ANNALS
OF THE
NEW YORK ACADEMY OF SCIENCES,
VOLUME IX.

I.—*The Craspedosomatidæ of North America.*

BY O. F. COOK AND G. N. COLLINS.

Read October 7, 1895.

INTRODUCTORY NOTE ON THE FAMILIES OF DIPLOPODA.*

Since the completion of the paper on North American Craspedosomatidæ many dissections and drawings of representatives of other families of Diplopoda have been made, resulting in the apprehension of more light on the affinities of the group here treated. Among the forms studied are Striaria, Stemmatoiulus, Cambala, Cambalopsis, Nannolene, Pseudonannolene, Lysiopetalum, Pæromopus, Siphonophora, Siphonotus, Siphonorhinus, Spirostreptus, Spirobolus, Parainulus, Pseudoiulus, and numerous representatives of the Polydesmoidea. The result of this examination is opposed to the opinion of Pocock, Latzel and Berlese, that the present family is allied most closely to the Iulidæ. It seems more reasonable to place the Craspedosomatidæ next to the Polydesmidæ and to arrange the families of Diplopoda as follows:

Class **DIPLOPODA.**

Subclass **PSELAPHOGNATHA.**

Order **Ancyrotricha.**

Family **POLYXENIDÆ**,—genera Polyxenus and Lophoproctus.

Distribution: Cosmopolitan.

* By O. F. Cook.

Order **Lophotricha.**Family **PALEOCAMPIDÆ**,—genus *Paleocampa*.*Distribution*: A fossil from the carboniferous Mazon Creek beds, Illinois.Subclass **CHILOGNATHA.**Order **Oniscomorpha.**Suborder **GLOMEROIDEA.**Family **GLOMERIDÆ**,—genera, *Glomeris*, *Latzelia* (preoccupied by a fossil chilopod.)*Distribution*: Europe, Asia and North Africa.Family **GERVAISIIDÆ**,—genus *Gervaisia*.*Distribution*: Europe.Suborder **ZEPHRONIOIDEA.**Family **ZEPHRONIDÆ**,—genera *Zephronia*, *Sphaeropæus*, *Sphaerotherium*.*Distribution*: South Africa and Southern Asia.Order **Limacomorpha.**Suborder **GLOMERIDESMOIDEA.**Family **GLOMERIDESMIDÆ**,—genus *Glomeridesmus*.*Distribution*: South America and the West Indies.Family **ZEPHRONIDESMIDÆ**,—genus *Zephronidesmus*.*Distribution*: Sumatra.Order **Colobognatha.**Suborder **POLYZONOIDEA.**Family **POLYZONIDÆ**,—genera *Polyzonium*, *Platyzonium*, type *P. getschmannii* (*Cryptodesmus getschmannii* Karsch.)*Distribution*: North temperate regions of both hemispheres.Family **SIPHONOTIDÆ**,—genera, *Bdellotus*, type *B. formosus* (*Siphonotus formosus*, Pocock), *Rhinotus*, type *R. africanus* (*Siphonotus africanus*, Cook), *Siphonotus*.*Distribution*: Tropics of both hemispheres.This and the previous family may constitute a superfamily *Polyzonoidæ*, equivalent to the superfamily *Siphonophoroidæ*:Family **SIPHONOPHORIDÆ**,—genera *Bactrois*, type *B. vittatus* (*Siphonophora vittata*, Pocock), *Siphonophora*.*Distribution*: Tropics of both hemispheres.Family **SIPHONORHINIDÆ**,—genus *Siphonorhinus*.*Distribution*: Tropics of both hemispheres.

Suborder PLATYDESMOIDEA.

Family PLATYDESMIDÆ,—genera, Andrognathus, Brachyeybe, Dolistenus, Platydesmus, Pseudodesmus.

Distribution: North America, Europe and Asia.

Suborder SIPHONOCRYPTOIDEA.

Family SIPHONOCRYPTIDÆ,—genus Siphonocryptus.

Distribution: Sumatra.

Order Monocheta.

Suborder STEMMATOULOIDÆ.

Family STEMMATOULIDÆ,—genus Stemmatoulus.

Distribution: Tropics of both hemispheres.

Suborder XYLOIULOIDÆ.

Family XYLOIULIDÆ,—genus Xyloiulus (*Xylobius* Dawson).

Distribution: A fossil from the Sigillarian stumps of the carboniferous beds of Nova Scotia.

Order Merocheta.

Suborder LYSIOPETALOIDEA.

Family LYSIOPETALIDÆ,—genera, Callipus, Megastrephon, Eurygyrus, Lysiopetalum, Spirostrephon.

Distribution: North Temperate Zone.

Suborder CRASPEDOSOMATOIDEA.

Family CRASPEDOSOMATIDÆ,—genera, Aporogona, type *A. crenulata* (Craspedosoma crenulatum, Latzel), Atractosoma, Attemsia, type *A. stygia* (Latzel), Aulacosoma, Bactropus, Basigona, type *B. alhesina* (Fedrizzi), Bomogona, type *B. lombardica* (Brolemann), Branneria, Chelogona, type *C. carpathica* (Latzel), Caseya, Chordeuma, Cleidogona,* Conotyla, Craspedosoma, Grypogona, type *G. latzeli* (Atractosoma latzeli, Verhœff), Haasia, Haplogona,† type *H. oculodistincta* (Verhœff), Nastigona,† type *M. mutabilis* (Latzel), Melogona, type *M. rhenana* (Chordeuma gallicum var. rhenanum, Verhœff), Mycogona, type *M. germanica* (Chordeuma germanicum, Verhœff), Nanogona, type *N. polydesmoides* (Leach), Ochogona, type *O. pusilla* (Atractosoma pusillum, Verhœff), Phanogona, type *Ph. bohémica* (Rosicky), Pseudotremia, Rhiscosoma, Scoterpes, Trachygona,† Trichopetalum, Underwoodia, Xiphogona,† type *X. flavescens* (Latzel), Zygonopus.

Distribution: North Temperate regions and New Zealand.

*Cleidogona is proposed for Cryptotrichus Packard, preoccupied in Coleoptera.

† These three names take the places respectively of Latzelia, Poratia and Haasea, proposed by Verhœff in recent numbers of the Zoölogischer Anzeiger, but all preoccupied in Diplopoda,—Latzelia twice.

‡ For Trachysoma, recently proposed by Attems but preoccupied in Crustacea.

Family HETEROCHORDEUMIDÆ,—genera *Heterochordeuma*, Pocockia.

Distribution: Ceylon and Sumatra.

Family STRIARIIDÆ,—genus *Striaria*.

Distribution: Temperate North America.

Suborder POLYDESMOIDEA.

Family AMMODESMIDÆ,—genera *Ammodesmus*, *Doratodesmus* (*Doratonotus* Pocock, pre-occupied).

Distribution: Tropical Africa and Asia.

Family AUGODESMIDÆ,—genera *Augodesmus*, *Euryurus*, *Polylepis*.

Distribution: Tropical America.

Family CAMPODESMIDÆ,—genera *Campodesmus*, *Cyrtodesmus*.

Distribution: Tropical Africa and America.

