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A NEW FAMILY OF CAVERNICOLOUS MILLIPEDES WITH THE DESCRIPTION OF A NEW GENUS AND SPECIES FROM IDAHO (DIPLOPODA: CHORDEUMIDA: CHORDEUMIDEA)

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The Chordeumidea is accumulating species names faster than any other group of North American Diplopoda. About one-half its species, 47, have been described since 1950. This recent growth has occurred because the small size, localized populations, and, frequently, cave habitus of these millipedes have obstructed thorough collection in the past. These factors have only recently been overcome by comprehensive collecting. As a result of this rapid growth and the many artificial groupings which result from it, much organization of the higher classification remains to be done. Hoffman (1961) emphasizes that cooperation between workers, more thorough descriptions, more accurate illustrations, and revisions are necessary if a proper classification is to be attained.

Described herein is a new cave form unique among the known North American Chordeumidea. Related to Cleidogonidae, Conotylidae, and Bactropidae, it is distinguished from these families by having the ninth legs reduced and unsegmented. This species represents the type of a new family, which we name after the state in which it was collected.

IDAGONIDAE, NEW FAMILY

Diagnosis: Resembles Conotylidae in having 30 segments, slender body, long slender antennae, head entirely exposed from collum, undivided mentum of gnathochilarium, numerous pigmented ocelli, body with moderately developed setigerous tubercles, coxa of tenth leg with eversible pouch. Differs from Conotylidae in having the ninth legs reduced to small, unsegmented, sclerotized arms closely associated with the peltogonopods.

While this paper was awaiting publication, Loomis (1966) published descriptions of two new North American Chordeumoid families, and an addendum to the key of Chamberlin and Hoffman (1958). When the present paper was returned for corrections, we felt this important addition should also be included in a revised key.

KEY TO THE CHORDEUMOIDEA OF NORTH AMERICA

(Modified from Chamberlin and Hoffman, 1958, with addendum from Loomis, 1966.)

- 1. Body composed of 20 or 26 segments 2
- Body composed of 28, 30, or 32 segments 3

- 2. Segments 20; tergites not produced laterally into paranota (lateral carinae of authors) Ergethidae
 Segments 26; tergites with numerous short dorsal crests and prominent paranota Branneriidae

- 3. Telopodite of ninth leg pair of males thickened, often clavate, the second joint often forming a distinct angle with the coxa, the latter with a conspicuous inner process 4
 Ninth leg pair of males never clavately thickened as described above, and not forming a distinct angle with the coxa, which has no inner process 6

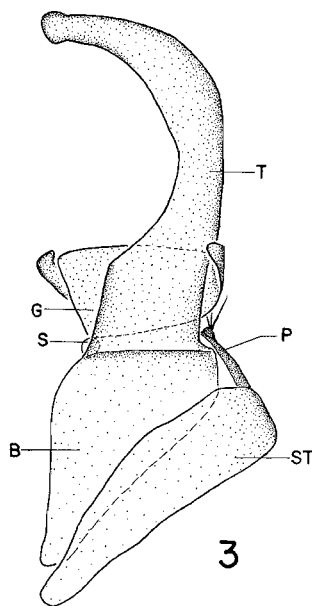
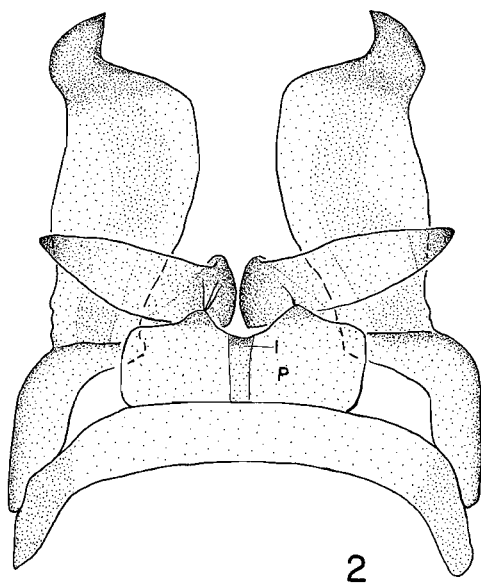
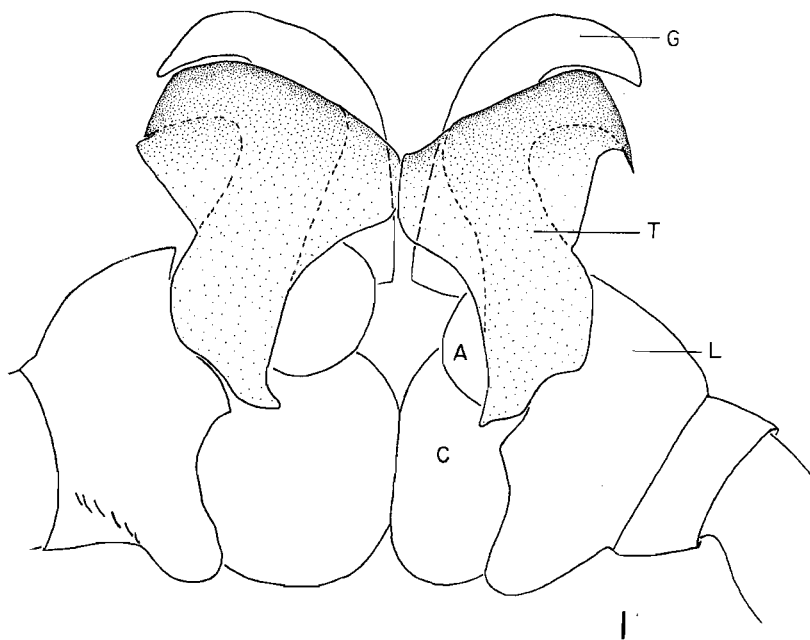
- 4. Gnathochilarium with mentum undivided, no promentum set off 5
 Gnathochilarium with distinct mentum and promentum Caseyidae

