan, 1932), pp. 50–51; D. A. Wilson, *Carlyle* (New York, E. P. Dutton, 1924) II, 111.

than to sketching the biography. The German romance sustains the narrative to the end of the last chapter and weaves the philosophy into the warp of the narrative. A brief summary of *Quintus Fixlein* will show this difference in emphasis and structural form.

Egidius Zebedaeus Fixlein, master of the fifth form in a German gymnasium, is ambitious to become pastor of Hukelum. His patroness, Frau Aufhammer, offers him as a substitute honor the conrectorship of his gymnasium. When she dies the following spring, she remembers him in her will with a splendid bed, a ducat for every year of his life, and the remuneration of his quintusship and conrectorship fees. By the mistake of a messenger who does not discriminate between two spellings of the same name, Egidius Fixlein receives the desired appointment as pastor of Hukelum, which was intended for Hans Füchlein. This mistaken appointment makes possible Fixlein's marriage to Thiennette.

It is a superstition in Fixlein's family that all the men die on or before their thirty-second birthday. Fixlein postpones his wedding until after he has survived the fatal day, or the day he believes to be his thirty-second birthday. There is some uncertainty about the age because the parish records had been destroyed when the church burned. As pastor of Hukelum, Fixlein's greatest project is the raising of money for a new steeple-ball for his church. Upon the removal of the old steeple-ball and the reading of the records it contains, Fixlein discovers that he is one year younger than he supposed and that the next day is his thirty-second birthday.

Immediately he falls ill of a fever, but he is cured by a simple therapeutic method suggested by his biographer: his mother brings his childhood toys to his bedside and talks to him as if he were a child and the almanac clock is moved ahead eight days so that upon awakening Fixlein believes that he has safely passed the fatal birthday. The narrative concludes with a sentimental farewell of the author to Thiennette and her husband as they leave the quiet hamlet of Hukelum for the noisy strife of the world.[5]

This summary of only the main narrative elements in *Quintus Fixlein* shows its greater proportion of narrative in comparison with *Sartor Resartus* in which the narrative is subordinated to the "clothes philosophy" and confined to five chapters of Book Two.

From even so brief a summary of the narrative in *Quintus Fixlein,* the difference in the character of the two heroes is apparent. Fixlein is a quiet, passive man with one ambition, which he realizes through another's mistake, and one fear, which he conquers through the loving deception of his family. The volcanic Teufelsdröckh fights

[5] Jean Paul Richter, "Quintus Fixlein," translation by Carlyle, *German Romance* (Edinburgh, Tait, 1827), III, 154–345. All references to *Quintus Fixlein* in the text of this paper are to this translation.

his own battles; he may be a portrait of Richter but certainly he does not resemble Fixlein.

The relation of the love story to the motivation of the hero's character is entirely different in the two books. Teufelsdröckh can not marry Blumine because he is poor and beneath her in social position; the issue of his love is black despair until he hears in his soul the "Everlasting Yea." Fixlein loves a girl of his own class and their marriage serves to right an injustice done her, for Frau Aufhammer had died before completing that part of her will in which she intended to remember Thiennette.

Georg Brandes calls Richter a writer of realistic idyls,[6] and *Quintus Fixlein* has, indeed, that peculiar mingling of a romantic and sentimental atmosphere with homely realistic details which justifies such a characterization. The domestic scenes in the mother's garden cottage and later in the parsonage, the descriptions of the wedding crowds, of Fixlein's moving to Hukelum, and of the preparation for Thiennette's birthday celebration, the scenes connected with the raising of the steeple-ball, the humor of the students' fishing for the professor's hens, the details of the barn used for a church—these are convincing German scenes; the characters are flesh and blood persons in spite of the idyllic frame for the picture and the euphuistic flavor of the style.

Since *Sartor Resartus* contains so much more of philosophical exposition than of biographical narrative, there is not the opportunity for the kind of realism which *Quintus Fixlein* contains. Instead of the realistic tone, the few events of Teufelsdröckh's life are related in the manner of the modern stream-of-consciousness novel and the descriptions are given in an impressionistic style. Teufelsdröckh in his tower, in spite of realistic touches in the descriptions of the disorder, is not as real a figure as Fixlein in his cottage home, his gymnasium, his church, and his parsonage.

These differences in narrative emphasis, in the character of the hero, and in realistic detail indicate that Carlyle was by no means modeling *Sartor Resartus* on the romance he had just translated.

Another general resemblance between these two books is the idealistic philosophy expressed in each, but when the elements in these philosophies are placed side by side, certain individual differences appear. Pape in his study (p. 42) maintains that Carlyle got his "clothes philosophy", even the Swift influence, through Richter. But Carlyle's use of clothes as a symbol for the superficial and visual world is a metaphor consistently sustained throughout *Sartor Resartus*, while the references to clothes in *Quintus Fixlein* are more incidental to separate descriptions or comments. The follow-

[6] *Main Currents in Nineteenth Century Literature* (London, Heineman, 1902) II, 66.

ing passages cited by Pape illustrate this difference which Pape has ignored in arguing for Richter's influence upon Carlyle.

> For him a garment was a sort of hollow half-man, to whom only the nobler parts and the first principles were wanting: he honoured these wrappages and hulls of our interior. (p. 129)
>
> the crazy philosophers in *Gulliver's Travels* who, for social converse, instead of the names of things, brought the things themselves tied up in a bag; (p. 166)
>
> This afternoon she had been over . . . visiting the white-muslin Thiennette. (p. 136)
>
> It might be that, as according to Tristam Shandy, clothes; according to Walter Shandy and Lavater, proper names exert an influence on men. . . . (p. 168)

There is also the humorous metaphor with regard to Fixlein:

> He purposely remained in his own Edition in Sunday Wove-paper: I mean, he did not lay aside his Sunday coat. . . . (p. 138)

Then there is the remark, which Pape missed, about the Kräutermütze (herb-cap) which the parson put on to strengthen his memory:

> 'Would to heaven,' said I, 'that Princes, instead of their Princely Hats, Doctors, and Cardinals, instead of theirs, and Saints instead of their martyr crowns, would clap such memory-bonnets on their heads!' (p. 303)

It is true, as Pape has pointed out, that Carlyle almost quotes Richter in calling clothes "those Shells and outer husks of the body" and that he refers to Walter Shandy's insistence that there is much in names.[7] (II, i, 88). These two resemblances, one a natural result of their both knowing a book that any well-read man of the time would know, are perhaps not evidence of a profound influence of Richter upon Carlyle's style, but rather evidence that the two writers shared an interest in symbols.

Of greater importance than any mere similarity of phrasing is the idealistic character of the philosophy in both books. To Richter as well as to Carlyle, the material world is a symbol of the invisible God. Richter wrote:

> I looked up to the starry sky, and an everlasting chain stretches thither, and over and below; and all is Life and Warmth and Light, and all is God-like or God. . . . (p. 309)

Carlyle would enjoy translating such a passage, for he wrote:

> Is not God's universe a Symbol of the Godlike; is not Immensity a Temple? . . . Listen, and for organ-music thou wilt ever, as of old, hear the morning stars sing together (III, vii, 251)
>
> . . . Through every star, through every grass-blade, and most through every living soul, the glory of a present God still beams. (III, viii, 261)

[7] *Sartor Resartus* (New York, A. L. Burt, n.d.) Book II, chapter i, page 88. All references within this paper to *Sartor Resartus* are to book, chapter, and page in this edition.

