

ANNOUNCEMENTS OF THE MEETINGS OF THE ACADEMY  
AND AFFILIATED SOCIETIES

Saturday, October 20	The Biological Society The Helminthological Society
Wednesday, October 24	The Geological Society The Medical Society
Saturday, October 27	The Philosophical Society
Wednesday, October 31	The Medical Society
Thursday, November 1	The Entomological Society
Friday, November 2	The Geographic Society
Saturday, November 3	The Biological Society

The programs of the meetings of the affiliated societies will appear on this page if sent to the editors by the eleventh and twenty-fifth day of each month.

## CONTENTS

### ORIGINAL PAPERS

	Page
Geophysics.—Evaporation from large bodies of water and some figures for Chesapeake Bay. ROGER C. WELLS.....	461
Physics.—Unit of thermal resistance: The "fourier." D. ROBERTS HARPER 3d....	469
Physical Geography.—A preliminary note on blue-green algal marl in southern Florida in relation to the problem of coastal subsidence. ALFRED P. DACHNOWSKI-STOKES and R. V. ALLISON.....	476

### PROCEEDINGS

The ACADEMY.....	481
------------------	-----

This JOURNAL is indexed in the International Index to Periodicals to be found in public libraries

### OFFICERS OF THE ACADEMY

*President:* ROBERT B. SOSMAN, Department of Research and Technology,  
U. S. Steel Corporation.

*Corresponding Secretary:* L. B. TUCKERMAN, Bureau of Standards.

*Recording Secretary:* W. D. LAMBERT, Coast and Geodetic Survey.

*Treasurer:* R. L. FARIS, Coast and Geodetic Survey.

Vol. 18

NOVEMBER 4, 1928

No. 18

JOURNAL  
OF THE  
WASHINGTON ACADEMY  
OF SCIENCES

BOARD OF EDITORS

AGNES CHASE  
BUREAU PLANT INDUSTRY

JOHN B. REESIDE, JR.  
NATIONAL MUSEUM

EDGAR W. WOOLARD  
GEORGE WASHINGTON UNIVERSITY

ASSOCIATE EDITORS

L. H. ADAMS  
PHILOSOPHICAL SOCIETY

S. A. ROHWER  
ENTOMOLOGICAL SOCIETY

E. A. GOLDMAN  
BIOLOGICAL SOCIETY

G. W. STOSE  
GEOLOGICAL SOCIETY

R. F. GRIGGS  
BOTANICAL SOCIETY

J. R. SWANTON  
ANTHROPOLOGICAL SOCIETY

ROGER C. WELLS  
CHEMICAL SOCIETY

PUBLISHED SEMI-MONTHLY  
EXCEPT IN JULY, AUGUST, AND SEPTEMBER, WHEN MONTHLY

BY THE  
WASHINGTON ACADEMY OF SCIENCES

MT. ROYAL AND GUILFORD AVES.  
BALTIMORE, MARYLAND

Entered as Second Class Matter, January 11, 1923, at the post-office at Baltimore, Md., under the Act of August 24, 1912. Acceptance for mailing at a special rate of postage provided for in section 1103, Act of October 3, 1917. Authorized on July 3, 1913

## Journal of the Washington Academy of Sciences

This JOURNAL, the official organ of the Washington Academy of Sciences, aims to present a brief record of current scientific work in Washington. To this end it publishes: (1) short original papers, written or communicated by members of the Academy; (2) short notes of current scientific literature published in or emanating from Washington; (3) proceedings and programs of meetings of the Academy and affiliated societies; (4) notes of events connected with the scientific life of Washington. The JOURNAL is issued semi-monthly, on the fourth and nineteenth of each month, except during the summer when it appears on the nineteenth only. Volumes correspond to calendar years. Prompt publication is an essential feature; a manuscript reaching the editors on the fifth or the twentieth of the month will ordinarily appear, on request from the author, in the issue of the JOURNAL for the following fourth or nineteenth, respectively.

*Manuscripts* may be sent to any member of the Board of Editors; they should be clearly typewritten and in suitable form for printing without essential changes. The editors cannot undertake to do more than correct obvious minor errors. References should appear only as footnotes and should include year of publication. To facilitate the work of both the editors and printers it is suggested that footnotes be numbered serially and submitted on a separate manuscript page.

*Illustrations* in limited amount will be accepted, drawings that may be reproduced by zinc etchings being preferable.

*Proof*.—In order to facilitate prompt publication no proof will be sent to authors unless requested. It is urged that manuscript be submitted in final form; the editors will exercise due care in seeing that copy is followed.

*Authors' Reprints*.—Reprints will be furnished at the following schedule of prices.

Copies	4 pp.	8 pp.	12 pp.	16 pp.	Covers
50	\$ .85	\$1.65	\$2.55	\$3.25	\$2.00
100	1.90	3.80	4.75	6.00	2.50
150	2.25	4.30	5.25	6.50	3.00
200	2.50	4.80	5.75	7.00	3.50
250	3.00	5.30	6.25	7.50	4.00

An additional charge of 25 cents will be made for each split page.

Covers bearing the name of the author and title of the article, with inclusive pagination and date of issue, will be furnished when ordered.