- 5. Coxae of legs 10 and 11 possess gland opening; peltogonopods coalesced, coxal region large and distinctly divided from telopodite; paragonopods with 3 to 5 segments, with or without a terminal claw Trichopetalidae
 Coxae of legs 11 lack gland opening; peltogonopods not coalesced, with coxa and telopodite not distinctly separated; paragonopods consist of 3 segments, lacking a terminal claw. . . . Conotylidae

- 6. Last tergite prolonged into a projection which surpasses the anal valves Urochordeumidae
 Last tergite not thus prolonged 7

- 7. Dorsum densely short-setose in addition to macrosetae and other sculpturing; segment 1 enlarged, much wider than head, anterior margin transverse and triarcuate; outer macroseta of each side well within lateral limits; last segment short and broadly rounded throughout behind Rhiscosomididae
 Dorsum never short-setose; segment 1 not wider than head, usually much narrower, anterior margin rounded or rounded-angular; outermost macroseta at lateral limit; last segment with sides oblique and nearly straight, apex truncate 8

Figures 1-3, facing page, *Idagona westcotti*. Fig. 1, male paratype, gonopods and coxae of tenth legs, *in situ*, ventral view. A - anteromesal coxal lobe; C - basal region of coxa; G - paragonopod; L - lateral lobe of coxa; T - telopodite of peltogonopod; Fig. 2, male paratype, anterior view of gonopods illustrating relative positions of sclerites. I - intersternal bar; P - plate; Fig. 3, male paratype, left lateral view of gonopods. B - basal region (coxopodite) of peltogonopod; G - paragonopod; P - plate and intersternal bar; S - sternum of paragonopod; ST - sternum of peltogonopod; T - telopodite of peltogonopod.



- 8. Gnathochilarium with mentum undivided, no promentum set off 9
 Gnathochilarium with distinct mentum and promentum 10
- 9. Ninth male legs conspicuous, five segmented and with a small claw; length 9 mm; setigerous tubercles obsolete Bactropidae
 Ninth male legs (paragonopods) inconspicuous, unsegmented, and without a claw; length 14 mm; setigerous tubercles moderately developed Idagonidae
- 10. Size large, at least 14 mm long; body without strongly projecting paranota Cleidogonidae
 Size smaller, body 8 mm or less, with prominent paranota 11
- 11. Metazonites with dense scattering of thin, short, longitudinal carinae; macrosetae small; paranota thick, following contour of dorsum, and evident to last two or three segments; ninth male legs three jointed Tingupidae
 Metazonites densely granular on keeled segments, smooth on others; macrosetae large; paranota strongly projecting, almost horizontal, thin, and terminating on segment 23 or 24; ninth legs six jointed Apterouridae