Richter has no greater respect for mere reason than has Carlyle. In *Quintus Fixlein,* the author addresses his hero thus:

> How didst thou behave thee in these hot whirlpools of pleasure?—Thou movedst thy Fishtail (Reason), and therewith describedst for thyself a rectilineal course through the billows. (p. 241)

Carlyle's well-known attitude toward reason as second to intuition may be illustrated by this question:

> Shall your science proceed in the small chink-lighted, or even oil-lighted, underground workshops of Logic alone? (I, x, 69)

In the philosophy of happiness of the two writers there are more significant likenesses and differences. Richter gives three ways to happiness:

> The first, rather an elevated road, is this: To soar away so far above the clouds of life, that you see the whole external world, with its wolf-dens, charnel-houses, and thunder-rods, lying far beneath you, shrunk into a little child's garden. The second is: Simply to sink down in this little garden; and there to nestle yourself so snugly, so homewise, in some furrow, that in looking out from your warm lark-nest, you likewise can discern no wolf-dens, charnel-houses or thunder-rods, but only blades and ears, every one of which, for the nest bird, is a tree, and a sun screen, and rain screen. The third, finally, which I look upon as the hardest and cunningest, is that of alternating between the other two. . . .
>
> every mortal with a great Purpose, or even a perennial Passion . . . all these men fence themselves in by their internal world against the frosts and heats of the external. . . . (p. 116)

Furthermore, Richter states that his purpose in publishing *Quintus Fixlein* is "not so much to procure you a pleasure as to teach you how to enjoy one" (p. 115) and that "I may show to the whole earth that we ought to value little joys more than great ones." (p. 118) In the last letter box, Richter gives again "elementary principles of the science of happiness':

> Enjoy thy Existence more than thy Manner of Existence . . . Stake in no lotteries,—keep at home,—give and accept no pompous entertainments,—travel not abroad every year! . . . Despise Life, that thou mayst enjoy it!—Inspect the neighborhood of thy life; every shelf, every nook of thy abode; and nestling in, quarter thyself in the farthest and most domestic winding of thy snail house!—Look upon a capital but as a collection of villages, a village as some blind alley of a capital; fame as the talk of thy neighbors at the street-door; a library as a learned conversation, joy as a second, sorrow as a minute, life as a day; and three things as all in all: God, Creation, Virtue! (pp. 300–01)

Concluding his book with a farewell walk with Fixlein and Thiennette, Richter looks back sadly at the little village of Hukelum and pictures its simple life:

> . . . the happy hamlet, whose houses were all dwellings of contented still Sabbath-joy, and which is happy enough, though over its wide-parted

> pavement stones there passes every week but one barber, every holiday but one dresser of hair, and every year but one hawker of parasols. (p. 306)

Something of this same perspective is expressed throughout the spiritual conflict of Teufelsdröckh. In his first agony of soul, he turns to nature for healing. In the grandeur of the mountains he says:

> . . . it seems as if Peace has established herself in the bosom of Strength. (II, vii, 152)

As he views a magnificent sunset:

> . . . he felt as if Death and Life were one, as if the Earth were not dead, as if the Spirit of the Earth had its throne in that splendor, and his own spirit were therewith holding communion. (II, vi, 153)

After passing through the darkness of "The Everlasting No" and "The Centre of Indifference," he found light and peace in his philosophy of self-annihilation and work:

> There is in Man a Higher than Love of Happiness: he can do without Happiness, and instead thereof find Blessedness! . . . Love not Pleasure; love God . . . Do the Duty which lies nearest thee . . . and working, believe, live, and be free. (II, ix, 189, 191–92)

Although there is agreement here that happiness is based upon a spiritual emancipation from a material world, Richter does not concern himself with Carlyle's idea of renunciation. Carlyle's doctrine of "Produce! Produce!" is a social message. Richter's philosophy of happiness is self-centered: he gets away from the ugliness of the world by soaring above it or nestling behind a lovely thing that shuts out the sight of the ugly. Carlyle would cultivate the garden; Richter would snuggle down between the furrows, screened by the blades and ears.

Both writers show sympathy with humble laboring people. The settings of *Quintus Fixlein* are simple cottage rooms and rural landscapes. The story opens with Fixlein walking through the country toward his mother's home; his mother is working in the kitchen when he arrives; her home is the gardener's cottage of the castle of Aufhammer; the country church-yard, the church, and the parsonage are important in the story. The descriptions and narratives are from the lives of people who work for their living.

Richter has sympathy for the down-trodden government clerks:

> What can it profit the poor quill-driving brethren, whose souls have not even wing-shells, to say nothing of wings? Or these tethered persons with the best back, breast, and neck-fins, who float motionless in the wicker Fish-box of the State, and are not allowed to swim, because the Box or State, long ago tied to the shore, itself swims in the name of the fishes? To the whole standing and writing hosts of heavily-laden State-domestics,

> Purveyors, Clerk of all departments, and all the lobsters packed together heels over head into the Lobster-basket of the Government office-rooms, and for refreshment, sprinkled over with a few nettles; to these persons, what way of becoming happy *here*, can I possibly point out? (p. 117)

Richter's answer is that by taking a compound microscope and discovering

> that their drop of Burgundy is properly a Red Sea, that butterfly dust is peacock's feathers, mouldiness a flowery field, and sand a heap of jewels. (pp. 117–118)

a man may win happiness with "not great but little good-haps."

This sympathy with the worker and this insistence upon realizing the spiritual significance of the ordinary and near-at-hand is found also in the descriptions of Teufelsdröckh's childhood home and in Carlyle's praise of the worker:

> Two men I honor, and no third. First, the toilworn Craftsman that with earthmade Implement laboriously conquers the Earth, and makes her man's. . . . A second man I honor, and still more highly: Him who is seen toiling for the spiritually indispensable; not daily bread, but Bread of Life. . . . Unspeakably touching is it, however, when I find both dignities united; and he that must toil outwardly for the lowest of man's wants, is also toiling inwardly for the highest. (II, iii, 225–26)

Carlyle feels a bond of brotherhood with the laborer:

> O my Brother, my Brother, why can I not shelter thee in my bosom, and wipe away all tears from thine eyes! (II, ix, 186)

A highly idealized conception of human relationships is apparent in the poetic picture of love and of women in *Quintus Fixlein*: Thiennette is "like a lily dipt in the red twilight", "a smooth, fair-haired, white-capped dove," "a gentle soul"; the bethrothal of Fixlein and Thiennette is a tender spiritual experience; their married life is a "Greek fire of moderate and everlasting love". (pp. 138, 140, 141, 199–200, 278.) Richter believes that

> Love, like men, dies oftener of excess than of hunger. (p. 233)

Since Teufelsdröckh's love ends in frustration and despair, there is not the same tone in the passages about love and women, yet to him love is

> a discerning of the Infinite in the Finite, of the Idea made Real. (II, v, 143)

and he had a few, short ecstatic days with Blumine.

As we should expect from idealistic philosophers, both writers believe in peace. Richter concludes his book with these words:

> Ah retire, bloody war, like red Mars; and thou still Peace come forth like the mild divided moon. (p. 309)

Carlyle asks ironically:

> Or what will any member of the Peace Society make of such an assertion as this: "The lower people everywhere desire war. Not so unwisely; there is then a demand for lower people—to be shot!" (III, vii, 248)

Both writers satirize the materialism, selfishness, and pettiness which prevent the realization of the ideal. Richter describes the selfish struggle as

> the rioting, fermenting Court-sphere, where men in bull-beggar tone demand from Fate a root of Life-Licorice, thick as the arm, like the botanical one on the Wolga, not so much that they may chew the sweet beam themselves, as fell others to earth with it. (p. 306)

Teufelsdröckh tells us that the divine command has faded away from remembrance and its opposite "Thou shalt steal" is everywhere promulgated. He pictures the world as a place where

> each, isolated, regardless of his neighbor, turned against his neighbor, clutches what he can get and cries 'Mine' . . . on all hands hear it passionately proclaimed: *Laissez faire.* (III, v, 229–30)

Frau von Aufhammer is described as "lively, pious, and proud" and satirized for her patronizing manner toward Fixlein:

> Her heart was a flowing cornucopia to all men, yet this not from philanthropy but from rigid devotion: the lower classes she assisted, cherished, and despised, regarding nothing in them, except it were their piety. (p. 143)

This passage is typical of Richter's less sympathetic attitude toward the nobility and public officials than toward Fixlein and his household. One idyllic quality of his book is its implied premise that simple country people are inherently noble. Carlyle has a similar prejudice against the aristocracy which colors the Blumine episode and appears in Teufelsdröckh's lyric tribute to the "toil-worn Craftsman." (II, iii, 225.)

Both writers show their contempt for greed and graft. Richter takes occasion to satirize the power which Frau Aufhammer has to bestow an academic promotion upon Fixlein and to comment thus upon the whole corrupt appointive system:

> The Town-Syndic drove a trade in Hamberg candles; and the then Burgermeister in coffeebeans. . . . Their joint traffic, however, which they counted on exclusively, was in the eight school-offices of Flachenfingen. . . . Properly speaking, the Councillor derives his freedom of office-trading from that principle of the Roman law: . . He who has the right of giving anything away, has also the right to dispose of it for money, if he can. Now as the council-members have palpably the right of conferring offices gratis, the right of selling them must follow of course. (pp. 164–5.)