Envelopes for mailing reprints with the author's name and address printed in the corner may be obtained at the following prices: First 100, \$4.00; additional 100, \$1.00.

As an author will not ordinarily see proof, his request for extra copies or reprints should invariably be attached to the first page of his manuscript.

<i>The rate of Subscription per volume is</i> .....	\$6.00*
Semi-monthly numbers.....	.25
Monthly numbers.....	.50

*Remittances* should be made payable to "Washington Academy of Sciences," and addressed to the Treasurer, R. L. Faris, Coast and Geodetic Survey, Washington, D. C.  
*European Agent*: Weldon & Wesley, 28 Essex St., Strand, London.

*Exchanges*.—The JOURNAL does not exchange with other publications.

*Missing Numbers* will be replaced without charge, provided that claim is made within thirty days after date of the following issue.

\*Volume I, however, from June 19, 1911, to December 19, 1911, will be sent for \$3.00. Special rates are given to members of scientific societies affiliated with the Academy.

JOURNAL  
OF THE  
WASHINGTON ACADEMY OF SCIENCES

VOL. 18

NOVEMBER 4, 1928

No. 18

BOTANY.—*New South American species of Werneria.*<sup>1</sup> S. F. BLAKE,  
Bureau of Plant Industry.

*Werneria* H. B. K. is a medium-sized genus of Asteraceae of the tribe Senecioneae, closely related to *Senecio* and distinguished from it by no definite character except the connation of its phyllaries to the middle or beyond. On the basis of this feature, *Werneria* is included by Bentham & Hooker and by O. Hoffmann in the subtribe Othonninae (Othonneae of Bentham & Hooker) along with several other genera which are restricted to southern Africa.

*Werneria* itself, with the inclusion of the 10 new species here described, is a genus of some 62 species, about 7 of which<sup>2</sup> (aside from the species described from the Old World) are of somewhat doubtful status. Fifty-eight species occur in the South American Andes from Venezuela (a single species) and Colombia to Chile and Argentina at high altitudes, usually 3000 to 5000 meters. The lowest altitude definitely recorded for any species is about 2750 meters, at which *W. nubigena* and *W. villosa* were collected in Peru by Macbride and Featherstone. The only species known outside this range in America is *W. nubigena* H. B. K., which occurs from Ecuador to Peru and Bolivia, and is found on the mountains of Guatemala at about 3355 to 3660 meters elevation in a form, described by DeCandolle as *W. mociniana*, which I am unable to distinguish in any way from the typical South American one.

<sup>1</sup> Received August 11, 1928.

<sup>2</sup> *Werneria acerosifolia* Hieron., from description not clearly distinguishable from *W. villosa* A. Gray, but perhaps identical with *W. canaliculata* Sch. Bip.; *W. apiculata* and *W. brachypappa* Sch. Bip., perhaps not separable specifically from *W. pygmaea* Gill.; *W. calyculata* Turcz.; *W. disticha* H. B. K., very close to *W. nubigena* H. B. K.; *W. dombeyana* (Wedd.) Hieron., imperfectly described; *W. mandoniana* Wedd., very close to *W. orbignyana* Wedd., the latter known to me only from description.



Four species are accredited to the Old World, *Werneria africana* Oliver & Hiern and *W. antinorii* Avetta<sup>3</sup> from Abyssinia, *W. ellisii* Hook. f. and *W. nana* (Decaisne) Benth. from the western Himalaya of India and western Tibet, at high altitudes. The distribution of these four makes it extremely improbable that they are very closely related genetically to the typical South American species. I have seen no material of them and so cannot speak with assurance about their position, but the probability, almost the certainty, of their origin from *Senecio* independently of the South American species is in itself no obstacle, in my opinion, to their being placed unequivocally in *Werneria* if their characters agree with those of that genus. A tendency to connation of the phyllaries at base is widespread in the vast genus *Senecio*. The accentuation and fixation of this tendency in one or more *Senecio* prototypes is undoubtedly the source of the genus *Werneria* as represented in South America, where its considerable variation in habit makes it probable that it arose from *Senecio* at several different foci. The appearance of this same widespread tendency to a gamophyllous involucre in two regions of the Old World is in no way remarkable. It is indeed surprising that it has not happened more frequently, particularly in the high altitudes with which it appears to be in some way correlated.

As originally described by Humboldt, Bonpland, and Kunth the genus *Werneria* included six species. Six were added by Schultz Bipontinus in 1856 from Lechler's Peruvian collections; eight by Weddell in 1856, and two more in 1894, the latter manuscript names published with descriptions by Klatt; four by Asa Gray in 1861, from the Peruvian collections of the Wilkes Expedition; six by Hieronymus in 1895, and two more in 1901. One was described from Chile by Philippi in 1873, and four more in 1891. The other accessions to the genus have been mainly single species described by various authors. Weddell's monographic treatment of 17 species in his "Chloris Andina" (1856) is the only available recension of the American species as a whole and is quite inadequate at present, including less than a third of the species now known. A working key prepared by the writer several years ago for the identification of the material of the genus accumulated at the United States National Herbarium from the South American collections of Dr. F. W. Pennell, E. P. Killip, and J. Francis Macbride has been entirely remade after the study of many more specimens, but is