IDAGONA BUCKETT AND GARDNER, NEW GENUS

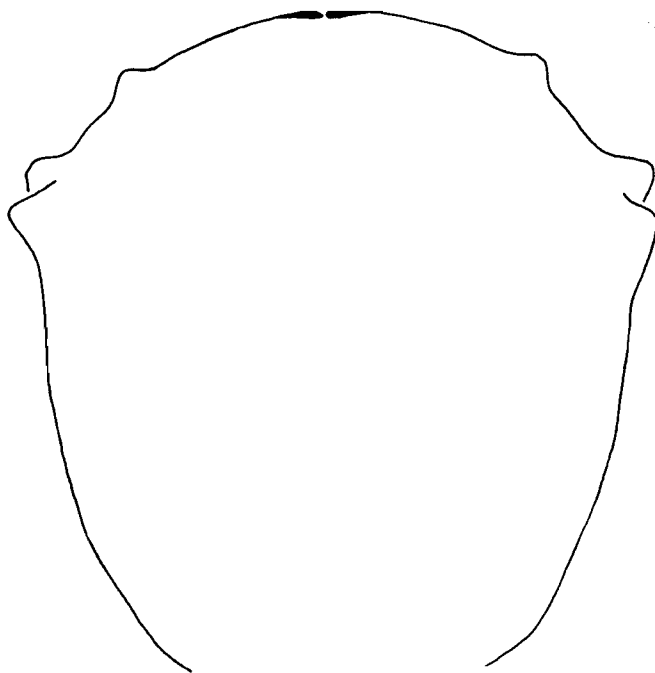
Diagnosis: Body with 30 segments, light brown; pigmented ocelli well developed (14 - 17 per patch); antennae very long, slender, reaching caudad to seventh segment; gnathochilarium with mentum undivided, promentum not set off; setigerous tubercles moderately developed on small shoulder-like prominence in medial body segments; peltogonopods large, simple, arched caudad and fitting tightly against coxae of tenth legs; paragonopods small, closely appressed to peltogonopods; coxae of tenth and eleventh legs swollen, an eversible pouch present in each coxa of tenth legs.

Type species: *Idagona westcotti* Buckett and Gardner, new species.

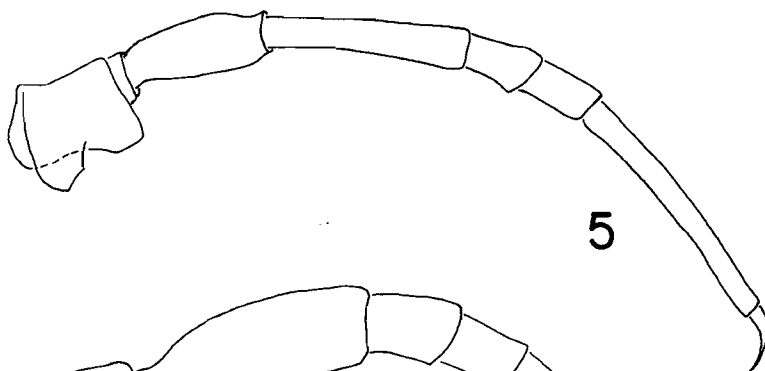
IDAGONA WESTCOTTI, NEW SPECIES

Holotype male: Body cream to light brown; length 14 mm. Head with vertex prominent, nearly smooth, glossy, sparsely hirsute; frons more densely hirsute; epicranial suture distinguishable; head much wider than

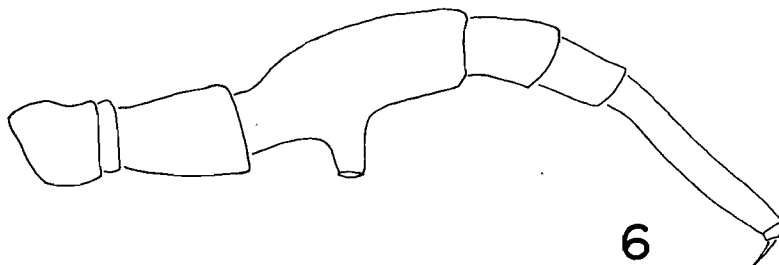
 Fig. 4, female allotype, tergite of medial body segment, posterior view; Fig. 5, tenth leg of male paratype; Fig. 6, third leg of male paratype.