Richter continues with a long ironic argument for the preservation of the rights of selling offices rather than for bestowing them

merely "for connexions, relationships, party recommendations and bowings and cringings." In order to prevent such evils, he suggests separating the virtues of the office from the office and selling it with or without the virtues, hereby increasing the cash business.

Although Carlyle's hatred of greed and graft in all forms is not expressed in this kind of light humorous tone and his irony, as in the famous passage on hunting down the paupers (II, iv, 227), resembles Swift's bitter irony more than Richter's gentle restraint, both despise these vices. The difference of tone has been well-characterized by Carlyle, who said of Richter, "His very contempt is placid and tolerant."[8]

Petty ambition and jealousy is satirized by Richter through Hans Füchlein's feelings of superiority toward Egidius, who has not purchased a patent nobility and who does not spell his name the aristocratic way, through Hans' envy of his rival's promotion, through the desire of the peasants to have their names and those of their children in the new steeple ball. With such materialistic concerns Carlyle, too, would have no patience.

The pedagogical element contained in both books shows a scorn for pedantry, which is perhaps one way in which academic pettiness manifests itself. Richter makes fun of Fixlein's learned works:

> He had labored—I shall omit his less interesting performances—at a *Collection of Errors of the Press* in German writings: he compared *Errata* with each other; showed which occurred most frequently; observed that important results were to be drawn from this, and advised the reader to draw them. (pp. 146–47)

Fixlein observed that

> The Jews had their *Masora* to show, which told them how every letter was to be found in their Bible; . . . But have we Christians any similar Masora for Luther's Bible to show? Has it been accurately investigated which is the middle word or the middle letter here, which vowel appears seldomest, and how often each vowel? Thousands of Bible Christians go out of the world, without ever knowing the German A occurs 323,015 times (therefore above 7 times oftener than the Hebrew one) in their Bible. (p. 147)

Carlyle's scorn for pedantry is more serious and bitter:

> My teachers, says he [Teufelsdröckh], were hide-bound pedants. . . . How can an inanimate, mechanical gerund-grinder foster the growth of anything? . . . How shall *he* give kindling, in whose own inward man there is no living coal, but all is burnt out to a dead grammatical cinder? (II, iii, 106)

The reference to Fixlein's leaving "the Death-valley of the Gymnasium" where one "mounts from one degree to another, not very

[8] *German Romance*, III, 14.

dissimilar to the common torment of Hell" reflects Richter's own distaste for a profession where

> merits are always rewarded by more opportunities for new merits; and often enough he [the schoolmaster] is not dismissed from his post at all. (p. 232)

To Fixlein, the life of a pastor seemed like Paradise in contrast to the life of a Quintus, for

> Here dwells no envy, no colleague, no Subrector; here in the heavenly country, no man works in the *New Universal German Library* . . . here the Perfected requires no more increase of knowledge. . . . Here too one need not sorrow that Sunday and Saint's day so often fall together into one. (p. 231)

Ignoring some sly satire on the disposition of Fixlein and the general attitude of clergymen toward intellectual growth, we may note that the feeling of Fixlein for academic life is similar to that of Teufelsdröckh for "the worst of all hitherto discovered universities" with

> a small ill-chosen library; . . . certain persons, under the title of Professors, being stationed at the gates, to declare aloud that it was a University. (II, iii, 110–11)

The picture of the school life of Teufelsdröckh from the elementary school through the gymnasium and the university is an unhappy, uninspiring experience. Fixlein as a teacher in a German gymnasium finds academic life a burden and a torture.

These examples show the philosophy of the two books to be similar in general character: each expresses a spiritual interpretation of life and of happiness and satirizes all forms of materialism and greed that are inconsistent with this idealism. The two authors agree that the complex life of a mechanical age enslaves the soul, that freedom is found in human relations through a spirit of love, and that simple virtue seems to be associated with simple living.

In addition to the general resemblances of *Quintus Fixlein* and *Sartor Resartus* in narrative devices and in philosophical background, there are certain likenesses in style to which attention has frequently been called. Professor MacMechan cites Thoreau's statement that Carlyle's description of Richter's style is a good analysis of his own and says that Lowell, too, felt that Carlyle was profoundly influenced by Richter.[9] MacMechan does not agree with this conclusion but prefers to accept Froude's opinion that Carlyle's style is not German at all but rather the result of the Annandale environment.

Any reader of *Sartor Resartus* will note that Carlyle's capitalization of nouns and use of compounded words suggest a German in-

[9] "Preface," Athenaeum edition, pp. xiv–xv.

fluence, but these are the superficial characteristics of the style. An analysis of the style lying within the language of the two books shows some resemblances but also differences supporting the originality of Carlyle and his superiority to Richter in many qualities of his language. A comparison of these style characteristics is significant: intrusion of the personality of the author, lyric qualities of the prose, use of figurative language, sentimentality, humor, impressionistic description, wealth of illusion, sentence structure, and diction.

Jean Paul intrudes himself all through the narrative by addressing the characters:

> Sleep, for today, though thou hast done nought ill
> . . . All prosperity attend thee, thou foolish Quintus! (pp. 141–42)
> And besides, dear Fixlein. . . . How didst thou behave . . . ? (p. 241)
> Happy Fixlein! . . . How shall I paint thee . . . . ? (p. 244)
> Good-night, old Fixlein! I am tired. (p. 259)
> O Thiennette, go away from the sick bed. . . . (p. 294)

He introduces his own personality by adding comments about himself such as these:

> For toward the critical Starchamber of the Reviewers he entertained not the contempt which some authors actually feel—or only affect, as for instance, I. (p. 257)

> And here must I in reference to those reviewing Mutes, who may be for casting the noose of strangulation around my neck, most particularly beg, that, before so doing on account of my Chapters being called Letter-boxes, they would have the goodness to look whose blame it was, and to think whether I could possibly help it, seeing the Quintus had divided his Biography into such Boxes himself. (pp. 150–51)

Several times he addresses the reader in this informal fashion:

> I lied not, for so it is. . . . But look in the note. (p. 285)

And there follows a footnote supporting the truth of the statement. Then he reminds the reader that he is reading by explaining that a scene was without witnesses

> except the two or three thousand readers who are peeping with me through the window. (p. 252)

Carlyle sometimes addresses Teufelsdröckh directly:

> Poor Teufelsdröckh! It is clear to demonstrate thou art smit. (II, vi, 143)
> Unhappy Teufelsdröckh! Though neither Fleet nor Traffic, nor Commodores pleased thee. . . . (II, v, 133)

He does not, so often as Richter, follow his exclamation of address with a sentence of direct address. Oftener the third person is used:

> Too-heavy-laden Teufelsdröckh! Yet surely his bands are loosening. (II, vii, 180)

Another difference between the two books is that Jean Paul becomes a character in his book by arriving to visit Fixlein. Carlyle's connection with his hero remains that of editor.

The lyric quality of the prose is a marked stylistic resemblance between *Quintus Fixlein* and *Sartor Resartus*. These passages from Richter will illustrate:

> Rise, fair Ascension and Marriage day and gladden
> readers also! Adorn thyself with the fairest jewel,
> with the bride, whose soul is pure and glittering
> as its vesture. (p. 242)
> O never fall, thou lily of Heaven, and may four
> springs instead of four seasons open and shut
> thy flower-bells to the sun! (p. 247)
> White night-butterflies flitted,
> white blossoms fluttered,
> white stars fell,
> and the white snow-powder hung silvery
> in the high shadow of the Earth,
> which reaches beyond the moon,
> and which is our Night.
> Then began the Eolian Harp of the Creation
> to tremble and to sound, blown on from above,
> and my immortal soul was a string in this Harp. (p. 308)

Readers of Carlyle have often commented upon the lyric quality of the concluding paragraphs of "The Everlasting Yea."

> But it is with Man's Soul as it was with Nature:
> the beginning of Creation is—Light . . .
> The mad primeval Discord is hushed;
> the rudely jumbled conflicting elements
> bind themselves into separate Firmaments:
> deep silent rock foundations are built beneath;
> and the skyey vault with its everlasting Luminaries above: instead of a dark wasteful chaos, we have a blooming, fertile, heaven-encompassed World. . . . I too could not but say to myself: Be no longer a Chaos but a World, or even a Worldkin! Produce! (II, ix, 193–94)

There is also the dithyramb on silence from the chapter "Symbols":

> The benignant efficacies of Concealment who shall speak or sing? Silence and Secrecy! Altars might still be raised to them. . . . Silence is the element in which great things fashion themselves together. . . . Speech is of Time, Silence is of Eternity. (II, iii, 215–16)

Although the prose style of both authors takes on a poetic quality at times, the passages just quoted illustrate a typical difference in that poetic quality. Richter is highly ornamented, self-centered, relating the universe to man. Carlyle's vision is of a vast universe to which he seeks to relate man, and his language is appropriate and dignified, without the prettiness of decoration which characterizes Richter.