<sup>3</sup> Ex O. Hoffm. in Engl. & Prantl, Nat. Pflanzenfam. 4<sup>o</sup>: 301, 302. 1892, hyponym. Omitted from Index Kewensis. Said to be transitional to *Euryops*.

still not in state for publication owing to lack of material of several described species. A tentative grouping of the species, with partial keys, is here presented as an aid to future students of the genus. It is based on the material in the United States National Herbarium, the entire collection of the New York Botanical Garden and Columbia College (about 100 sheets), and a considerable amount of material borrowed from the Gray Herbarium and the Field Museum, as well as several photographs and fragments of authentic specimens obtained at Kew Herbarium in 1925 or (in the case of *W. rigida* Benth.) recently sent by Dr. A. W. Hill. I wish to express my thanks to the curators of the herbaria mentioned for the opportunity to examine the collections under their charge. In the following key the dagger indicates that no material has been examined by the writer; the placing of a name in parentheses, that the species is doubtfully a member of that group. In the first four groups the leaf blade is toothed or lobed; in the remaining three the blade is entire, although the margin is sometimes of different texture and pectinate-ciliate or finely glandular-denticulate.

One species of the genus, *Werneria poposa* Phil., of northern Chile and northwestern Argentina, is much valued in its native habitat as a remedy for intestinal colic, being used in the form of infusions and decoctions. It has been studied histologically and chemically by Dr. Fidel Zelada,<sup>4</sup> who extracted from it a glucoside which he calls "poposina" ("poposa" is the vernacular name of the plant).

I. Group of *W. pinnatifida*. Leaves pinnatisect.—A. Leaves strictly glabrous, their lobes 2–6 pairs, subequal, entire. *W. solivaefolia* Sch. Bip. AA. Leaves usually pilose along rachis above, their lobes 5–20 pairs, alternately unequal, often lobulate. B. Phyllaries 20–25; leaves about 9 cm. long. *W. pinnatifida* Remy. BB. Phyllaries 8–15; leaves mostly 6 cm. long or less. *W. heteroloba* Wedd., *W. obtusiloba* Blake, sp. nov.

II. Group of *W. dactylophylla*. Leaves bifid, trifid, or 3-lobed (the lobes sometimes again 3-lobed), small, 1 cm. long or less; plants leafy-stemmed, suffrutescent.—A. Leaves bifid. *W. rosenii* R. E. Fries. AA. Leaves trifid or 3-lobed. B. Stem and upper leaf surface densely pilose-lanate. *W. dactylophylla* Sch. Bip. BB. Stem and upper leaf surface glabrous, or apex of leaves loosely pilose (*W. amblydactyla*). C. Leaf segments linear, mostly 2–4 mm. long, acutely subulate-tipped. *W. digitata* Wedd. CC. Leaf segments not linear, 1.5 mm. long or less, obtuse. D. Leaves loosely pilose at apex when young, 1–1.5 mm. wide at apex, the linear petiole under 1 mm. wide and not glandular-denticulate. *W. amblydactyla* Blake, sp. nov. DD. Leaves not pilose. E. Leaves practically linear, cylindric-prismatic, 4–6 mm. long, barely 1.5 mm. wide above. *W. incisa* Phil. EE. Leaves linear-

<sup>4</sup> *Estudio botánico y químico de la Werneria poposa Philippi (n.v. poposa)*. Univ. Nac. Tucumán, Mus. Hist. Nat. Bol. 10. 17 pp., illust. 1927.

cuneate, 8–10 mm. long, 2–4 mm. wide above, densely pectinate-ciliolate with stiff acute non-glandular cilia. *W. decora* Blake, sp. nov.

III. Group of *W. pygmaephylla*. Leaves crenately 3–9-lobed, 2 cm. long or less.—*W. pygmaephylla* Blake, sp. nov.; († *W. melandra* Wedd.?).

IV. Group of *W. orbignyana*. Leaves (at least in part) 3–5-dentate or -denticulate at apex, spatulate to linear-cuneate or obovate, mostly 3–9 cm. long.—† *W. orbignyana* Wedd., *W. mandoniana* Wedd.

V. Group of *W. pectinata*. Leaves small, spatulate or linear-spatulate, rosulate at base of head and scattered on short horizontal rhizomes, with densely pectinate-ciliate margin (the cilia ca. 0.5 mm. long, stiff, acuminate, not glandular).—*W. pectinata* Lingelsh.,<sup>5</sup> † *W. knocheae* Perkins; († *W. denticulata* Blake?).

VI. Group of *W. lycopodioides*. Truly leafy-stemmed, suffrutescent, the stems densely covered with uniform small unlobed leaves 11 mm. long or less. (Through *W. marcida* and *W. sedoides*, this group nearly connects with the minor group in VIII centering about *W. humilis*. In all of the latter the leaf axils are woolly.)—A. Leaf axils woolly. † *W. poposa* Phil., *W. lorentziana* Hieron. AA. Leaf axils not woolly. *W. decumbens* Hieron., *W. marcida* Blake, sp. nov., *W. lycopodioides* Blake, sp. nov., *W. sedoides* Blake, sp. nov., *W. weddellii* Phil., † *W. juniperina* Hieron., († *W. denticulata* Blake?).