Family CHELODESMIDÆ,—genera *Chelodesmus*,* *Leptodesmus*, *Odontopeltis*, *Odontotropis*, *Priodesmus*, *Rhachodesmus* (*Rhachis*, is pre-occupied), *Strongylodesmus*.

Distribution: Tropical America.

Family CRYPTOESMIDÆ,—genera *Aporodesmus*, *Cryptodesmoides*, *Cryptodesmus*, *Poratia*, *Trichopeltis*.

Distribution: Tropics of both hemispheres.

Family CYCLODESMIDÆ,—genus *Cyclodesmus*.

Distribution: Tropical America. There seems to be little ground for supposing that the Malayan genus *Doratonotus* is related to the Mexican genus *Cyclodesmus*.

Family GOMPHODESMIDÆ,—genera *Astrodesmus*, *Aulodesmus*, *Gomphodesmus*, *Harmodesmus*, *Marptodesmus*, *Sphenodesmus*, *Tycodesmus*.

Distribution: East Tropical Africa.

Family HAPLODESMIDÆ,—genus *Haplodesmus* (*Haplosoma* Verhoeff, pre-occupied).

Distribution: Amboina.

Family ONISCODESMIDÆ,—genera *Cyphodesmus*, *Oniscodesmus*, *Sphæriodesmus*.

Distribution: Tropical America.

Family OXYDESMIDÆ,—genera *Anisodesmus*, *Isodesmus*, *Mimodesmus*, *Orodesmus*, *Oxydesmus*, *Seytodesmus*, *Tylodesmus*.

Distribution: Tropical Africa.

* Pores 13, on segments 5, 7, 9, 10-19, latero-inferior; sternum of fifth segment of male with four processes, that of the sixth with two; male legs with a large process from the apex of the penultimate joint. Type *Chelodesmus marxi*, U. S. National Museum.

Family PARADOXOSOMATIDÆ,—genera Paradoxosoma, Trachydesmus.

Distribution: Corfu.

Family PHATYRRHACHIDÆ,—genera Acanthodesmus, Odontodesmus, Platyrrhacus, Trachelodesmus.

Distribution: Tropics of both hemispheres.

Family POLYDESMIDÆ,—genera Brachydesmus, Chactaspis, Goniodesmus, type *G. fissilobus* (Polydesmus fissilobus, Brolemann), Polydesmus, Scytonotus.

Distribution: Temperate Europe, Asia and North America.

Family STRONGYLOSOMATIDÆ,—genera Anoplodesmus, Centrodesmus, Cnemadesmus, Cylindrodesmus, Eudasyptis, Icosidesmus, Iulidesmus, Ophiodesmus, type *O. verhaafi* (Strongylosomum verhaeffi, Brolemann), Orthodesmus, Prionopeltis, Rhachidomorpha, Strongylosoma, Tetracentrosternus, Trogo-

Distribution: Cosmopolitan, mostly Tropical.

Family STYLODESMIDÆ,—genera Cynedesmus*, Lophodesmus, Pyrgodesmus, Stylodesmus.

Distribution: Tropics of both hemispheres.

Family XYSTODESMIDÆ,—genera Eurydesmus, Fontaria, Pachydesmus, type *P. crassicutis* (Wood), Rhysodesmus, type *R. limax* (Sauss.), Stenodesmus, Xystodesmus, type *X. murtensii* (Peters).

Distribution: North America and Eastern Asia.

Order Diplocheta.

Suborder SPIROSTREPTOIDEA.

Family SPIROSTREPTIDÆ,—genera Alloporus, Archispirostreptus, Ctenoiulus, Odontopyge, Plusioporos, Rhynchoproctus, Spirocyclistus, Spiropæus, Spirostreptus, Thyropygus.

Distribution: Tropics of both hemispheres and South Africa.

Family TRACHYSTREPTIDÆ,—genera Trachystreptus, type *T. cambaloides*,† Lophostreptus, type *L. magnus* (Karsch).‡

Distribution: Tropical Africa.

*Type *Cynedesmus formicola*, U. S. National Museum; the genus also includes *C. ornamentalus* (Cryptodesmus ornamentalus, Karsch).

†*Trachystreptus cambaloides* sp. n.—Nearly black; antennæ strongly clavate, lying in lateral concavities of the first segment; head, first and last segments closely punctate; other segments with numerous irregular cariniform longitudinal ridges. Segments 37–39. Length 25 mm.; width 2.2 mm. Habitat, Liberia.

‡I have examined the type of *Glyptulus magnus* Karsch, in the Berlin Museum.

Suborder CAMBALOIDEA.

Family PSEUDONANNOLENIÆ,—genus *Pseudonannolene*.*Distribution*: South America.Family NANNOLENIÆ,—genera *Nannolene*, *Iulomorpha*.*Distribution*: Western North America and South Africa.Family CAMBALIÆ,—genus *Cambala*.*Distribution*: Eastern North America.Family CAMBALOPSIÆ,—genera *Cambalomorpha*, *Cambalopsis*, *Glyphiulus*, *Trachyiulus*, *Trichocambala*.*Distribution*: Southern Asia.Family ARCHIULIÆ,—genera *Archüulus*, *Archicambala*, type *A. dawsoni* (*Xylobius dawsoni*, Seudder).*Distribution*: Fossils from the Sigillarian stumps of the carboniferous beds of Nova Scotia.

Suborder IULOIDEA.

Family IULIÆ,—genera *Allaiulus*, *Anaulaciulus*, *Brachyiulus*, *Chromatoiulus*, *Cryptoiulus*, *Cylindroiulus*, *Diploiulus*, *Hemipodoiulus*, *Iulus*, *Mesoiulus*, *Micropodoiulus*, *Pachyiulus*, *Palaeoiulus*, *Tachypodoiulus*, *Typhloiulus*, *Unciger*, *Xestoiulus*.*Distribution*: North Temperate Zone.Family PARAULIÆ,—genera *Paraiulus*, *Pseudoiulus*, *Ptyoiulus*, type *P. pennsylvanicus* (Brandt).*Distribution*: Temperate North America.Family PEROMOPHIÆ,—genus *Pteromopus*.*Distribution*: California.Family BLANIULIÆ,—genus *Blaniulus*.*Distribution*: Europe.Family ISOBATIÆ,—genus *Isobates*.*Distribution*: Europe and Temperate North America.

Suborder SIPHONOIULOIDEA.

Family SIPHONOIULIÆ,—genus *Siphonoiulus*.*Distribution: Sumatra.

*This most remarkable form is probably worthy of ordinal rank and might be called *Rhinognatha*. The absence of legs from the third and fourth segments indicates want of affinity with the *Colobognatha*, while the form of the head and antennæ will doubtless exclude it from the *Diplocheta*.

Order **Anocheta**.

Suborder **SPIROBOLIDEA**.

Family **SPIROBOLIDE**,—genera *Acanthiulus*, *Rhinocricus*, *Spirobolellus*, *Spirobolus*, *Thyroproctus*, *Trigoniulus*.

Distribution: Tropics of both hemispheres.

Subclass **ARCHIPOLYPODA**.

Family **EUPHOBERIDE**,—with numerous genera.