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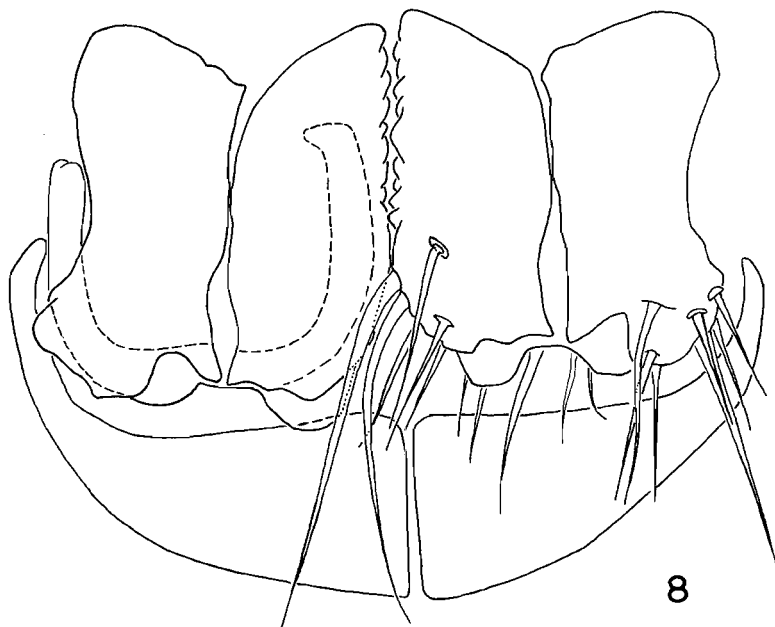
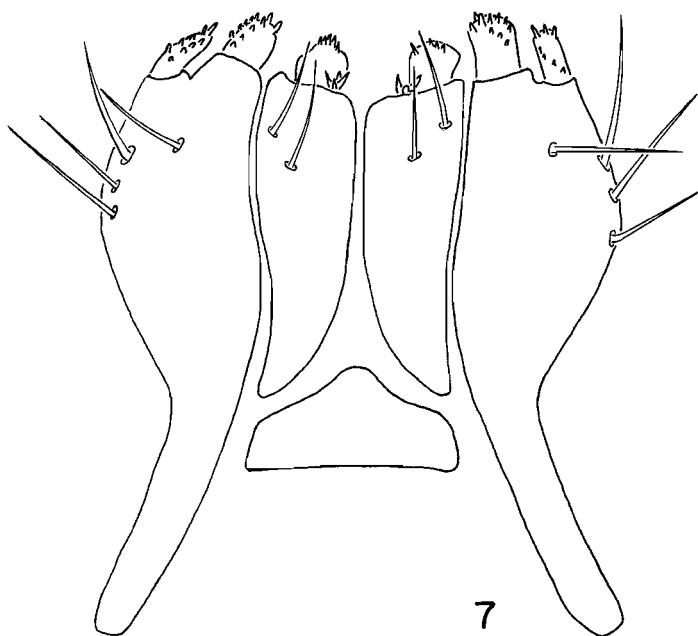
collum; mandibular cheeks laterally protruding far beyond eyes; anterior margin of labrum concave with three well-defined teeth; labral setae six on each side; eyes pigmented, placed in triangular patch with four transverse rows of 6, 5, 3, and 2 ocelli respectively; antennae reaching caudad to seventh segment; approximate ratios of antennal segments as follows, beginning with first: 1, 4, 8, 5, 5, 7, 3, 5, 2; gnathochilarium with promentum apparently absent (as in Fig. 7), stipes and lingual lamellae each with two sense cones.