VII. Group of *W. caulescens*. Radical leaves tufted but scarcely rosulate, much larger than cauline, grass-like or plantain-like, or subacicular, erectish; stem evident, subscapose, 2–30 cm. high.—A. Larger leaves 1 cm. wide or more. *W. stuebelii* Hieron., *W. plantaginifolia* Wedd. AA. Larger leaves 6 mm. wide or less. B. Rays white. *W. staticaefolia* Sch. Bip., *W. caulescens* (Wedd.) Griseb., † *W. dombeyana* (Wedd.) Hieron.? BB. Rays yellow inside, red or purple outside. *W. villosa* A. Gray, († *W. acerosifolia* Hieron.?).

VIII. Remaining species. Leaves entire (or margin glandular-denticulate), rosulate or densely crowded on very short or sometimes elongate caudices, occasionally rather scattered on spreading rhizomes; heads usually sessile, sometimes short-peduncled. A varied group, capable of subdivision.—A. Leaf sheaths not ciliate and without axillary tufts of hairs. B. Heads discoid. C. Anthers black or violet. † *W. melanandra* Wedd. CC. Anthers yellow. *W. carnulosa* A. Gray.—BB. Heads radiate. C. Leaves 4–6 cm. long, linear or very narrowly linear-oblancoate, the blade not distinguished from the petiole; involucre 13–17 mm. high. *W. glaberrima* Phil. CC. Leaves much shorter, or else spatulate and scattered on short rhizomes; involucre 7–12 mm. high. D. Leaves scattered on slender rhizomes, definitely spatulate, the blade 2–6 mm. wide. *W. spathulata* Wedd. DD. Leaves rosulate or densely clustered. E. Involucre 4–5 mm. high. *W. aretioides* Wedd. EE. Involucre 7–12 mm. high. *W. ciliolata* A. Gray, *W. cochlearis* Griseb., († *W. denticulata* Blake).

AA. Leaf sheaths long-ciliate or with axillary tufts. B. Leaves densely setose-strigose on surface. *W. strigosissima* A. Gray. BB. Leaves not setose-strigose. C. Leaf blades glandular above, pilose beneath, ovate to subspatulate, 6–10 mm. wide. *W. glandulosa* Wedd. CC. Leaf blades

<sup>5</sup> *W. ciliata* Wedd., never described, was published by Schultz Bipontinus as a synonym of *W. ciliolata* A. Gray. Examination of Mandon 99, chirotype collection, in the herbarium of the New York Botanical Garden, shows that the name is synonymous with *W. pectinata* Lingelsh., described in 1910.



glabrous on both surfaces. D. Leaf sheaths marcescent (whole leaf sometimes so), long-persistent, conspicuous, nearly or quite as long as the blades. E. Leaves bristle-tipped. *W. leucobryoides* Blake, sp. nov. EE. Leaves obtuse to acute, not bristle-tipped. F. Rays rosy. *W. rosea* Hieron. FF. Rays white. G. Involucre 12–18 mm. high; leaf blades 12–28 mm. long. *W. crassa* Blake, sp. nov. GG. Involucre 5–8 mm. high; leaf blades 6–9 mm. long. H. Leaves articulate at or just below junction of sheath and lamina, the latter normally deciduous in all but the younger leaves. *W. articulata* Blake. HH. Leaves not definitely articulate, the whole sheath and blade persistent, becoming corky. I. Lamina of leaves about 4–6 mm. long, 1–1.2 mm. wide; leaves mostly spreading. *W. humilis* H.B.K. II. Lamina of leaves 3–4 mm. long, 1 mm. wide or less; leaves mostly erect or appressed. *W. soratensis* Hieron.—DD. Leaf sheaths not marcescent or long-persistent or conspicuous, usually very much shorter than the blades. E. Rays yellow. F. Leaf blades 1.8 mm. wide or less, the costa prominent beneath. *W. canaliculata* Sch. Bip., *W. cornea* Blake, sp. nov. FF. Leaf blades mostly 2–3.5 mm. wide, the costa obsolete or impressed beneath. *W. pumila* H.B.K. (including *W. densa* Benth.), *W. rigida* H.B.K.; († *W. calyculata* Turcz.).—EE. Rays white. F. Leaf blades usually 3–12 mm. wide. G. Achenes and ovaries glabrous. *W. graminifolia* H.B.K. GG. Achenes and ovaries silky. *W. nubigena* H.B.K., † *W. disticha* H.B.K.—FF. Leaf blades mostly under 1.5 mm. wide. G. Leaves very densely rosulate, acicular, the blades 5–20 mm. long, 0.3–1 mm. wide, mucronate. *W. caespitosa* Wedd. GG. Leaves looser, less densely rosulate; plants when well developed with short spreading rhizomes bearing more or less scattered leaves (doubtfully so in *W. brachypappa*). H. Leaves acutely mucronate. *W. apiculata* Sch. Bip. HH. Leaves obtuse. *W. pygmaea* Gill., † *W. brachypappa* Sch. Bip.