This group is an assemblage of widely different fossil forms, some of which will probably prove to be true Chilognatha; thus the genus *Amnilyspes* bears striking resemblance to certain genera of Polydesmoidea. The species of *Euphoberia* and *Acantherpestes*, however, are types apparently very distinct from the Chilognatha. The six dorsal setae are located as in *Craspedosomatidae*, while the setae and unpaired seminal duct are both present in *Stemmatoiulus*, the representative of an order equal in antiquity to the Archipolypoda, so that the derivation of the Chilognatha from the Archipolypoda is not indicated by present evidence, though a common origin is most probable.

The orders and families of Chilognatha are in need of careful description which will make the labor of characterizing species and genera less difficult. In all the suborders, except the Polydesmoidea, the assignment of the genera to the different families is made with some confidence. The classification of the Polydesmoidea is in a backward state, owing to the fact that the older writers neglected many of the more important characters and the arrangement of some of the genera may prove to be more or less artificial and provisional.

The character which during our study of the *Craspedosomatidae* we supposed to be unique among recent Diplopoda—the dorsal setae—is shared by *Stemmatoiulus*, which has even the curious setiferous papillae of the last segment, though there are four in *Stemmatoiulus*, and only two in *Craspedosomatidae*. The co-existence in *Stemmatoiulus* of pores and setae show that the presence or absence of either of these structures is not of itself evidence of close affinity or wide diversity. The supposition that the spines are in some way a substitute for the repugnatorial apparatus is also shown to have no foundation.

The presence of external seminal ducts in Iulidae and their absence in *Craspedosomatidae* is at once an important and an easily

stated diagnostic character, and has been used in the following synopsis of orders. So various are the adaptations of legs in different parts of the body to assist in copulation, that the weight of the principal distinction on which the group *Oniscomorpha* rested has its relative importance somewhat diminished. Others of its characters are evidently coördinations with its habit of rolling into a sphere, and are not necessarily to be interpreted as evidences of a diversity of origin.

Synopsis of Orders of CHILOGNATHA.

Body composed of not more than 13 distinct segments; male copulatory organs several-jointed, situated at the posterior end of the body.

Order *Oniscomorpha*

Body composed of at least 19 segments.

Males with the legs of the seventh segment unmodified; external seminal ducts long, divaricate, beset with whorls of setae...Order *Limacomorpha*

Males with one or both pairs of legs of the seventh segment transformed into copulatory organs.

Males with eight pairs of legs in front of the 4-5-jointed copulatory organs, which replace the posterior pair of legs of the seventh segment and the anterior pair of the eighth; segments 1-5 each with a single pair of legs.....Order *Colobognatha*

Males with seven pairs of pre-copulatory legs; copulatory organs not more than 2-jointed, replacing one or both pairs of legs of the seventh segment.

External seminal apertures appearing as perforations of the coxæ of the second pair of legs.....Order *Merocheta*

Coxæ of second male legs imperforate.

Labrum with a median sinus; segments 1-5 with one pair of legs each; external seminal ducts wanting, the apertures located at the base of the second pair of legs.....Order *Anocheta*

Labrum with a median tooth; segment 3 or 4 footless; external seminal ducts present.

Pleure entirely obliterated; legs 7-jointed; external seminal apertures through paired, unjointed; external ducts inserted at the base of the second male legs.....Order *Diplocheta*

Pleure nearly free; legs 8-jointed; external seminal aperture single, through a 2-jointed external duct inserted at the base of the second male legs.....Order *Monocheta*

NOTES ON SPECIMENS AND TYPES.

As *Lysiopetalidæ* and *Chordeumidæ* the American species of this family have been subject to more revision than those of any

other. We concluded, however, after attempting a study of the forms occurring in central New York, that more complete descriptions of the known species would be necessary for their identification and an understanding of their generic relationships. Especially undesirable would be the projection of the new species into the existing confusion.

Through the kindness of Drs. Riley and Gilbert we were permitted to examine the types in the National Museum and the collection of the University of Indiana. These, with our own collection, gave us examples of nearly all the described species.

Unfortunately the types of the species described by Wood, Packard, Cope, Ryder and Harger are not accessible, and may be no longer in existence. Drs. Cope and Ryder expressed their regret at being unable to assist us, as their specimens could not be found. Dr. Packard favored us with a vial of specimens of *Pseudotremia* and stated that his material may have been deposited in the Museum of Comparative Zoölogy, at Cambridge. Owing to the illness of Dr. Hagen we could not get access to the specimens, nor ascertain whether they are in the Museum. The Museum of the Philadelphia Academy of Sciences contains but one species of this family, a *Cryptotrichus*, but not Wood's type.

A study of the material at hand soon showed us that we had entirely underestimated our task; it purported to consist of twelve of the fourteen species then known, but from it we have been compelled to erect seven additional species. Collections made by ourselves added four more, and when this paper was nearly finished Captain Casey presented a bottle of California *Myriapoda* among which we found still another novelty, increasing to twenty-eight the number of species known from North America. From this it may be inferred that many species are still to be discovered, especially since the distribution is usually very local. Individuals are scarce, and require the most careful collecting in very moist habitats where species of other families are not commonly found, and which are therefore not visited except in special quests for *Craspedosomatidæ*.

Our thanks are due to Mr. R. Innes Pocock, of the British Museum, for many kindnesses in the way of opportunity of examining the collections under his charge, and for specimens of European *Craspedosomatidæ* which have enabled us to verify our opinion of their generic distinctness from American forms.

NOTES ON HABITS AND STRUCTURE.

The habits of living Craspedosomatidae show considerable difference from those of other families, and emphasize the importance of some structural characters which have, we think, not received proper weight in classification.

Reference is made chiefly to *Trichopetalum*,* which on account of its abundance, small size and transparent exo-skeleton is well suited for observation. But so much alike are all the members of this family, that there is probably little difference with regard to considerations of habits or structure, with the exception of lack of eyes in cave forms.

In central New York *Trichopetalum* is one of the most common and generally distributed of *Diplopoda*, though liable to be overlooked on account of its small size. Like the other members of this family it inhabits rather wet places, but does not seem particular in other respects, living among mosses and rotting leaves, and under sticks and pieces of bark.

When undisturbed the gait of *Trichopetalum* is quite leisurely, but when frightened it never attempts to protect itself by coiling up, relying on its powers of flight. This course is warranted by the fact that the Craspedosomatidae are more fleet of foot than other Chilognatha, though some species of Iulidae are able to progress at a very respectable pace. It is also noteworthy that the fleetest species of Iulidae (*Paraiulus*) are not inclined to coil up when frightened, but attempt to run, and even when captured and held they do not at first employ the ruse of coiling up and feigning death, but attempt to escape by vigorous wriggling. All Iulidae seem, however, to have the power of coiling up, and will sooner or later exercise it for protection.

The ability to coil up depends on a certain form and structure of the segments. The dorsal part must be longer than the ventral, and the amount one segment overlaps the next must be greater in the form that is able to coil up. There is also necessitated a larger amount of flexible integument between the segments.

The Iulidae manifest all these characters, even to the flattening of the pedal laminae and the basal joints of the legs; other Chilognatha have them, usually in a less degree.

* The species described in this paper as *Trichopetalum album*.