Further examination of the figurative language shows the superiority of Carlyle. Richter strains for effects, piles on metaphors so profusely that the prose is ridiculously overburdened with them at times, in spite of the beauty in some of his luxuriant passages. A comparison of these two descriptions of sunsets, the first from *Quintus Fixlein,* the second from *Sartor Resartus,* will illustrate the difference in the use of figurative language:

> I see the Sun standing amid roses in the western sky, into which he has thrown his ray-brush wherewith he has been painting the earth. (p. 261)
>
> A hundred and a hundred savage peaks, in the last light of Day; all glowing, of gold and amethyst, like giant spirits of the wilderness. . . . (II, vi, 153)

Richter is fond of personification. These examples seem natural and unstrained:

> The Spring was standing like a conqueror, with Winter at its feet. (p. 248)
> Winter commencing his ice-painting on the windows. (p. 258)

But less successful are figures like these:

> And so Delirium dyed for itself rosy wings in the Aurora of life, and fanned the panting soul,—(p. 296)

When it comes to the figurative language used in the love episodes, there are interesting similarities and differences. Many writers have compared love to an electric force. Both Richter and Carlyle use such comparisons. Richter says:

> The fingers are electric dischargers of a fire sparkling along every fibre. . . . (p. 193)

Carlyle's chapter "Romance" abounds in figures drawn from electricity:

> It is this approximation of the Like and Unlike that such heavenly attraction, as between Negative and Positive, first burns out in a flame. (II, v, 134)
>
> In the conducting medium of Fantasy, flames forth that fire-development of the universal Spiritual Electricity, which, as unfolded between man and woman, we first emphatically denominate Love. (II, v, 134)

He speaks of love also as "Electric, Promethean glance." (II, v, 136) But he does not stop with this imagery. Love for him becomes a "volcanic, earth-bringing, all consuming fire" with explosions "more or less Vesuvian." In the inner nature of his hero there is a "nitre of latent passion and sulphurous humor enough." After the "mad explosion, painfully lacerating the heart itself," there remains "only the crater of an extinct volcano." (II, v, 136–37) Richter has no figures to correspond with these. For him, love is a force operating more quietly, "a Greek fire of a moderate and everlasting love." As in the case of several other comparisons, there

appears the greater dynamic force of Carlyle; his impatient, violent energy contrasts with the calmer sentimentalism of Richter.

With respect to Blumine and Thiennette the language is similar. Blumine is a "Goddess of Flowers," a "Rose-Goddess." (II, v, 138, 140) Thiennette is like a "lily dyed in the red twilight"; she resembles an Italian flower. (pp. 138, 190) "She herself was a little conscious . . . that she was bending her flower-leaves imperceptibly toward a terrestrial body, namely toward Fixlein." (p. 190) Not only are women flowers, but they are angels, and figures from Paradise abound in the Fifth Chapter, Book Two of *Sartor Resartus* and the Fifth Letter-Box of *Quintus Fixlein,* the latter always carrying the comparison to greater extremes.

The more one studies Richter's figurative language, the more he feels the superiority of Carlyle's. *Quintus Fixlein* is heavily-laden with metaphor, simile, and personification of the over-strained type; Carlyle uses striking language, picturesque language, but there is never in it that anxiety for effect that easily becomes ridiculous. Carlyle's style has a grotesque strength, but Richter's is weakened by the weight of the ornaments which he piles on. As an example of such a defect take this figure from a description of Fixlein's sermon writing:

> . . . there digging out a marrowy sentence, here clipping off a song blossom with both to garnish his homilectic pastry. (p. 235)

Or take this description of Fixlein's gazing lovingly at Thiennette:

> Fixlein . . . began to unrol the spiral butterfly's-sucker of his vision, and to lay it on the motionless leaves of this same sleeping flower. (pp. 189–90)

Carlyle is not guilty of a conceit of this type.

Such defects of over-ornamentation in Richter may be the product of a sentimentality which Carlyle does not share. Jean Paul is conscious of this attitude, but he is too much of a German Romanticist to want to change it. In one of his characteristic addresses to himself, he says:

> I would even now—for I still recollect how I hung with streaming eyes over these two loved ones, as over their corpses—address myself and say: Far too soft *Jean Paul* whose chalk still sketches the models of Nature on a ground of Melancholy; harden thy heart like thy frame, and waste not thyself and others by such thoughts. Yet why should I do it, why should I not directly confess what, in the softest emotion, I said to these two? (p. 307)

He believes in the necessity of tears and their value:

> the fire of love like that of Naphtha likes to swim on water. (p. 193)
>
> The heart . . . was plunging with all its wounds in warm streams of tears to be healed; as chapped flutes close together by lying in water and get back their tones. (p. 198)
>
> The Harmonica-bells in man which sound to the tones of a higher world, must, like glass Harmonica-bells, if they are to act, be kept moist. (p. 196)

Fixlein behaves like the sentimental hero, weeping when the steeple-ball is hung, falling ill because of fear.

Like many writers of the sentimental school, Richter's romanticism has a gloomy aspect. Throughout *Quintus Fixlein* there is preoccupation with death; this is not true of *Sartor Resartus*. Fixlein's life is overshadowed by the fear of death on his thirty-second birthday. The memories of the younger brother who was drowned move like a ghost through the narrative. (p. 250–54) On the evening of their marriage day, Fixlein and Thiennette go to the grave of Fixlein's father and address his spirit while Thiennette feels the ghosts of her parents arise. The day of joy is concluded with "a holy embrace at a father's grave." (p. 250) When Thiennette becomes pregnant, she expects to die and the unborn child is compared to a "little angel sculptured on a grave stone." (p. 254)

Carlyle has none of this kind of melancholy. His melancholy is social; it grows from a despair over the materialistic, mechanical philosophy of his age.

To offset the almost sickening effect of Richter's sentimentality and romantic gloom, there is his whimsical humor. Vaughan analyzes it as a "collation of incongruous images and ideas from his miscellaneous reading."[10] Though the following images are not easily identified as drawn from miscellaneous reading, they do illustrate the collocation of incongruous ideas.

> Our Hekelum voyager could still, after evening prayers, pick leaf-insects, with Thiennette, from the roses; worms from the bed, and a Heaven of joy from every minute. (p. 155)
>
> He then softly wakened his mother . . . and she had the city cook to waken who, like several other articles of wedding-furniture, had been borrowed for a day or two from Flachsenfingen. (p. 243)

In describing the service at the placing of the new steeple-ball, Richter says that the pastor offered

> a prayer for Mr. Stechman the slater (who was already hanging on the outside of the steeple and loosening the old shaft); and entreated that he might not break his neck, or any of his members. (p. 280)

There is a gentle whimsical quality in his complaint that other months besides May deserve poetical night-songs much more, hence:

> I myself have often gone so far as to adopt the idiom of our market women, and instead of May butter, to say June butter, as also June, March, April songs. (p. 260)

The best illustration of humor in *Quintus Fixlein* is in the story of the poverty of Fixlein's student days. Instead of sentimentalizing over the noble co-operation of four boys' taking their turns in using one bed and one overcoat, Richter tells how they replenished their

[10] C. E. Vaughan, *The Romantic Revolt* (New York, Scribner's, 1900), p. 314.

larder by an ingenious device of fishing for hens with a bread-pill bait. The hens belonged to a professor who kept his fowl in a court-yard located conveniently beneath the window of the students' room. (p. 134)

Perhaps his portrait of Frau Aufhammer is harsh, but it is laughable:

> . . . a ripe flower, with (adipose) neck-bulb, and tuberosity (of lard). Already, in the half of her body cut away from life by the apoplexy, she lay upon her lard-pillow but as on a softer grave. (143)

When she asks him about his orthodoxy, he proves it by launching into a sick-bed exhortation which makes her pride of birth crouch in humility before his pride of office and priest-hood.