***Werneria obtusiloba* Blake, sp. nov. Fig. A.**

Acaulescent perennial; rhizome very short, erect; leaves rosulate, the broad scarious sheaths glabrous, 1.3–2 cm. long, the blades linear or lance-linear in outline, 1–2.5 cm. long, 4–7 cm. wide, pilose along costa above, pinnatisect into 5–11 pairs of very unequal obovate, ovate, or oval, obtuse, entire or 3-lobed segments, the larger about as long as the breadth of the rachis between them; heads discoid, short-peduncled; involucre 8–10 mm. high, 11–13-fid.

Rhizome thick, 1 cm. long or less, glabrous; leaves stellate-imbricate, 2.5–4.5 cm. long, the petiole ("sheath") amplexicaul, 3-nerved, 3–5 mm. wide at base, often purplish-margined, the blade fleshy, glabrous beneath, the lobes obtuse to broadly rounded, 1–4 mm. long, 0.6–2 mm. wide, the larger often with 1–2 supplementary lobules at base; peduncle essentially glabrous, clavate, 1 cm. long or less, sometimes with 1 or 2 linear entire bracts; involucre campanulate, glabrous, the teeth triangular or deltoid, 3–3.5 mm. long, 1.8–2.4 mm. wide at base, obtuse, ciliolate at apex, the scarious margin often purplish; flowers numerous, their corollas white becoming purple-tipped, 6–6.5 mm. long, the tube 3.2–3.5 mm., the funnellform throat 2 mm., the ovate teeth 0.8–1 mm. long; ovaries glabrous; pappus white, in age purple, 6 mm. long; style tips truncate, minutely hispidulous around apex.

PERU: In sandy soil, with cushion and rosette plants, cordillera east of Carumas, Prov. Moquegua, alt. 4500–4600 m., 7–8 Mar. 1925, A. Weberbauer 7362 (type no. 552591, Field Mus.; dupl. no. 44298, U. S. Nat. Herb.).

Wet seepy soil along streamlet, Vincocaya, Dept. Arequipa, 4370-4380 m., 18 Apr. 1925, *F. W. Pennell* 13338 (Field Mus., Gray Herb.).

Closely allied to *Werneria heteroloba* Wedd., of which it may eventually prove to be a form. In that species, as described by Weddell and as represented by a considerable series of specimens before me, the principal leaf segments are linear or essentially so and acute or acuminate to the callous tip.

***Werneria amblydactyla* Blake, sp. nov. Fig. B, c.**

Rhizomes short, branched, the branches or stems tufted, about 2.5 cm. high, densely leafy above, glabrous; leaves about 9 mm. long, loosely crisped-pilose toward apex when young, glabrate, the scarios-margined, barely amplexicaul sheath about 2 mm. long and 2 mm. wide, entire or slightly denticulate at base, the petiole 5 mm. long, 0.6-1 mm. wide, linear, thick, flat above, rounded beneath, entire, the blade 1.5 mm. wide or less, of 3 ovate-oblong, obtuse, erect, connivent, thick lobes 0.6-1 mm. long, subequal or the middle one usually slightly shorter than the lateral; heads sessile, radiate; involucre 9-10 mm. high, 9-13-(-"20")-fid about to middle.

Rhizomes about 3 mm. thick, covered with the persistent bases of the sheaths, the erectish branches about 4-7; leaves densely imbricated; heads campanulate, solitary, terminal; lobes of involucre triangular, acuminate to an obtusish apex, sparsely pilose above along midline, scarios-margined, 4 mm. long, 1.5 mm. wide at base, 1-vittate; receptacle convex, alveolate, glabrous; disk 10-11 mm. high, 8-12 mm. thick; rays slightly exerted, glabrous, the slender tube 3 mm. long, the narrowly obovate lamina entire, 3-nerved, 7.5 mm. long, 1.8 mm. wide; disk corollas glabrous, 6 mm. long, the tube 1.6 mm., the funnel form throat 3.4 mm., the ovate teeth 1 mm. long; disk achenes (immature or infertile) glabrous, columnar, 2.5 mm. long, about 7-nerved; pappus brownish white, 6 mm. long, the bristles somewhat united in groups at extreme base; style tips hispidulous around the subtruncate apex, usually tipped with a setose tuft nearly 0.5 mm. long.

PERU: Alparmarca, in the Andes, *Wilkes Expedition* (type no. 44300, U. S. Nat. Herb.).

Related to *W. digitata* Wedd., as a form of which it was recorded and briefly described by Gray.<sup>6</sup> The examination of material clearly referable to that species (*F. L. Herrera* 1033, Hacienda Churu, Prov. Paucartambo, Peru, 3700 m., Jan. 1926, U. S. Nat. Herb.) makes it evident that the Wilkes specimens are to be separated specifically. In *W. digitata* the plants are much larger and coarser, the considerably broader leaves are without the loose hairs of *W. amblydactyla*, their lobes are longer (mostly 2-4 mm.) and acutely subulate-tipped, and the broader sheaths and petioles are definitely ciliolate or denticulate. As already noted by Dr. Gray in his examination of the same specimens, the conspicuous tuft of bristles terminating the subtruncate style tips is sometimes absent (at least in more mature flowers of the disk). I have not found any of the "truly opposite" leaves described by him, although some subopposite leaves, apparently due to the obsolescence of the internodes, can be seen.