In the Craspedomatidæ, however, the dorsal and ventral portions of the segments differ less in length, and although the pedal laminae have no chitinized connection with the pleuræ, the body is not coiled in a close spiral. Even when tightly contracted in alcohol, Trichopetalum and its allies are able to do little more than form a circle, a position of doubtful use as a means of defense, especially when compared with the close spirals which Inulidæ assume. The Craspedosomatidæ lack, besides, the strong exo-skeleton and repugnatorial secretion of the other families, so that for them coiling up would not have much advantage as a means of defense.

As might be inferred from the preceding statements the instinct of feigning death is not developed in Craspedosomatidæ. While they are able they attempt to run away, but if held in the hand the heat and drier atmosphere are soon fatal. This was noticed especially in *Underwoodia polygama*. If held in the hand and exposed to sunlight they were soon unable to run in the ordinary way, wriggled convulsively a few times and died. This would happen in a minute or two, while the specimen was being examined with a lens to determine the sex. In such cases care was taken to see whether the animals would recover, but they did not do so.

Individuals of Trichopetalum are also of very delicate organization. They will not endure captivity to any such extent as other Chilognatha, and will speedily die under conditions apparently favorable to the other families. Dryness of the atmosphere is quickly fatal, and the animals seem to suffer if the ventilation is insufficient, even though the moisture is adequate.

On the other hand, it should be mentioned that a specimen of *Conotyla fischeri* was found running about on a log one morning in February, when the ground was frozen and the cold severe enough to have covered with ice-crystals both the ground and the under side of the log. Such ability to withstand the cold appeared very strange at the time, and on investigation it was found that beetles and spiders under the log were incapable of motion, though they recovered after being warmed in the hand. The *Conotyla* was not, however, under the log, but on the upper side of it, apparently quite as lively and vigorous as during the warmer parts of the year, showing that he had been able to withstand the cold of the February night and either keep lively

through it or recover his powers at a temperature considerably below the freezing point. This can be understood if we may suppose that these animals have means of obtaining and using larger amounts of oxygen than other tracheata, and are more warm-blooded. In accord with this supposition is the following observation on *Trichopetalum* by Dr. John A. Ryder, several times verified by ourselves.

"While examining some living specimens of *Trichopetalum lunatum* under the microscope, about a year since, I observed that the respiration of the animal appeared to be conducted in a most singular manner. The air seemed to be drawn in under the labrum, and in some way to enter the dorsal cardiac sinus as bubbles, which could be traced for some distance, more than half the length of the animal, as they traveled slowly backwards, until they disappeared over the opaque mass of ingested food contained in the intestine. ~~These bubbles of air always passed backwards.~~ It may be that they passed backwards inside of the intestine, but the impression that I got was that they were traveling through the cardiac sinus or dorsal heart of the animal. This circumstance may explain why it is that there are no pores on the side of the body, though it is true that the lateral pores of millipeds are usually 'foramina repugnatoria,' and have nothing to do with the trachea or respiratory apparatus. This raises the question whether our *Lysiopetalidæ* are not distinguished from other forms in some more important way than has been hitherto supposed."

In connection with this ability to withstand cold should be mentioned the fact that in Europe the Alpine species affecting the highest altitudes are *Craspedosomatidæ*.

The eyes are well developed in *Trichopetalum*, though the ocelli are only moderately numerous. That is, the individual ocelli are large, prominent and convex, as is usual in the family, which has eyes apparently better developed than in other *Diplopoda*, and not flat or merely pigmented spots as in other cases. But the type of eye seems to be the same as in the *Iulidæ* and other families, and the animals take no notice of anything in front until the antennæ are in contact with the object, indicating that in all probability, the eyes are unable to form definite images, but are merely spots sensitive to light. Yet the animals do not appear to have as decided objection to light as members of other

families. When a specimen of *Trichopetalum* is uncovered no perturbation is apparent unless the animal is actually touched.

Not only do the antennæ come in contact with an object, but also as a usual thing, the front of the head. The creatures are not able to overcome their momentum with sufficient quickness, or else their mental operations are too slow. They are not, however, worse off than many animals of higher organization, and better developed sense-organs, for many reptiles and mammals do not, as a rule, turn out for an obstacle until they have come into actual contact with it.

That the eyes of the *Diplopoda* are incapable of forming images is, however, chiefly to be inferred from their plan of structure, as Lubbock has pointed out. And with the flattened eyes of *Iulidæ* and *Polyzonidæ* this is at once plain; but the eyes of *Craspedosomatidæ* are much more convex, regular and well-defined than those of the others, and approach more nearly the condition where effective vision might be possible.

One of the most noteworthy characteristics of *Trichopetalum* exists in the great freedom of motion enjoyed by the head. In other families the head is set more or less deeply into the first segment which is hollowed out in front to receive it, and is consequently incapable of more than a slight motion. In such cases the head is smaller, that is, narrower than the first segment; but in the *Craspedosomatidæ* the head is much broader than the first segment, against which it is fastened as to a neck, and upon which it moves with considerable liberty in any direction.

In like manner the mandibular stipes are in this family exceptionally developed, and capable of rapid movement in the process of chewing. The movement of the stipes in chewing has not been noticed in other *Diplopoda*, though its absence we have in some cases observed.

The antennæ are, in most species of the family, exceptionally slender, but do not noticeably differ from the *diplopod* type. In *Trichopetalum*, however, they are shorter and somewhat clavate. They are manipulated in the usual manner, though their motions are more than ordinarily quick.

If the antennæ are dipped into a liquid or touched against any thing that sticks to them they are at once cleaned in the mouth. How the animals manage to keep the other parts of their bodies clean is an interesting question, for although they live in places

where they would be likely to become soiled they are always clean to a degree. But when not to be cleaned the antennae are frequently bent at the fourth joint and the end held near the mouth, for no reason apparent.

In males the posterior pair of legs of the seventh segment are two-jointed, the distal joint being thick and clavate, and curved up against the side of the body. In walking, this modified foot which cannot touch the ground, is waved back and forth in unison with the legs on either side. The copulation of these animals has not been observed, but that this structure can have any part in the process is hard to believe or imagine, and that it is to be looked upon as a merely rudimentary structure seems more reasonable. In American Craspedosomatidae are found the transitional stages between the condition existing in the Polydesmidae and Lysiopetalidae, where only the anterior pair of feet of the seventh segment have been modified for copulatory purposes, and the condition present in the Iulidae and Polyzonidae, where both pairs are thus modified. As might be expected, the modification in form and the modification in function are apparently taking place gradually, and in the present case a part of the leg aids in copulation while the rest waves idly, "from force of habit."

Even in the Craspedosomatidae which do not have the usual six bristles of each segment well-developed on the anterior part of the body, as in *Pseudotremia* and *Chordeuma*, the posterior median bristles of the last segment are well developed and to all appearances alike in all the species. They are curiously modified, consisting of a cylindric, or slightly conic, enlarged base, from the distal end of which projects a long, exceedingly slender, flexible bristle, or in this case more properly a hair. This is sufficiently stiff to remain nearly straight, but is much finer than the bristles of the preceding segments, and not brittle.

Attached to the ends of these bristles have on several occasions been noticed fine threads like spiders' web dragging out behind the animals as they walked, that is in *Trichopetalum*. And in the living specimens it has also been noticed that these modified bristles were sometimes carried vertically, and in others were nearly horizontal. The peculiar conformation of the bases of these bristles and of the apical portion of the segment suggests the possibility that these bases are articulated with the segment,

and that the animal may have the power of moving them at will, and the desirability of being thus able to move them becomes evident if they are supposed to be spinning organs, while it would be useless if they have no special function.