The humor of Richter is lighter and less purposive than that of Carlyle. Except for the fact that Carlyle has the similar quality of effect through incongruity, it would be hard to see any resemblance between the humor of the two writers. What Professor MacMechan calls a "juxtaposition of the remote and the incongruous"[11] might be illustrated by these passages from *Sartor Resartus*.

> Andreas too attended Church: yet more like a parade duty, for which he in the other world expected pay with arrears. (II, ii, 100)
>
> The hungry young looked up to their spiritual nurses; and for food were bidden to eat the east-wind. (II, iii, 114)
>
> . . . when Caesar, doubtless with difficulty, swam the Nile, yet kept his *Commentaries* dry. . . . (II, iii, 103)

Of course, the whole plan of *Sartor Resartus* is humorous: the character of Teufelsdröckh, the clothes imagery of his philosophy, the chaotic condition of his manuscript jammed into paper bags with laundry bills and other incongruous matter. Satire and bitter irony, however, predominate in the book. It is the passage on hunting down the poor in the chapter on "Helotage", or the chapter on "The Dandiacal Body", which is typical of Carlyle's humor. He lacks the lighter touches of Richter.

For impressionistic description, both Carlyle and Richter have a gift. In the description of Fixlein's wedding Richter has used the impressionistic method:

> . . . the marriage guests has all thrown off their night-caps, and were drinking diligently;—there was a clattering, a cooking, a frizzling; tea-services, coffee-services, and warm beer-services were advancing in succession; and plates of bride cakes were going around like potter's frames or cistern wheels. The Schoolmaster, with three young lads, was heard rehearsing from his own house in *Arioso* . . . but now rushed all the arms of the foaming joy-streams into one, when the sky-queen besprinkled with blossoms, the bride, descended upon the Earth, full of quivering, humble love;—when the bells began;—when the procession-column set forth with

[11] "Preface," p. lv.

> the whole village round and before it;—when the organ, the congregation, the officiating priest, and the sparrows on the trees of the church window, struck louder and louder their peals on the drums of the jubilee-festival. (p. 245)

On Thiennette's birthday her husband keeps her at church while his mother prepares a surprise for his wife and puts the house in the kind of order which is described thus:

> The old mother . . . has all day been gliding about and brushing and burnishing and scouring and wiping, . . . everything hangs, as with all married people who have no children, in its right place, brushes, flyflaps, and almanacks;—the chairs are all stationed by the room police in their ancient corners. (p. 251)

Carlyle's account of the childhood of Teufelsdröckh employs the impressionistic technique. He selects the "paternal orchard," "the brave old Linden," the old men talking in its shadow, "the wearied laborers reclining," "the young men and maidens dancing," the festivals and games, the first short clothes, the suppers in the orchard as the material of Teufelsdröckh's recollections of his childhood. (II, ii, 92–94)

Another quality of style which is common to both writers is a wealth of allusion. Carlyle said of Richter's style that it contained "allusions to all the provinces of Earth, Sea, and Air." Professor MacMechan says that only two English writers, Macaulay and Swinburne, approach Carlyle in wealth of remote allusion.[12]

A casual examination of almost any page from either *Quintus Fixlein* or *Sartor Resartus* reveals allusions to literature of many nations, to the Bible, to nature, to science, to mythology, and to contemporary social and political conditions. But this common stylistic quality does not mean that Carlyle is modeling his style upon Richter's, but rather indicates the wide reading of both men.

Pape cites Carlyle's word-compounding in the German manner as an evidence of Richter's influence upon Carlyle's style, but there is one important point to consider in accepting this as evidence: Carlyle was attempting deliberately to imitate a German style in presenting *Sartor Resartus* as the work of an erratic German philosopher; his word-compounding and coining of German-like words is a logical part of his literary device and scarcely as strong an evidence of a permanent influence upon his style as Pape makes it. Carlyle's study of German for ten years previous to writing *Sartor Resartus* had given him a feeling for the heavily-compounded nouns so characteristic of German style.

The same comment is applicable to sentence rhythm and sentence length, but it would not be surprising if translating a sentence like

[12] *Ibid.* p. lii.

this from Richter should exert some influence upon the style of the translator:

> And when he, himself hurried on by the internal stream, inexpressibly softened by the farther recollections of his own fear of death on this day, of his life now overspread with flowers and benefits, of his entombed benefactress resting here in her narrow bed—when he now—before the dissolving countenance of her friend, his Thiennette—overpowered, motionless, weeping, looked down from the pulpit to the door of the Shadech vault, and said: "Thanks, thou pious soul, for the good thou hast done this flock and to their new teacher; and in the fulness of time, may the dust of thy God-fearing and man-loving breast gather itself, transfigured as gold-dust, round thy reawakened heavenly heart," was there an eye in the audience dry? (p. 237)

The comparisons that have been made in this paper are the basis for submitting the following conclusions:

1. Although there are general similarities in narrative form and devices between *Sartor Resartus* and *Quintus Fixlein,* there are specific differences: Carlyle's narrative is subordinated to the philosophical content, his editorship is more energetic, his hero is a more vigorous person, and *Sartor Resartus* lacks the many realistic narrative and descriptive touches characterizing *Quintus Fixlein.*

2. The most striking resemblances between the two books are in their idealistic philosophy: both deplore the materialism of the contemporary social life; both hold a spiritual view of nature; both place intuition above reason, express sympathy for the humble worker, satirize greed, corruption, and war; both glorify peace and simple living.

3. Yet within these likenesses there are differences: Richter's philosophy of happiness is a self-centered escape from the materialistic world; Carlyle has a social message in which the individual must renounce self for the greater happiness of work for the common good; the tone of Richter's satire is calm in contrast with Carlyle's vehement and often bitter denunciation and irony.

4. Carlyle's style is superior to Richter's in the effective use of figurative language and the control of sentimentality.

5. A grotesque strength characterizes Carlyle's excesses, but Richter's excesses are weakened by heavy ornamentation.

6. While Carlyle's humor is like Richter's in its mingling of incongruous elements, he lacks the whimsical, light touches that mark Jean Paul's prose; the whole plan of *Sartor Resartus* is humorous, but the theme is a serious one developed in a tone of great earnestness.

7. Both writers have a gift for impressionistic description and for a lyrical prose style.

8. The pages of the two books abound with allusions to many sources.

9. The superficial similarities in diction and sentence structure are appropriate devices for suggesting that *Sartor Resartus* is the work of an eccentric German philosopher and should not be used as an isolated argument for an influence of Richter's style upon Carlyle's.

10. The general similarities of the two books are those that one might expect when men of somewhat different temperaments but similar convictions face similar social problems. The differences in narrative form and tone, however, mark *Sartor Resartus* as a distinctively original creation. It will always be a greater book than *Quintus Fixlein* because a vigorous social message has more vitality than a sentimental flight from reality.

AMERICAN CRITICISM OF GEORGE MEREDITH'S NOVELS. 1860–1895

DOROTHY DEE BAILEY[a]
Wisconsin State College, Superior

American tastes and attitudes, far from being static, have undergone considerable changes within the last hundred years. Two cultural trends have been at war: traditional ethical idealism versus scientific realism. The intellectual shot heard round the world was Darwin's *The Origin of Species* in 1859. Many intellectuals read the book, but each interpreted it according to his own philosophy. American scientists steeped in traditional concepts, such as Asa Gray and Agassiz, interpreted the Darwinian explanation of evolution according to their differing orthodoxy; novelists of the variety of Crane and Norris applied the Darwinian theory of survival to their interpretation of moral and economic issues; financial wizards appealed to a social Darwinism to justify their ways toward their competitors; and agnostics applauded so loudly naturalistic theories to affirm their agnosticism that they could not deny their evangelical heritage. Literary critics who abided by traditional ethical idealism were challenged by scientific realists relying on a Darwinian explanation of natural laws, and they searched for biological techniques in the treatment of literature.

A study of the American literary criticism of the novels and poetry of the British author George Meredith during the latter part of the nineteenth century reveals to some extent this conflict in critical theory, and thereby helps to explain one facet of American cultural history. In addition it indicates a tardy acceptance of Meredith's writings among American men of letters.

By 1860 George Meredith was known and respected in his own country by George Eliot, Kingsley, John Morley, Leslie Stephen, Carlyle, Fitzgerald, Swinburne, and Rossetti; whereas the first American notice of him which has come to light is an unsigned review published in *Harper's New Monthly* in January of 1861. The entire entry is short enough to quote:

> *Evan Harrington, or, He Would Be a Gentleman* (published by Harper and Brothers) is a spirited novel, illustrative of the distinctions of rank in English society, and remarkable for the vivacity of its narrative and the dramatic richness of its dialogue.[1]

[a] Present address: Commonwealth of Pennsylvania State Teachers College, West Chester, Pennsylvania.