<sup>6</sup> Proc. Amer. Acad. 5: 140. 1861.

*Werneria decora* Blake, sp. nov. Fig. D, E.

Suffruticulose, about 1 dm. high; rhizome branched, the branches erectish, thick, densely leafy above, covered below with the imbricated bases of old sheaths; leaves 7–10 mm. long, conspicuously ciliolate throughout, linear-cuneate in outline, 3-vittate, the scarious sheath 2.5–3 mm. wide at base, amplexicaul, the flat petiole 1.8–2 mm. wide, the blade passing gradually into the petiole, 2.5–4 mm. wide, 3-lobed, the lobes rounded or subtruncate, thickish, the lateral about 1–1.3 mm. long and wide, the middle one usually about half as long and wide, sometimes obsolete; heads sessile, radiate, “the rays white, the disk yellow;” involucre 12–14 mm. long, about 13-fid to middle.

Rhizomes 4–7 mm. thick, much branched, densely covered with the imbricated bases of old sheaths, the green leafy tips 2–4.5 cm long; leaves somewhat yellowish green, fleshy, thickened above, their cilia stiffish, subulate, acuminate, eglandular, 0.1–0.3 mm. long; disk shorter than or equaling the involucre; involucre campanulate, the tube multivittate, the lobes oblong, very obtuse, 3–5-vittate, often somewhat erose on the narrow subscarious margin, minutely ciliolate-tufted at apex, 6–7 mm. long, 2–2.5 mm. wide; rays about 18 (more numerous than phyllaries), glabrous, the tube 3.5 mm. long, the lamina linear-spatulate, 10 mm. long, 1.5–2 mm. wide, 4–7-nerved, entire or obscurely emarginate; disk corollas glabrous, 7.5 mm. long, the tube 2.5 mm., the funnellform throat 4 mm., the teeth ovate, obtusish, 1 mm. long; achenes (immature) glabrous; pappus brownish white, about 7.5 mm. long; style tips of disk flowers truncate-rounded, hispidulous in a ring all around at apex, with terminal rounded naked umbo, of ray truncate-rounded, irregularly and unevenly hispidulous, sometimes with a short terminal tuft of hairs; anthers “reddish in age.”

PERU: In loose soils of alpine basin slopes, Casapalca, Dept. Lima, alt. about 4725 m., 21 May 1922, *Macbride & Featherstone* 849 (type no. 517377, Field Mus.; dupl. no. 1,185,462, U. S. Nat. Herb.).

An attractive and very distinct species, at once distinguished from *W. rosenii* R. E. Fries by its conspicuously ciliolate leaves with much broader, very blunt lobes, normally 3 in number, and from *W. incisa* Phil. by its much larger and broader, ciliolate leaves, and much larger involucre.

*Werneria pygmophylla* Blake, sp. nov. Fig. F, G.

Tiny, caespitose, acaulescent, spreading-pilose throughout; leaves rosulate, without axillary tufts, the petiole linear, about 1 cm. long, the suborbicular blade 2–4 mm. long and wide, crenately 3–9-lobed, conduplicate; heads discoid, small; involucre 6–8 mm. high, about 18-fid, the blunt teeth ustulate-tipped; achenes densely papillate.

Plants in small tufts, altogether 1–1.8 cm. high; rhizomes branched, short, slender, leafy only at apex; leaves 8–15 mm. long; petioles subscarious toward base, 3-vittate, flat, ciliate, sparsely pilose on back above, 7–11 mm. long, 2 mm. wide or less at base, scarcely amplexicaul; blades abruptly distinguished from petioles, green, fleshy, strongly conduplicate, often slightly inequalateral, very obtuse and often slightly cucullate at apex, at base subcordate to rounded-cuneate, shallowly crenate-lobate with rounded lobes, pilose on both surfaces; peduncles 4 mm. long or less, bearing a few linear entire leaves; heads campanulate-hemispheric, about 8 mm. high, 9 mm. thick (as pressed),



about 49-flowered; receptacle flattish, alveolate, glabrous; involucre loosely pilose especially on the lobes, these mostly oblong, obtuse, 2.5–2.8 mm. long, 1–1.5 mm. wide, sometimes irregularly united nearly to apex, narrowly scarious-margined, with blackish brown tips, minutely brown-ciliolate at apex; disk corollas “now greenish-, now bluish-white,” glabrous, 4.2–4.5 mm. long, the tube much swollen at base, 2.2–2.4 mm., the cylindric-campanulate throat about 1.7 mm., the ovate teeth 0.5 mm. long; immature achenes oblong, 1.5 mm. long; pappus whitish, copious, easily deciduous, 4 mm. long; style tips truncate, minutely hispidulous at apex; “anthers and stigmas dark brown.”

PERU: On sandy soil, growing with cushion and rosette plants, Cordillera east of Carumas, Prov. Moquegua, alt. 4500–4600 m., 7–8 Mar. 1925, A. Weberbauer 7358 (type no. 552587, Field Mus.; dupl. no. 1,233,480, U. S. Nat. Herb.).