SENSE-ORGANS AND PROBLEMATICAL STRUCTURES.

In the course of the systematic examination of the different forms it was necessary to mount above a hundred microscopic slides. These gave opportunity for the examination of the more minute structures of the animals, sometimes under tolerably favorable conditions. Following are noticed briefly the structures which came to our attention. Some of them seem not to have been previously recorded, and our notes may be of use when a histologic study of the group is attempted.

I.—*Antennæ.*

On the antennæ are several types of more or less hair-like structures, all of which may prove to be sense-organs.

—1. *The So-called Olfactory Cones* (figs. 61 and 190).—These are well developed in all the species, the number being always four, as is the case in most Diplopoda. We have counted hundreds of specimens, including representatives of all the families, and have never found less than four. There are more than four cones in Glomeridæ, some species of Spirobolus, and a genus of Polydesmidæ from east Africa. The reports of one, two and three cones can be paralleled by the carelessness displayed in counting the segments of Chilopoda.

The cones of Craspedosomatidæ appear to differ from those of other families only in being more slender, more like a wine bottle in shape, and with longer bases.

2. *Hairs of Ordinary Form.*—Such may occur on other parts of the body, and it is possible that all may have more or less of tactile function. According to Sazepin's diagrams of the antennæ of Iulidæ and Polydesmidæ these hairs have neural connection, and the same conditions seem to obtain in sections of the antennæ of *Conotyla fischeri*.

3. At about the middle of the seventh joint, and pointing laterad when the antennæ are extended, is a solitary, rather slender, mammillate-conic, transparent protuberance, narrowed at the tip and produced into a long, very slender, and exceedingly fine-

pointed hair. (figs. 61 and 190.) This structure is about the size of the olfactory cones, but histologically it is different, the contents of the enlarged base being evidently granular, instead of longitudinally fibrillate as in the cones.

Sazepin mentions nothing of this sort, and we have been unable to find anything similar on the antennæ of Iulidæ, Polydesmidæ, Lysiopetalidæ or Polyzonidæ. The structure in question is probably present in all Craspedosomatidæ, and may be looked upon as another evidence of the superior organization of this family. We have had no opportunity of examining the antennæ of Sco-terpes, but find it in all the other genera here treated.

4. On the same side of the same joint, just above the previously mentioned organ is a considerable number of long slender cones, differing from ordinary hairs in being thicker, and with a large internal lumen. The base inserted in the chitin is large and bulbous.

5. On all sides of the distal portion of the sixth joint are scattered transparent cones differing from the preceding sort in being somewhat broader, with blunt rounded ends. They are also very thin-walled, the lumen being continued nearly or quite to the end, and are not enlarged at base.

6. On the fifth joint, more numerous toward, but not confined to the distal portion, are structures very similar to the last, but differing in that they are longer, sharp-pointed, and of somewhat denser tissue. They differ from those of the seventh joint in being larger and longer and not enlarged at base.

7. On the distal portion of each joint are hairs two or three times as long and large as the average. Similar hairs of other families are by Sazepin denominated "Schutzhaare," explaining their greater size by supposing them to be a special provision for the protection of the sense organs, near which they are located. They are probably articulated to the antennal surface, being surrounded by a chitinous ring at base. That their role is not confined to what is mentioned above is shown by the fact that they occur on joints where there are no shorter sense-organs. A lumen can be seen extending through more than half the hair, the distal portion of which is very slender and frequently flexuous.

The above structures are described from *Conotyla fischeri*. The same or equivalent seem to exist in other species, which do not, however, offer equal facility of observation.

II.—*A Possible Auditory Organ.*

Between the base of the antenna and the neighboring ocelli is a ring-like elevation of the chitinous surface of the head. We have been able to find this in most of the diplopod families. In the Craspedosomatidæ it is well-developed,—nearly as large as a single ocellus. Sometimes it appears that the surface included in the ring is covered by a delicate membrane, at others the appearance is that of a dark central spot or aperture (fig. 133).

That the structure in question is a sense-organ appears very likely, but its function can only be conjectured. It is not impossible that it may prove to be an auditory organ. Certain species of Glomeridæ, of the genus *Sphærotherium* are known to have stridulating organs, and in them, at least, an organ of hearing would be expected. That other diplopods stridulate is not known, and would seem unlikely. There have been also no experiments to determine whether they are able to hear, and such experiments would be very difficult and probably unsatisfactory.

III.—*The Labral Hairs.*

On the labrum is a transverse row of long hairs provided in some forms, at least, with neural connections (fig. 194). These hairs do not appear to be especially differentiated in structure. They are placed in depressions, though this is not so much the case in the present family as in the Iulidæ. The best guess would probably be that they have merely tactile function. The number and arrangement of the hairs is very constant.

IV.—*Gnathochilarium.*

1. *Cones similar to those of the Antennæ.*—On the apices of the processes of the stipes, and on the lingual lobes are more or less numerous conical structures resembling in a general way the so-called olfactory cones of the antennæ (fig. 59). The fibrillated structure is still more apparent than in those organs, and the neural connections are very evident. They are also much shorter and proportionally broader than the antennal cones, have thicker walls, and a more evidently hollow apex, the wall there being exceedingly thin. The size is very variable.

There is no inherent improbability in the idea that these are

also olfactory organs. They would enable the animal to detect substances suitable for food, being always near the ground, and directly in front of the mouth. They are found in all Chilognatha, but in Craspedosomatidæ are best developed. They are not so much as usual confined to the apices of the structures on which they are placed, occupying nearly the whole lateral edge of the exterior process of the stipes.

2. *The interior Cone of the Lingual Lobes.*—This is larger and longer than the others, directed mesad and somewhat curved in that direction. It is sharp-pointed and apparently of homogeneous structure, no lumen being apparent. Its special function, if any, must be different from that of the other cones.

3. *The Styliform Processes.*—Near the anterior-interior corner of the lingual lamina is a peculiar, usually more or less tri- or quadri-dentate structure apparently consisting of a solid piece of chitin. This does not appear to exist in the other described families of diplopods, except in some Polydesmidæ (e. g., *Scytototus*). We have no notion of any purpose it could serve.

4. *The Bristles of the Gnathochilarium.*—On the lower surface and lateral edges of the gnathochilarium are a few hairs of greater size than the others, and with enlarged bases. They are probably tactile in function.

5. *Probable Taste-pits.*—The chitinous covering of the lingual lobe is on the superior side extended backward over the ends of the lingual laminae. This extension consists of a chitinous rim enclosing an oval space covered by a transparent membrane in which are scattered numerous pits, each surrounded by a chitinous ring. These are shown in fig. 62 as they appear in *Conotyla fischeri*.

V.—*The Dorsal Setae.*

These structures characteristic of the family are of transparent chitin, narrowly conic, with an enlarged base which fits into the socket of the setigerous tubercle. Sections show that the setae are hollow, and that the chitinous exo-skeleton is interrupted by an aperture in the middle of the socket.

The median pair of setae of the last segment are different from the others in that there is a more broadly conic base tipped with a slender hair. The function of these may be different from that of the others, though what the function of either can be is hard

to conjecture, unless they are spinning organs, as suggested in another place.