[1] *Harper's New Monthly Magazine* (January 1861), XXII, 260.

Not until 1875 did the eminent American literary critic Edmund Clarence Stedman offer a criticism of Meredith's writings. In his critical study of poets of the Victorian era he wrote:

> Meredith's verse is a further illustration of turning at will from one poetic method to another; he is dramatic and realistic, but occasionally ventures upon a classical or romantic study. He often fails his purpose, though usually having one. His *Poems of the English Roadside* seem to me his most original work, of them "Juggling Jerry" is the best.[2]

In line with apologists of idealism who scorned most departures from traditional poetic techniques, Mr. Stedman logically condemns Meredith's poetic experimentations.

In the thirteenth edition (1887) of his book, Mr. Stedman increases Meredith's allotted space to a half page, praises his poetry for its originality, and calls him "the Emerson of English poets."[3] He sees veritable harmony between Emerson's "Woodnotes" and Meredith's "The Woods of Westermain" and "The Lark Ascending." The British poet, the critic finds now, has talent for melody and metrical structure. In *Victorian Anthology 1837–1895,* a companion to *Victorian Poets,* Meredith is represented by five of his most famous sonnets from *Modern Love;* "Juggling Jerry," "The Lark Ascending," "Lucifer in Starlight," "The Spirit of Shakespeare," and "Two Masks." Modern anthologists still regard these selections as Meredith's greatest poetic achievements.

By virtue of including a criticism of Meredith's poetry in his book, Stedman was the first American critic of note to recognize his talents; furthermore, he perceived an underlying idealism in the poet's philosophy, even though its roots lie in Earth or Nature. Either he reconciles Meredith's naturalistic view with his own idealism, or the naturalism escapes him. Since he calls the writer "the Emerson of English poets," he evidently parallels Meredith's strong ethical bent, human aspiration, and wholesome optimism with the American poet's. His specific reference to "The Lark Ascending" and "Woodnotes" indicates that assumption. He also found a certain idealism which was congenial to his own principles of literary criticism. Strengthening the conflict, Stedman was in the vanguard of such scholars and critics belonging to the realistic school of critical theory as Howells, James, Brander Matthews, and H. H. Boyesen, who chose to ignore the British author for the most part. It is unfortunate that Stedman left no criticism of Meredith's prose.

In 1879 Harper's printed *The Egoist.* Only one review, that in the New York *Times,*[4] has been located. Although it is very inco-

[2] Edmund Clarence Stedman, *Victorian Poets* (Boston, 1875), p. 271.
[3] *Ibid.,* p. 447.
[4] New York *Times,* December 21, 1879, p. 4. First the reviewer states that *Evan Harrington* was printed in 1859. He confuses it with *The Ordeal of Richard Feverel.*

herent, a certain truth is elicited from the idea that *Evan Harrington* is a preface to *The Egoist* in so far as both novels deal with pretentiousness, although the former exposes it with more fun and less malice than does the latter. The reviewer notices something "molièrish" in its touch, and finds that "the lesson the book imparts is that egoism brings punishment." Even though he concludes that *The Egoist* is "disappointing and wearisome," he discovers that "elements of the truest high comedy are in this book." Judging from the reviewer's criticism, one conjectures that he knew nothing about Meredith, aside from the fact that he was the author of these two novels. Such reviewing is not proof, but is suggestive, of the ignorance among American critics and reviewers of this writer. One is puzzled by the paucity of information on his works when Swinburne, George Eliot, Leslie Stephen, and other English critics had reviewed them favorably in leading English periodicals.[5]

The following year an article appeared in *Appleton's Journal* by H. Holbeach. Revealing a Darwinian influence, he concludes that the new fiction will thrive in spite of scourgings by the clergy, because great changes, he thinks, induced by a new intellectual outlook, will foster "the spread of scientific knowledge, the increase of luxury, the far-reaching aesthetic revival. . . ."[6] By referring to the Prelude in *The Egoist* he illustrates that new fiction reflects a scientific attitude. His article is significant because he was aware of the impact of science on the intellectual and literary *milieu,* and he recognized an ever-growing value of the novel as a vehicle of interpreting changing social and cultural patterns.

In May of 1885 Harper Brothers published an American edition of *Diana of the Crossways,* and shortly thereafter two American reviews appeared. The former, in the New York *Times,*[7] accuses the book of dullness and condemns it for a "constant aristocratic flavor which gives one an idea that Mr. Meredith is inclined toward snobbishness." A reviewer in the *Literary World*[8] admits that Diana is "palpitating with life, overflowing with witty sayings, a center of resplendent womanhood."

Although American periodical and newspaper reviewers and literary critics do not furnish a rich harvest of Meredithian criticism, pirated editions were evidently becoming successful. George Munro

---

Next he says that the Harper edition carries the *imprimateur* of 1861. His comparison of Meredith's technique with that of Henry James is interesting, because it is the first such reference available that makes this comparison. He says: "If, 'Evan Harrington' could be very English at times with the beefiness which Trollope confesses to, it showed a lightness of touch, an episodic character, which is only equaled today by our own Mr. James."

[5] See Vardis Fisher, *George Meredith's Literary Reputation, 1850–1885,* Unpublished Ph.D. Dissertation, University of Chicago, 1925. Mr. Fsher treats exclusively of Meredith's literary reputation in England.

[6] H. Holbeach, "New Fiction," *Appleton's Journal* (April 1880), XXIII, 345–354.

[7] New York *Times,* July 6, 1885, p. 3.

[8] *Literary World,* Boston (July 25, 1885), XVI, 261.

published in February of 1885 without authorization the first twenty-six chapters of *Diana* from the *Fortnightly Review*. It was the first of many books by Meredith he was to pirate. His cheap paperbacks evidently sold successfully; otherwise he would not have bothered to publish them. Thus it seems that if American men of letters and reviewers as well as American publishers were doing little or nothing to popularize Meredith, illegal publishers were, and this method might have been one way that Meredith enlarged his American reading public.

Between 1885 and 1887 Roberts Brothers[9] published a complete edition of ten volumes to date of Meredith's works. Referring to this edition, Meredith in 1886 writes: "Americans appear to have received my work very generously." In the same letter he praises the United States:

> Since their most noble closing of the Civil War, I have looked to them as the hope of our civilization: and in reading Professor Jebb's account of Sophocles on the Harvard stage, I have seen that they have the sprit to excel in classics and belles lettres. Therefore I am justly flattered by their praise if I win it; their censure, if they deal it to me, I meditate on.[10]

The first review to appear announces that "there is a cult of Meredith,"[11] though available published criticism does not sustain this view. In 1886 four reviews credit Meredith with brilliant language, forceful character drawing, "coolness of touch," and treatment of "people as if he was that audience that hears enacted the drama of life."[12]

Lack of available reviews and notices indicates that the novels were not publicized individually as they came off the press. One wonders if Roberts Brothers were slow or inefficient or both in their advertising, despite one reference to a "Meredith cult."

In 1887 the *Literary World* published an unsigned article which reviews all of Meredith's volumes. Seeming to disagree with previous accounts of his popularity, this reviewer remarks that his novels were strangely new to American readers.[13] He interprets

---

[9] In 1885 Roberts Brothers of Boston had started an authorized publication of a complete edition of Meredith's works to date. It was in collaboration with Chapman and Hall of London. The Publisher's Trade List Annual for 1889 lists the following: *The Ordeal of Richard Feverel, Evan Harrington, Harry Richmond, Diana of the Crossways, Sandra Belloni, Vittoria, Beauchamp's Career, The Egoist, The Shaving of Shagpat and Farina, Rhoda Fleming,* all uniform volumes, 12 mo. @ $2.00. Popular edition, 16 mo. $1.50.

[10] *Letters,* Ed. by W. M. Meredith, 2 vols. (New York, 1912), II, 388.

[11] New York *Times,* April 19, 1886, p. 3.

[12] New York Daily *Tribune,* May 16, 1886, p. 10. *Critic* (August 28, 1886), VI, 107. New York *Times,* November 21, 1886, p. 12. New York Daily *Tribune,* October 24, 1886, p. 10.