A unique species, at once recognized by its rather dense pubescence, ustulate-tipped phyllaries, papillate achenes, and suborbicular shallowly crenate-lobed conduplicate leaf blades, resembling in their normal folded condition a fist, whence the name. The species is closely similar in many respects to a species of *Senecio* collected by Pennell in the Department of Arequipa (Pennell 13344), but in that the phyllaries are distinct essentially to base, while in *W. pygmaephylla* they are truly connate to well above the middle.

*Werneria marcida* Blake, sp. nov. Fig. H, I, J.

Suffrutescent (?), caespitose, glabrous, the rhizomes branched, the branches apparently erect, densely leafy throughout, 2–4 cm. long, the green leafy growth of the year only about 1 cm. long or less; leaves at first erect, glaucescent green, in age marcescent, brownish, shrunken and spreading, lance-oblong or ovate-oblong, 8.5–10.5 mm. long, 2.5–4 mm. wide, acute and apiculate to obtusish, not at all dilated at base, 1-vittate, subglandular-denticulate especially above, flat, the petiolar portion 5–7 mm. long, narrowly scarious-margined, the lamina narrower, about 3.5 mm. long, triangular or triangular-oblong; heads sessile or subsessile, radiate, the rays “white,” the disk “yellowish green;” involucre 9–10 mm. high, 13–16-fid.

Branches numerous, about 8–12 mm. thick including the leaves; leaves densely imbricate; heads 2.2–2.8 cm. wide; disk about 1 cm. high, 1.5 cm. thick; involucre campanulate-hemispheric, the tube multivittate, the teeth triangular to deltoid, obtuse or acutish, 3–4-vittate, ciliolate at apex, 5–6 mm. long, 2.5–4 mm. wide at base, the narrow subscarious margin sometimes denticulate; rays 19–22 (more numerous than phyllaries), glabrous, the tube 3.5–3.8 mm. long the elliptic lamina 10–11 mm. long, 3.5 mm. wide, 2–3-denticulate, about 5-nerved; disk corollas glabrous, 6.5 mm. long, the tube 1.8 mm., the cylindric-funnelform throat 3.7 mm., the ovate teeth 1 mm. long; disk achenes (immature) oblong, 2 mm. long, with about 7 thick ribs; pappus brownish, 4.5–5.2 mm. long, the bristles united at extreme base into a sort of collar; style tips truncate, minutely hispidulous at tip, in disk flowers rather conspicuously papillose on back.

PERU: In mounds by brook, Rio Blanco, Dept. Lima, alt. about 4575 m., 20–25 Mar. 1923, J. Francis Macbride 3032 (type no. 534102, Field Mus.; dupl. no. 1,191,416, U. S. Nat. Herb.).



Nearest *Werneria decumbrens* Hieron. (ex char.) from between Tomarape and Tacora, Peru, in which the leaves have a conspicuous amplexicaul ciliate sheath 3 mm. long and 5 mm. wide and a subacrose blade 8 mm. long and 1.25 mm. wide at base.

*Werneria lycopodioides* Blake, sp. nov. Fig. K, L, M.

Suffrutescent, glabrous, the rhizomes apparently decumbent, up to 25 cm. long, fastigate-branched, densely leafy above, the leaves scattered below; leaves triangular, 3-5 mm. long, ciliolate-denticulate below apex, the short amplexicaul scarious sheath 2.5-3 mm. wide, the blade about 2 mm. wide above the sheath, fleshy, acute or obtuse, erect or in age spreading; heads sessile, radiate, yellow, the rays scarcely exceeding involucre (heads young); involucre about 6 mm. long, 8-9-fid for less than half its length, the lobes broad and blunt.

Rhizomes about 3 mm. thick below, glaucescent, the internodes on the lower parts (still bearing green leaves) up to 4 mm. long; densely leafy young growth 3-6 cm. long; blades flat above, convex beneath, usually acutely whitish-apiculate when young, becoming obtuse, slightly cucullate at apex, yellowish green; heads 8-9 mm. high, about 41-flowered; involucre campanulate, 5-7 mm. high, purple throughout, glabrous, the tube multivittate, the lobes deltoid or deltoid-ovate, 2-2.5 mm. long, 2-3 mm. wide at base, minutely ciliolate-tufted at apex, 3-vittate; receptacle convex, alveolate; rays (immature) 10, definitely yellow, linear-oblong, entire or emarginate, 2-3-nerved, 5 mm. long; disk flowers about 31, their corollas (submature) glabrous, 5.8 mm. long, the tube 1.3 mm. long, the cylindric-funnelform throat 3.5 mm. long, the ovate acutish teeth 1 mm. long; ovaries glabrous; pappus straw-color, about 6 mm. long; style branches truncate or rounded-truncate, hispidulous or papillose at apex.

CHILE: Cordillera Volcan Tacora, Co. Quiñuta, Prov. Tacna, Dept. Tacna, alt. ca. 5000 m., April 1926, *E. Werdermann* 1164 (type in Gray Herb.; photog. and fragm. no. 44297, U. S. Nat. Herb.).