In common with Polydesmidae the anal valves of this family are provided with slender bristles, but there are always three pairs instead of two, the constant number in Polydesmidae.

The preanal scale has two slender bristles, as in Polydesmidae. These are of the same form as those of the anal valves, have enlarged bases and may prove to be tactile organs; at least this would be a reasonable inference in case neural connection can be proven.

VI.—*Legs.*

The legs are increasingly hirsute distad, some of the hairs being especially long and with enlarged bases, perhaps tactile organs. On the inner edge of the last joint of the first and sometimes of the second legs is a pectinate row of stout hairs or bristles; it may be these are of use in feeding or in cleaning the face and antennæ.

The first legs have the claw large, and two distinct supplementary claws. The other legs usually have one supplementary claw. ~~The other structures of the legs are more properly to be noticed under the head of sexual characters.~~

On the claw of all the legs of *Conotyla fischeri* is a peculiar hair, which we have not found on other species. The hair in question rises from the inferior groove about midway between base and apex, and lies closely appressed to the claw, beyond which it extends as an exceedingly fine, frequently flexuous filament, needing careful observation to be seen with a quarter-inch objective. When the animal is walking this hair necessarily comes first in contact with the ground and seems conveniently located for a tactile organ. It appears very remarkable that the other species have no similar structure, but a careful search has failed to find it.

VII.—*Secondary Sexual Characters.*

These are, as in other families of Diplopoda mostly confined to modifications of the anterior male legs. We give here a list of such modifications, not including those of the ninth male legs which are described under the different genera and species.

1. Body of males stouter and broader, especially segments six and seven, than that of females. This is not always noticeable, but is very evident in *Cleidogona*.

2. Second legs strongly crassate, a character appearing only in Underwoodia.
3. Second legs abnormally slender: Caseya.
4. Coxæ of second legs with a conic process: Zygonopus, or with a long curved or hamate process: Caseya, Underwoodia.
5. Third joint of second legs with a cushion-like bunch covered with conic processes: Conotyla.
6. Third joint of second legs tuberculate on ventral face: Caseya.
7. Last joint of second legs with a pectinate row of stout hairs on the inner edge: Conotyla, Cleidogona, and probably the other related genera.
8. Claw of second legs very small, much exceeded by a tuft of long flexuous hairs: Underwoodia.
9. Legs 3-7 strongly crassate: Trichopetalum, less so in most of the other genera.
10. Coxæ of third legs produced into a rounded prominence with a tuft of hairs at apex: Caseya, Underwoodia.
11. Third joint of third legs much crassate: Underwoodia.
12. Last joint of third and many succeeding legs with the ventral face hispid with fine bayonet-like spines: Conotyla, Cleidogona, Pseudotremia.
13. Fourth joint of fourth and fifth legs with a cushion-like bunch covered with conic tubercles: Conotyla.
14. Sixth legs with coxa somewhat enlarged, and with a tuft of long hairs: Caseya.
15. Sixth legs strongly crassate: Zygonopus.
16. Seventh legs with coxa greatly enlarged, bearing a conic process and tufts of hairs: Caseya.
17. Coxæ of seventh legs with a large tuberculate bunch on the posterior side: Conotyla (figs. 70 and 73).
18. Fourth joint of seventh leg with a proximally directed, apically quadridentate process: *Conotyla fischeri* (figs. 70 and 71).
19. Tenth and eleventh legs with the coxæ perforate: Cleidogona, Pseudotremia, Conotyla. Sometimes a shapeless mass of membrane or hardened secretion projects from the aperture; perhaps this is what is described by Latzel as a wart-like process in European Chordeumidæ.
20. Coxæ of tenth male leg greatly enlarged and with a distal aperture: Caseya, Underwoodia (figs. 185, 210, 211). In Ca-

seya there is a rounded projection from the rim of the opening, on the posterior side.

21. Coxæ of eleventh leg with a large conic process: Pseudotremia, Cleidogona. In Pseudotremia the process projects from near the base of the coxa, in Cleidogona from the middle or above.

22. Eleventh and twelfth legs with coxa prominent, tuberculate: Conotyla.

23. Eleventh legs with third joint proximally produced into a large, somewhat curved process: Conotyla.

24. Eleventh and twelfth, and probably the succeeding legs, tuberculate on the third and fourth joints: Caseya.

25. Pedigerous lamina of twelfth legs with a large conic process directed cephalad: Cleidogona Conotyla, Pseudotremia.

In addition there should be noted an aperture near the distal end of the second joint of the ninth legs of Cleidogona. Inside the joint may be traced a duct or gland running nearly its whole length. In one mounted specimen this is filled with air and shows very clearly, also very numerous minute tubes opening into it. The opening is on the ventral face of the joint, under the base of the third joint, which is flexed upon the second. In the specimen mentioned an irregular mass, probably a secretion hardened by alcohol, lies in the aperture.

CHARACTERS OF THE FAMILY.

As nothing purporting to be a complete description of the present family has ever appeared in English, we offer the following attempt at supplying the deficiency, although future study will probably necessitate amendments.

Family CRASPEDOSOMATIDÆ Gray.

Todd's Cycl. III., p. 546 (1842).

Chordeumidæ, C. L. Koch, and many recent authors.

Lysiopetalidæ (*pro parte majore*) of Cope, Ryder and Packard.

Body moderately elongate or slender, depressed, convex or cylindric, subfusiform, capable of being spirally coiled.

Head larger and broader than the first segment, which fits into a concavity of the head instead of covering the hind portion of it as in Iulidæ.

Eyes usually well-developed, of numerous (10-30) ocelli arranged in definite patches; entirely wanting in certain cave forms.

Antennae remote at base, generally elongate, third and fifth joints longest, eighth joint with four olfactory cones.

Mandibles with 8-12 pectinate lamellae, a molar tooth, a dentate lamella, and a masticatory plate. The stipe has a distinct cardo; exposed surface of stipe (buccal area) very large and prominent, convex, not areate.

Gnathochilarium with stipes separate, cardo small; in front the two coniferous processes common to Chilognaths.

Mentum entire, trapeziform, large.

Promentum evident, triangular, included between the bases of the lingual laminae, or nearly obsolete.

Lingual laminae rather long, distinct, anteriorly with or without a denticulate lobe, posteriorly separated by the promentum.

Median lobe well-developed, with a longer or shorter usually tridentate process on each side.

First segment slightly longer, but otherwise smaller than the second.

Segments laterally strongly, moderately or not all carinate; the dorsal face of each provided with six bristles, sometimes rudimentary and very minute, more or less arranged in a transverse row; each bristle usually located upon a smaller or larger tubercle; surface otherwise smooth or roughened with tubercles not setigerous.

Repugnatorial pores wanting.

Peligerous laminae all free; pleura completely coalesced with scuta.

First, second, fourth and antepenultimate segments each bearing one pair of legs, the third and last two footless.

Anal segment obtuse or broadly truncate, with two pupillae at apex, each ending in a long, slender bristle.

Legs seven-jointed, generally long, the third, fourth and last joints longest.

In males any of the legs of the first eight segments are subject to more or less modification.

Genital opening of males in the coxae of the second pair of legs, as in Polydesmidae.