First and second legs of equal length; third legs 1.3 times length of preceding legs; fourth segment of third legs swollen, nearly 1.5 times as thick as equivalent segment on other legs, and produced into a cylindrical, mesally directed process (as in Fig. 6); fourth through seventh legs slightly larger than third legs, but not modified; ninth legs, herein referred to as paragonopods, greatly reduced and closely associated with peltogonopods; tenth legs each with distal portion of coxa produced into rounded, caudally directed lobe; ventral margin of lobe ventrally exceeding second joint, which arises laterad; also, tenth coxae each with a short, truncate anteroventral lobe situated anteromesad to and exceeded ventrally by large caudally directed lobe; anteroventral lobe with eversible pouch; remainder of tenth legs of same proportions as following legs, but about 15% smaller; coxae of eleventh legs swollen, but no gland openings apparent; remaining legs normal.

Collum nearly smooth, anterior margin rounded, posterior margin straight, caudolateral corners appearing rounded from dorsal view; median carina weakly represented on collum, extending strongly along succeeding segments, terminating on penultimate body segment; setigerous tubercles of collum weak, more prominent on succeeding segments (as in Fig. 4), diminishing on last eight segments; lateral two pairs of tubercles on each tergite of first seven postgenital segments raised on shoulder-like prominences (as in Fig. 4); posterolateral pair of setae largest of the six dorsal setae, reaching a length of 0.6 mm; anal segment truncate, much wider than long, yet slightly longer than preceding segment; anal lips weakly developed, lined with four pairs of setae; anal tergite with anterior margin mesally possessing a single pair of setae, lateral margins possessing two pairs of setae; one pair of spinnerets present on posterolateral corners of anal tergite.

Gonopods simple, constructed of a large peltogonopod and a small, slender paragonopod, each consisting of a single branch; in situ, peltogonopod proceeding ventrally, curving caudad at about three-fifths its length, entire peltogonopod fitting tightly against coxae of tenth legs (as in Fig. 1); basal portion of peltogonopod stout, distally broadening into a lamina with anterior surface convex, posterior surface

Fig 7, female allotype, gnathochilarium, ventral view; Fig. 8, female allotype, posterior aspect of cyphopods; setae omitted from left side and projecting arms omitted on right side.



slightly concave; peltogonopod narrowing distally of caudad curve to blunt, rounded apex, but with a small mesocaudal conical terminal process; paragonopod laminate, broadly joined to horizontal sternal bar; paragonopod proceeding cephalad between bases of peltogonopods, curving ventrolaterally around anterior face of peltogonopod of same side of body, terminating laterad of base of peltogonopod; paragonopod with basal end triangular: a broad horizontal base joined to sternum, a mesal vertical wall, and an oblique wall adjoining the other two; paragonopods evenly narrowing distad from triangular base to single vertical lamina, and eventually to pointed apex. A sclerotized intersternal bar extending between sterna of peltogonopods and dorsally of paragonopods; bar with a single median attachment on sternum of peltogonopod; posteriorly, bar forks and makes two attachments to sternum of paragonopod. A thin plate extends between intersternal bar and sternum of peltogonopod on each side of intersternal bar, with broad attachments both on sternum and anterior half of intersternal bar (cephalad of fork); plate arched, convex ventrally and possessing a ventrally directed tubercle; tubercles each possessing from 1 to 3 setae.

Allotype female: As in male, only lacking secondary sex characters such as modified third and tenth legs and glandular pouches. Cyphopods each consisting of two subequal lobes and a pair of curved arm-like projections (Fig. 8).

Specimens examined: Holotype male, allotype female, 3 male paratypes, 2 female paratypes, and 3 fragments of undeterminable sex, collected deep in Crystal Falls Cave, 20 mi. northeast of Dubois, Clark County, Idaho, 16 July 1965 (R. L. Westcott). One additional female specimen from Boy Scout Cave, Craters of the Moon National Monument, Butte County, 18 August 1965 (R. L. Westcott).

Type deposition: Holotype deposited in the Type Collection, Department of Entomology, University of California, Davis, California; one male paratype sent to H. F. Loomis, Miami, Florida; allotype retained in the authors' private collection; remainder of paratypes divided between University of Idaho, Moscow, Idaho, and the authors' private collection.

Discussion: The gonopods of *Idagona* are distinctive in several respects. The paragonopods are completely unsegmented, there being even no observable division between coxa and telopodite. Also, the extreme reduction of the paragonopods exhibits a reversal of the size relationship of the two gonopods in related groups.

The female cyphopods may be distinctive for the species, but no conclusions can be reached at this time, due to inadequate material and scarcity of illustrations of cyphopods in the literature.