An attractive plant, the deep purple involucre and yellow flowers contrasting with the yellowish green Lycopodium-like stems and leaves. *Werneria weddellii* Phil., which has similar leaves, is distinguished by its considerably narrower, fewer-flowered, green involucre, with longer and relatively much narrower lobes. The rays of that plant, moreover, are described by Philippi as whitish.

*Werneria sedoides* Blake, sp. nov. Fig. N, O, P.

Suffruticulose, caespitose, decumbent, forming dense mats up to 7 cm. wide, the very numerous branches mostly 2.5 cm. long or less, densely leafy, glabrous; leaves of the year erect, glaucous green, those of previous years persistent, blackening, spreading, broadly ovate, 4-4.5 mm. long, finely subglandular-denticulate throughout, 1-vittate, the sheath scarious, about 2 mm. long, 2.5-3.5 mm. wide, the lamina thickish, flattish with somewhat elevated margin above, about 2 mm. wide at apex of sheath, about 0.8 mm. wide near the usually minutely apiculate or sometimes obtusish apex; heads sessile, radiate, "white;" involucre about 10 mm. high, about 13-fid.

Leaves very densely imbricate; involucre broadly campanulate, 9-12 mm. high, 13-14-fid, the tube multivittate, the lobes triangular to oblong-ovate,

acute to obtusish, 4.5–7 mm. long, 2.5–3.5 mm. wide at base, 3-vittate, minutely ciliolate-tufted at apex, green, very narrowly scarious-margined; rays about 18 (more numerous than phyllaries), exerted, glabrous, tube 3 mm. long, the lamina narrowly spatulate, 4–6-nerved, subentire, about 9 mm. long, 2.5 mm. wide; disk flowers numerous, their corollas glabrous, 6.3 mm. long, the tube 1.8 mm., the cylindrical-funnelform throat 3.5 mm., the ovate teeth 1 mm. long; achenes (submature) oblong, glabrous, 3.5 mm. long, with about 8 thick ribs; pappus brown, 11 mm. long, the copious bristles deciduous irregularly in groups; style branches in both ray and disk truncate, hispidulous around the apex.

PERU: In tufts on wet rocky slopes, Punco, Dept. Huánuco, about 34 km. west of Huallanca, alt. about 4115 m., 1 Oct. 1922, *Macbride & Featherstone* 2475 (type no. 518901, Field Mus.; dupl. no. 1,186,098, U. S. Nat. Herb.).

Related to *W. marcida*, *W. lycopodioides*, *W. weddellii* Phil., and *W. juniperina* Hieron. In the two last the involucre is much narrower and fewer-flowered, shorter (7–8 mm. long), and only 8–10-fid; in *W. juniperina* the rays are described as only 2–6 with ligules 4.5 mm. long. In *W. marcida*, a much coarser and apparently laxer plant, the leaves are much larger and not at all dilated at base. *W. lycopodioides* is a much larger plant with less densely imbricated, yellowish green leaves, very much smaller yellow heads, and much smaller 8–9-fid involucre.

***Werneria leucobryoides* Blake, sp. nov. Fig. Q, R, S.**

Densely caespitose; rhizomes branched, erectish, very densely covered with marcescent erect leaves, the green growth of the year only 2–3 mm. long; leaves linear-subulate, acuminate, tipped with a more or less deciduous bristle nearly 1 mm. long, flat, densely long-ciliate for about half their length but glabrous on the surfaces, not amplexicaul at base, not lanate at base within, 4–5 mm. long, 0.5–0.8 mm. wide near base; heads tiny, sessile, radiate; involucre 6 mm. high, 11-fid.

Rhizomes up to 6.5 cm. long, 1 mm. thick (when denuded); branches with their leaves 3–5 mm. thick; leaves densely imbricate, the older ones completely persistent except for the bristle, becoming whitish and corky, the younger erect, 1-vittate, the petiolar portion or "sheath" thickish, 2.5–3.2 mm. long, densely ciliate for about 2 mm. with hairs 1–1.5 mm. long, the thinner light-green lamina 0.5–1.5 mm. long, often lacerate-denticulate toward apex, passing into the lax bristle, this 0.5–1 mm. long, deciduous except for its base, leaving the old leaves acuminate; heads about 6 mm. wide; involucre campanulate, glabrous, the tube multivittate, the lobes triangular, acuminate, ciliolate on the narrow scarious margin, 1–3 vittate, 3 mm. long, 1 mm. wide at base; rays 12, evidently white, glabrous, the tube 1 mm. long, the lamina 3.5 mm. long, 0.9 mm. wide, minutely 2–3-denticulate, 2–4 nerved; disk flowers 11, their corollas evidently white, glabrous, 2.6 mm. long, the tube 0.5 mm., the funnelform throat 1.6 mm., the ovate teeth 0.5 mm. long; young disk achenes glabrous, about 0.6 mm. long; pappus brownish, 2.8 mm. long; style tips in rays obtuse, essentially glabrous, in disk flowers tipped with a short obtuse cone, finely hispidulous around its base.

ECUADOR: At level of perpetual snow, Mount Quilindaña, Dec. 1897, *A. Sodiro* (type in herb. N. Y. Bot. Gard.; photog. and fragm. no. 44299, U. S. Nat. Herb.).