Number of segments, 26, 28, or 30, in adults; in young 28, 26, 23, 19, 15, 12, younger stages unknown.

Distribution: Europe, North America, Northern Asia and Northern Africa.

The scarcity of individuals of this family, the small size of the animals, and the fact that few localities outside of Europe and North America have been thoroughly searched, leave it entirely probable that the above distribution will be extended to the mountain regions of Central and South America and Asia. One species is known from the mountains of Mexico. It is a significant fact that not a single form has been reported from the tropical regions, and the writers are confident, after repeated and care-

ful searches, that the family is not represented in Liberia and the neighboring European colonies of the west coast of Africa.*

The above is substantially the same characterization of this family as that given by Latzel, with a few deviations, two of which are noteworthy. The first is that we credit all Craspedosomatidæ with six bristles to a segment, and the other that we give the number of segments as sometimes 26 and 28, changes which we will later on attempt to justify. The following additional description will apply to all the American species known to us and included in this paper. It has been our intention to omit from it no character common to all the species, no matter how unimportant any might seem to be, and for the sake of brevity, characters given here will not be repeated in generic and specific descriptions.

We consider it probable that most of the statements will be found true, except where noted, for all Craspedosomatidæ, but as many of them have to former writers seemed too unimportant to be included in family descriptions, and others have not been previously recorded at all, it seemed the part of caution not to combine them with the preceding description made to accommodate the European forms, and modified only enough to admit the American.

Body moderately elongate, about ten times as long as its greatest transverse diameter; posteriorly laterally compressed (except *Branneria*), giving an oval cross-section with dorso-ventral diameter greatest.

Vertex smooth, prominent, broadly and sub-angulately emarginate posteriorly, sparsely hirsute with hairs of moderate length; a short, fine, median sulcus and suture on the posterior portion ending at the point of greatest elevation.

Clypeus not distinct from the vertex by an apparent suture,† rather flat; lower part more hirsute, and with an elevated transverse ridge just above the labrum.

Labrum rather long, somewhat decurved, as least as broad as the lower part of the clypeus; corners broadly rounded, the emargination rather shallow. There are two transverse rows of setigerous punctations as is usual in Iulidæ, the upper row containing four and the lower ten punctations. The lateral bristles of the upper row are farther from the median than the latter are from each other; lower row interrupted behind the emargination.

---

* After the above was written Mr. Pocock published his new genus *Heterochordlenma* from the mountains of Burmah, and we became acquainted with the description of a New Zealand species of the family, *Craspedosoma trisetosum* Hutton (Ann. & Mag. Nat. Hist. Ser. 4, Vol. xx., p. 116, Aug. 1887.

† Differing in this from most Iulidæ and Polydesmidæ.

Antennae filiform or sub-clavate, moderately pilose, the hairs increasing in length and number on the distal joints. Seventh joint of antennae with a conic-mamillate sense-organ tipped with a long fine hair. Mandibular stipe with the exposed surface smooth, more or less hirsute with short hairs.

Hypostoma apparently not a part of the gnathochilarium, in the sense of having any intimate connection with that structure. In all the species examined it appears as a chitinated ridge around the ventral side of the slender neck of the animal.*

The stipes of the gnathochilarium are produced posteriorly far beyond the mentum and embrace the sides of the neck, which lies in the sinus thus formed behind (above) the mentum.

First segment semi-circular to broadly reniform in front; nearly straight behind, except for a broad, shallow emargination in the middle; anterior margin and lateral angles with a fine raised edge; three setae on each side; surface smooth.

Subsequent segments with three setae on each side, one close to the posterior angle of the lateral carina, the second slightly farther from the anterior angle, the third about midway from the carina to the median line. On posterior segments the arrangement tends toward a straight transverse line, and the setae are longer than on anterior segments. Beginning at the middle of the first segment and ending on the penultimate segment is a fine longitudinal sulcus, or rather a pair of sulci with a very fine raised line between (not apparent in *Branneria*). The surface of the segments, when not otherwise roughened, is finely reticulate, the pattern of the reticulation varying on different species and different parts of the body. When carinae and tubercles are present the exo-skeleton is scarcely thickened, the body cavity extending out into all prominences.

Supplementary margin not evident.

Anal segment without median furrow, truncate behind or with a broad shallow emargination; broadly sinuate on the sides. On this segment there are eight setigerous tubercles, two located near the middle of the dorsal surface of the segment, the other six near the posterior margin, one on each side by the sinuation, one at each corner of the emargination, and two near the median line, these last with thickened, conic or papilliform bases.

Anal valves not strongly convex, more prominent above the middle, each with three setae close to the margin.

Preanal scale semi-elliptical, broader than long, broadly truncate posteriorly, with two long bristles directed backward.

Pedigerous laminae medianly produced into a conic process which lies between the approximated coxae, and has its anterior face exposed. This ex-

* Judging from the present family it would not be an antecedently improbable theory to regard the hypostoma as the ventral part of the first segment. In that case it would not be necessary to consider the third segment footless, but to suppose that the ventral plates of the second and third segments have been crowded somewhat ahead. This also accords with the opinion of Heathcote, the result of a study of the embryology of *Iulus*.

posed face may be smooth or roughened, plane or with a longitudinal carina. On the 12th legs of males of some species the apex projects antero-ventrally as a large conic process.

First two pairs of legs 6-jointed, the others 7-jointed, by the intercalation of a very short joint just beyond the coxa.

As the species here described have usually been placed under the Lysiopetalidæ by American students of this group, it may not be superfluous to notice a few considerations regarding the systematic importance of the characters on which this family is based.

The Family-Chordeumidæ was erected in 1847 by C. L. Koch, his entire characterization being: "*Der Körper standhaft mit 30 Ringen*," and this would be sufficient, as far as known, to distinguish the European species among Chilognatha. Mature individuals of certain small species of Iulidæ sometimes occur with as low as 30 segments, but in no Iulus is the number of segments constant. We have, however, in America at least four species of Craspedosomatidæ with less than 30 segments in the mature condition, a fact which might seem to militate against the validity of the family.

The number of segments, however, though appearing to be a character of considerable value on account of its supposed constancy, is by no means the most important of the numerous differences between this and other families. The more important distinctions have been neglected entirely or passed with a mere mention because of the easy statement of which the above apparently sufficient character was capable. In many respects the Chordeumidæ are evidently the highest of the helminthomorphous Diplopoda, if not of the whole group.

In the first place, the head is proportionally much larger than in any other diplopod family. Instead of being enclosed or covered by the first segment, this last structure forms a sort of neck, fitting into the posterior concavity of the head, and allowing a much freer motion for that member than is possible for other Diplopoda. All the organs connected with the head are in a comparatively high state of development. The eyes, antennæ and mandibles are all capable of more effective service than the corresponding structures of other families.

The legs are proportionally longer and the animals capable of faster locomotion. This fact is correlated with the absence of re-

pugnatorial pores as a means of defense. There is no reason for supposing that the members of this family have or ever had any thing like repugnatorial pores, notwithstanding such statements as "Annuli with two pores on each side of the median line.—Pseudotrema,"* and the characterization found in some of the more careful European works "Repugnatorial pores obsolete," or "repugnatorial pores evanescent." In the one case the sockets of the lateral setæ have been taken for pores, while in the other there has been an unwillingness to say "pores wanting," on account of their constant presence in other families.