The gonopods of a paratype were cleared in 15% NaOH and were stained with lignin pink; the sclerites were loosened in order to ascertain the relationships of the various parts. The coxopodite of the peltogonopod basally curves laterally around the end of the sternum, but does not fuse with it; however, the telopodite of the paragonopod does

appear to fuse with the posterior sternum. The lateral edges of the posterior sternum fit against the basal region of the peltogonopods, but do not coalesce with them. The attachment of the thin sclerotized plate on the anterior sternum is more mesad than the attachment of the peltogonopod on the sternum. There appears to be only a membranous connection between the plate and the peltogonopod. The intersternal arm is the only sclerotized connection between the two sets of gonopods, the telopodites not being united. The intersternal arm is probably of sternal origin, but the plates are of dubious origin.

The approximate placement of Idagonidae is determinable by somatic characters. Its size, slender body, long slender antennae, number of segments, number of eyes, and moderate setigerous tubercles place it in the Chordeumidea near the families Cleidogonidae and Conotylidae, from which it is superficially indistinguishable.

In order to distinguish between members of this Conotyloid complex, workers have relied on genitalic characters, especially the ninth legs, or peltogonopods of the male, modified from the ninth leg. The configuration of these structures apparently manifests generic and familial ties within this group. In the Conotylidae the general form of the telopodite of leg nine consists of two or more thickened, elongate segments. In Cleidogonidae and Bactropidae, the ninth legs tend to be reduced but not distally thickened. In these families the generic classification has been based largely on the segmentation of the ninth legs, as illustrated by Hoffman's (1950) key to the Cleidogonidae.

However useful the ninth legs have been in elucidating familial and generic affinities within the complex, they give no clue as to the position of the apparently distant Idagonidae. Nevertheless, the closest ally to Idagonidae may be inferred from other characters. The absence of a promentum in the gnathochilarium is an important somatic character and relates it to Conotylidae, Bactropidae, and Trichopetalidae. Bactropidae differs from Idagonidae in its diminutive size and relatively clavate antennae. However, more must be known about the family Bactropidae before accurate relationships can be determined. Trichopetalidae differs from Idagonidae in possessing more complicated and coalesced peltogonopods, coxal openings on leg 11, and in being distributed only in the eastern and southern part of North America. Conotylidae resembles Idagonidae in the larger size, elongate antennae, lack of gland openings on coxa of leg 11, relatively simple and non-coalesced peltogonopods, and in possessing a distribution overlapping the type locality of *Idagona*. Conotylidae, therefore, seems to be the most closely related family to Idagonidae.

Also collected in Crystal Falls Cave was a single immature male specimen of the family Conotylidae, which can be easily distinguished by the characters in the key, as well as its possessing only 5 unpigmented eyes.

ACKNOWLEDGMENTS

We wish to express our appreciation to Mr. R. L. Hoffman and to Mr. H. F. Loomis for their notes on gonopod morphology and their opinions

on the relationships of Idagonidae to other families within the Chordeumidea. We would like to acknowledge the ardent collector for whom we take great pleasure in naming the species herein described as new, Mr. Richard L. Westcott, University of Idaho, Moscow, Idaho. Without the extensive survey work conducted by personnel at the Department of Entomology at the University of Idaho in collecting arthropods, this work would not have been possible.

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THE "MICHIGAN LIST"

The *List of Michigan Insects and Related Arthropods*, envisioned and initiated by the late Robert Dreisbach, will begin publication later this year. The list, edited by Roland L. Fischer and Ronald S. Wilkinson with the assistance of John H. Newman, Mogens C. Nielsen and Henry K. Townes, is being compiled by leading authorities. It will reflect the latest phylogenetic concepts of classification.

Fascicles, each comprising an order or other major taxon, will appear as they are ready. Authors will include an introduction to each taxon, furnishing such information as biology, ecology and general distribution in Michigan. Individual species listings will be accompanied by county distribution, earliest and latest date of adult capture, larval food when known, and other pertinent data.

Publication costs will be financed by the Dow Chemical Company of Midland, Michigan. Society members and subscribers entitled to receive *The Michigan Entomologist* will also receive the *List of Michigan Insects* free of charge, and others may obtain it upon payment of a nominal handling charge to be announced with each fascicle.

R.S.W.