[13] *Literary World* (April 30, 1887), XVIII, 137–138. The critic adds: "With all this alacrity to take up with British cleverness, we do not seem to have opened our hearts to one writer, who, for nearly thirty years, has been elaborating—the word is properly used—from an immense mass of social raw material, his half score of volumes, each as distinct in its whole as perfected marble, though as to the imperfections of the details no two critics may agree."

Meredith's social criticism in terms of contrast between traditional rational conventionality and new scientific realism. The novels, he thinks, fill a gap between those by Eliot, Trackeray, and Dickens, and those with a naturalistic slant.

In the same year a long review of *Diana of the Crossways* appeared in the New York *Daily Tribune*.[14] Allying himself with literary theorists of the traditional school, this reviewer condemns Meredith for being "deficient in that sympathy with human weakness which can alone put a writer *en rapport* with his kind." Diana's treasonable act offends his sense of Victorian decorum. In spite of his apparent dislike and disapproval of Meredith, he discerns an acuteness of observation and a solidity of judgment, shared only by George Eliot, and he prophesies that Meredith will gain a steady and surviving audience. Then he makes one new and valuable contribution to Meredithian criticism by perceiving that Meredith adopts a technique of the Greek chorus for his own ends, even though he accuses the novelist of employing this device too frequently, and thereby surcharging the moral.

Just as an increasing number of reviews appeared in 1887 and the years following, so did the number of personal accounts increase. One of the most searching is an article by Flora L. Shaw, published in 1887 in the *New Princeton Review*,[15] in which she combines details about the author's personality with a close, though biased, analysis of his literary aims. Miss Shaw quotes long passages from their conversations at his home in Box Hill to illustrate his ideas on truth and virtue and his abhorrence of cynicism and sentimentalism; the same ideas which are so succinctly explained in his letters[16] and so hilariously presented in *Evan Harrington*. An inconsistency exists in her criticism; for while she supports wholeheartedly Meredith's passion for reason, she also interprets his satire in terms of affection. She misses the objectivity of his method. Her position illustrates the dilemma of an era which tries to cling to traditional idealism and at the same time to accept the dispassionate reason of scientific realism.

Not until 1887 was Meredith's name mentioned in the *Atlantic Monthly*,[17] when a "contributor" criticizes him for giving his readers only a half truth by believing that reason can overcome sentiment.

---

[14] New York Daily *Tribune*, September 11, 1887, p. 10.

[15] Flora L. Shaw, "George Meredith," *New Princeton Review* (March 1887), III, 220–228.

[16] Meredith writes: "Against that cynicism I do protest. None of my writings can be said to show a want of faith in humanity, or of sympathy with the weaker, or that I do not read the right meaning of strength." *Letters*, II, 388.

[17] "A Word with Mr. George Meredith," from the "Contributor's Club," *Atlantic Monthly* (June 1887), LIX, 854–855.

After the publication of Roberts Brothers edition, an interest in Meredith's writings among college students is noticed. One student who tried to come to grips with Meredith's technique and philosophy was George Pierce Baker,[18] then an undergraduate at Harvard College. In a scholarly essay Mr. Baker traces classical and scientific influences in Meredith's novels. He finds "a trust in the guiding power of reason and intellect as that of the old Greek philosophers." He observes that each character undergoes a conflict between reason and passion. The author's role is that of moralist, not entertainer, for in "these life-histories . . . the particular man and his fate are as nothing compared with the lesson in ethics which his career illustrates. . . . His novels are all tales of mental and moral growth . . . the evolution is viewed in all possible lights." He adds that "to read the stories and sayings of George Meredith is to come upon a nineteenth century version of the doctrines of Socrates." But Mr. Baker also notices the impact of nineteenth century science in comparing Meredith's methods with

> experiments in biology and to say that in them George Meredith studies the development of men and women in the struggle between passion and intellect with much the patient enthusiasm of him who is watching the growth into being of some life-germ. In the past too much attention has been paid to striking dramatic episodes in the evolution, too little to the entire set of circumstances which makes the change possible, and to the ideas which the metamorphosis exemplifies.[19]

Not heredity or environment or individual will power, but "all the mitigating circumstances of natural disposition, of training, of environment, are given their proper share of responsibility" in the shaping of character. Sin is "not palliated or made insidiously fascinating." He interprets Meredith's weak and sentimental characters as his method of translating into artistic terms his philosophy of "blood, brain, and spirit," and his regard for classical centrality holds in check, Mr. Baker believes, his leanings toward naturalism.[20] This essay is historically as well as intrinsically valuable for its thorough and objective analysis of Meredith's novels.

In the same year another essay, this one by the Reverend Julius H. Ward,[21] states the thesis that Meredith concentrates on man's intellect to the exclusion of his spirit. He and Meredith fundamentally disagree over the participation of reason in shaping human

---

[18] George P. Baker, "George Meredith," *Harvard Monthly* (June 1887) IV, 138–146.

[19] *Ibid.*, pp. 138–139.

[20] Meredith himself illuminates his stand on this controversy in his *Essay on Comedy:* "it is unwholesome for men and women to see themselves as they are, if they are no better than they should be; and they will not, when they have improved in manners, care much to see themselves as they once were. That comes of realism in the Comic art; and it is not public caprice, but the consequence of a bettering state. The same of an immoral may be said of realistic exhibitions of a vulgar society." *Works,* Memorial Ed., 27 Vols. (London, 1909–1910), XXIII, 9.

[21] *Christian Union* (September 1, 1887), XXXVII, 199.

destiny. The author's relentless probing precludes a softness which the Reverend Mr. Ward believes would have been truer to nature, for he affirms that higher intuitions of men and women determine human destiny in time of crisis. Whereas other critics have hinted at it, he is the first one to associate Meredith squarely with the new school of scientific thought.[22] By taking this position he not only identifies himself with the traditional idealistic critics but he also adumbrates opinions of such humanists as Paul Elmer More, who finds the same limitation in Meredith.[23]

George Parsons Lathrop published an historically important critical analysis of Meredith's works in the *Atlantic Monthly*.[24] He labels *The Ordeal of Richard Feverel* "a sermon upon the folly of bringing up a boy on theory," he disposes of *Evan Harrington* with a few pithy phrases, and considers *The Egoist* "Meredith's worst novel," because his treatment of egoism is not only "fatiguing, but . . . revolting."

Mr. Lathrop was one of several noted American critics in the latter part of the nineteenth century to articulate a realistic theory of criticism upon a scientific rationale.[25] He discounts the plausibility of romance, and like Howells and James, advocates a faithful representation of the commonplace. He interprets nature in terms of experience and believes that an author's duty is to translate that experience into art. Meredith's method of implementing his purpose "with strict truth of probability and nature" in *Richard Feverel* is congenial to his own principles of realism, but despite this affinity, he finds Meredith's coldly objective method of dissecting egoism "fatiguing."

---

[22] The Reverend Mr. Ward points out a critical limitation. Meredith's triad is blood, brain, and spirit, but since spirit comes last in the spiral evolution, Meredith has a tendency to neglect it at the expense of the other two. In fact, one is often confused trying to maintain his distinction between brain and spirit. Whereas the novels amplify his theory, "The Woods of Westermain" epitomizes it:

> Each of each in sequent birth
> Blood and brain and spirit, three
> (Say the deepest gnomes of Earth),
> Join for true felicity.
> Are they parted, then expect
> Someone sailing will be wrecked;
> Separate hunting are they sped,
> Scan the morsel coveted.
> Earth that Triad is: she hides
> Joy from him who that divides;
> Showers it when the three are one
> Glassing her in unison.

[23] In a letter to Mrs. Janet Ross in 1861 Meredith says: "The truth is, my experiences are all mental . . . ." *Letters*, I, 23.

[24] George Parsons Lathrop, "George Meredith," *Atlantic Monthly* (February 1888), LXI, 178–193.

[25] See Lathrop's "The Growth of the Novel," *Atlantic Monthly* (June 1874), XXXIII, 684–697, and "The Novel and Its Future," *Ibid.*, (September 1874), XXXIV, 313–324.

It is regrettable that one of the most significant critics of this period only casually refers to Meredith. In a letter dated August 23, 1888, James Russell Lowell[26] wrote to Mrs. Leslie Stephen:

> I haven't been seriously at work on anything, but only entangled in the brief intricacies of George Meredith, like the poet of the "Roumant of the Rose," and like him consoling my scratches with the assurance that there was a consummate flower hidden somewhere among them, of which one gets enchanting glimpses now and then.

Certainly Meredith's turgid style should have been a subject for Lowell's satiric quips.

That William Dean Howells should choose to review *Beauchamp's Career*[27] in 1889 is understandable because of his continuous interest in social criticism. Despite "antiquated properties" of lords, ladies, squires, landed estates, and "unhappy marriages," all which are unrealistic to Howells, he discovers that "a great, fresh, and noble ideal of conduct evolves itself in the character of Beauchamp, a valiant young aristocrat turned democrat. . . ." More than social aspects hold his attention, however; his strong ethical turn of mind directs him to seek a moral vision in the story. He admires the narrative for its "certain splendid massiveness of effect," although he omits any reference to Meredith's technique. His fairness in passing judgment enables him to see merits in Meredith's works even though he dislikes them and finds them "difficult to read."

A reviewer in the *Critic*[28] contrasts Meredith with Howells; the former, he thinks, works with the laws of humanity, whereas the latter treats of the laws of society. He adds that Howells discovers comedy in the socially unconventional, but for Meredith it rests in the stupidly conventional.

Tomkins McLaughlin[29] published a review second in importance to Howells's review. Not only does he deduce that Meredith's purpose is "to write with a sense of responsibility to aim at an accurate psychology as morally obligatory, to satirize folly and to present exemplars of intelligent culture, to appeal for approval to the intellect," but also he successfully analyses Meredith's doctrine of "blood, brain, and spirit," in terms of evolutionary theory that leads from beast to soul. Man possesses a capacity to strive for the best. Striving is the test.

Through 1889, as a result of Roberts Brothers edition, reviews and criticisms of Meredith's works increased. From them one may deduce that his reading public was enlarging. In fact, one reviewer[30]

---

[26] James Russell Lowell, *Letters,* Ed. by C. E. Norton, 2 Vols. (New York, 1893), II, 358–359.

[27] "Editor's Study," *Harper's Monthly* (May 1889), LXXVIII, 984.

[28] *Critic* (June 1, 1889), XI, 267–268.

[29] Tomkins McLaughlin, "George Meredith as a Theorist," *New Englander and Yale Review* (August 1889), LI, 81–95.

[30] *Curio* (January–February 1888), I, 265–267.

boasts of his popularity from "London to Chicago," though this is probably an exaggeration. Nevertheless, from an historical angle, numerous minor articles and notices on Meredithian personalia and a seeming Meredithian cult indicate a growing interest on the part of the general reading public. Also, the critical essays are milestones in intellectual history because in general they reflect the two streams in American critical theory already referred to.

In 1890 Meredith completed *One of Our Conquerors,* and after its appearance serially from October, 1890, through May, 1891, in *Fortnightly Review,* Roberts Brothers added it to their edition. Divergent opinions were echoed here and abroad. Two reviews[31] complain of its packed thought and regret that an enlarged reading public had not tempered Meredith's style.

Following a new American edition of *The Tragic Comedians,* with an Introduction by Clement Shorter, several reviewers[32] agree for a change that Meredith did a brilliant psychological study of the tragedy of Helene von Donniges and Ferdinand Lassalle, and that Meredith is a subtle observer of the human heart. They even admit that this is one of Meredith's most readable books.

Reviews that follow the publication of *Lord Ormont and His Aminta* in 1894 oscillate between eulogy and acrimony, depending not so much on a reviewer's judgment of the novel as upon his particular prejudice toward the author.[33] One critic,[34] however, contrasts freedom of will shown in all Meredith's novels to a naturalistic determinism found in Hardy's. Characters in *Lord Ormont and His Aminta,* he finds, are not sad, helpless, fated creatures they are in *Tess of the D'Urbervilles.* Another critic[35] queries whether Meredith has "passed a sound, wholesome, calm, and enduring judgment upon human nature." He objects to the ending on grounds that it is an offense against the laws to which the greatest artists, such as Shakespeare and Dante, are obedient.

Diverse reactions to the moral problem in *Lord Ormont and His Aminta* clearly manifest a dilemma which was caused by contemporary fluctuating attitudes toward moral and social values. On the whole, reviewers adhering to traditional values denounced what naturalism they perceived with acrid words and irritated emotions, while those who approved were generous in their praise.

---

[31] New York *Daily Tribune,* April 26, 1891, p. 4. *Critic* (July 11, 1891), XVI, 13–14.

[32] *Public Opinion* (February 20, 1892), XII, 517. New York *Daily Tribune,* February 21, 1892, p. 14. *Dial* (April 1892), XII, 425. *Harper's Monthly* (June 1892), LXXXV, 155. *Overland* (October 1892), XX, 441–442.

[33] The more hostile reviews are found in New York *Times,* August 18, 1894, p. 3; *Critic* (September 8, 1894), XXII, 153; New York *World,* October 14, 1894, p. 15. The more favorable ones are in *Public Opinion* (August 23, 1894), XVII, 509–510; New York *Daily Tribune,* October 7, 1894, p. 14; *Outlook* (September 15, 1895), L, 437; *Harper's Monthly* (May 1895), XC, 978, sup. 3.

[34] New York *Times,* January 28, 1895, p. 4.

[35] *Atlantic Monthly* (February 1895), LXXV, 267–268.

Meredith's novel writing career closed in 1895 with the publication of *The Amazing Marriage,* which, of all his novels, stimulated the most reviews.[36] Their general tone, however, is less controversial than those of *Lord Ormont and His Aminta.* Critics for the *Nation, Critic,* and *Public Opinion*[37] concur with a reviewer for the Chicago *Evening Post*[38] that Meredith's "wordy mist . . . cannot hide his marvelous power, his deep knowledge of the human heart, and that splendor of diction which gleams out here and there like a strong sun from behind a heavy cloud." In contrast William Morton Payne's article in the *Dial*[39] is representative of those who find Meredith's style an obstruction to his narrative. Regardless of the "robust philosophy of his books, their utterly perverse manner must exclude them from the vital literary interest of the great majority of readers."

From an examination of Meredithian criticism in the United States through 1895, it seems evident that in literary trends scientific realism was impinging upon latent idealism. Critics of both shades disagreed in their interpretation of Meredith, for frequently those who used a scientific frame of reference accused him of romanticism, while those of the traditional school of critical theory, using an ethico-aesthetic rationale, often charged him with a naturalistic philosophy.

From an analysis of available criticism and a knowledge of some of the critics, a rough pattern emerges, denoting that Meredith's first appeal was to a few isolated intellects, then to a self-styled literary cult, and finally to an uncritical group.[40] While the quantity of reviews and notices increased, the quality deteriorated. Often reviewers were superficial in their remarks either from carelessness or from lack of understanding and appreciation of the author's aims and methods. A study of material available suggests a cultural lag among men of letters. For example, after collecting material for a study of the English novel, Sidney Lanier published *The English Novel and the Principles of Its Development* in 1879, but he does not mention Meredith's novels, although by that date he had

---

[36] From July 1895 through April 1896 fifteen reviews of *The Amazing Marriage* have been located. Eight are in newspapers and seven in magazines.

[37] *Nation* (December 12, 1895), LXI, 432–433. *Critic* (December 14, 1895), XXIV, 400. *Public Opinion* (January 9, 1896), XX, 56.

[38] Chicago *Evening Post,* February 8, 1896, p. 14.

[39] *Dial* (February 1, 1896), XX, 77.

[40] The serial publication of several short stories in the Sunday editions of the New York *Sun* in 1890 suggests a widening interest. Thomas B. Mosher's unique limited edition of *Modern Love* conveys an impression that an exclusive Meredithian cult might have existed. A reviewer in the Boston *Transcript,* December 15, 1892, p. 6, makes an enlightening statement regarding the rumor of Meredith's popularity: "They say in London nowadays that people who read George Meredith's novels when they were not popular, are developing a cult within a cult since the novels began to be read by the multitude and are retiring into an admiration of his poetry where only the privileged few may enter behind the veil."

already to his credit *The Ordeal of Richard Feverel* and *The Egoist,* his best known works. James, Howells, and Lowell offered very little rewarding criticism. Except for Edmund Clarence Stedman, not one outstanding American critic included his writings in a book of literary criticism. A thorough and perspicacious evaluation of the Meredithian canon by such literary giants as Paul Elmer More, Stuart P. Sherman, W. C. Brownell, and Joseph Warren Beach had to wait until the turn of the century.