The six setigerous tubercles of each segment are perhaps the most distinctive family character. In some species the setæ or tubercles or both are microscopic and rudimentary, but this only shows the tenacity of the character, as in no other recent family are there similar bristles.

~~In common with the Lysiopetalidæ the pedigerous laminæ are all distinct from the otherwise complete segmental rings.~~

It seems to us that the combination of these last three characters, want of repugnatorial pores, six setæ or spines, and the free pedal laminæ is sufficient ground for the opinion that the Craspedosomatidæ have of all living Diplopoda the greatest resemblance to the carboniferous group Archipolypoda.

That the relationship is very close we do not contend, but merely that the similarities are greater than in other recent forms and are not merely apparent but real.

The spines of existing Chordeumidæ are insignificant in size when compared with those of some of the fossil genera, such as Acantherpestes, but are the same in number, arrangement and method of attachment to the segments, *i. e.*, they stand in socket-like bases. Moreover there were other carboniferous forms which had bristles proportionally not much, if any, larger than those of Trichopetalum and Scoterpes, and of the same shape.

Other minor characters reinforce the above view, such as the large size of the head, prominent eyes, fusiform, somewhat flattened body and long legs.

That Chordeumidæ were probably more abundant in former geologic periods is seen from the fact that a considerable number

* Dr. Cope informed me recently that this statement was the result of accident by which the words "Spirostrephon" and "Pseudotrema" were substituted for each other. [O. F. C.]

of species have been described from the Baltic amber. They are at present probably among the least numerous as far as individuals of each species are concerned. North America is perhaps to be looked upon as the headquarters of the family, on account of the comparatively large number of generic types, though the number of new forms yet to be discovered in Europe is probably very great.

If the Craspedosomatidæ are the highest, in certain senses at least, and at once the most primitive of recent Diplopoda, it follows that the other families are to be looked upon as comparatively degraded, even if more complex, as in the addition of the repugnatorial apparatus.

GENERIC CLASSIFICATION.

—The more recent European writers have seemed inclined to include all the previously described American genera, except *Pseudotremia*, under the European genera *Craspedosoma* and *Chordeuma*. *Pseudotremia* was kept distinct mainly on account of the misapprehension that it had no dorsal setæ. From deference to the usually more thorough methods of the European investigators we began our study with somewhat of an expectation of the probable correctness of their view, which we still think was more or less justified by the incompleteness of American descriptions. We were soon convinced, however, that among the American forms are natural and compact groups of species meriting generic recognition. Between the species of such groups the characters of the antennæ, eyes, body-segments, gnathochilarium, legs and genitalia agree in indicating close affinities. Especially valuable, by reason of their constancy and ease of expression, are the characters of the ninth* legs of the males, and differences in these have always been reinforced by those drawn from other parts of the body. That these secondary sexual characters have not had their importance generally recognized in classification is no reason why they should not now be made available, and

* These have been referred to by Packard and others as the eighth legs, while Latzel considers them a part of the genitalia and does not count them. We believe it will be found more convenient to think of the eighth legs as replaced by the genitalia, and thus keep the numbers of legs and segments uniform in the sexes.

we believe they are worthy of being put forward as the most satisfactory yet suggested.

Synopsis of **Genera.**

A	{	Eyes present.....	B
		wanting.....	C
B	{	Segments 26, with numerous dorsal carinae.....	Branneria
		28 or 30.....	D
C	{	Sixth male legs crassate, the ninth unarmed.....	Zygonopus
		normal, claw of ninth large.....	Scoterpes
D	{	Ninth male legs 2-jointed, without claw.....	E
		4-5-jointed, with a claw.....	F
E	{	Third male legs with coxae produced.....	G
		normal.....	H
F	{	Ninth male legs embracing a bifid plate; dorsum granular.....	
			Pseudotremia
G	{	without plate; not granular.....	I
H	{	Second male legs strongly crassate; seventh legs normal.....	Underwoodia
		very slender; coxae of seventh enlarged.....	Caseya
I	{	Last joint of male legs hispid; segments 30.....	Conotyla
		not hispid; segments 28.....	Trichopetalum
I	{	Ninth male legs distally clavate; second joint slender.....	Bactropus
		hamate; second joint robust.....	Cleidogona

The presence or absence of eyes may not, of itself, be a sufficient generic character, as Latzel has said, though it certainly shows considerable divergence. In the preceding table this character is used merely as a convenient means of separation; the other features we believe to be of diagnostic value.

The external differences between the genera are not inconsiderable and it is possible to separate them without dissection. To facilitate this we add a key in which mere external characters are employed. That new forms will soon be discovered which will interfere with the continued utility of these keys, we can but expect.

Artificial Key to **Genera.**

A	{	Eyes present.....	B
		wanting.....	C
B	{	Dorsum rough with numerous carinae or granules.....	D
		smooth, except the six setigerous tubercles.....	E
C	{	Sixth male legs crassate; the ninth unarmed.....	Zygonopus
		normal, claw of ninth large.....	Scoterpes
D	{	Length 6 mm.; segments 26; dorsum carinate.....	Branneria
		18-30 mm.; segments 30; granulate.....	Pseudotremia

E	{	Length 6-9 mm.....	F
		14-25 mm.....	G
F	{	Setae long; carinae large; segments 28.....	Trichopetalum
		short; carinae small; segments 30.....	H
G	{	Carinae large; body outline serrate.....	Conotyla
		inconspicuous or wanting.....	I
H	{	Ocelli 27; carinae rounded.....	Bactropus
		13; carinae striate.....	Underwoodia
I	{	Sixth and seventh antennal joints equal, slender.....	Cleidogona
		twice as long as seventh, stout; body striate.....	Caseya

To judge from the works of Latzel, Haase and Verhoeff, there are also among the European Craspedosomatidae groups of species agreeing in secondary sexual characters, but there seems to have been no attempt at an arrangement based on homologies of this sort. We notice after the descriptions of the American forms the more striking of this class of characters as exhibited in the European genera and species, the generic descriptions being arranged on lines parallel with those previously given.

Dr. John A. Ryder was the first to use such characters as a basis of generic distinction. In describing *Zygonopus* he calls attention to the recognized importance of sexual characters in the generic classification of other groups, notably Crustacea, and affirms their availability in the Myriapoda.

In the Polydesmidae the ninth male legs are unmodified, while in Craspedosomatidae we have a series of gradations from the five-jointed down to a nearly or quite complete transformation into complex genital apparatus. In America are found the first members of the series, from five-jointed to two-jointed, while the others are found in Europe. It may be that in the European forms these legs have so completely taken on the function of genitalia as to be more susceptible of specific modification and are not of so much value in generic distinction; in the American forms, at least, they seem worthy of all the weight given to rudimentary and secondary sexual characters. Among the species already known the form of the ninth male legs is so constant an index of a whole complex of characters of other kinds that it is possible to distinguish the genera by them alone, as in the following table:—

A	{	Ninth male legs 4- or 5-jointed.....	B
		2-jointed.....	C
B	{	First and second joints thick, subequal in size.....	Cleidogona
		very large, the second cylindrical, slender.....	D

C	{	Second joint rounded oval, basal joint flask-shaped.....	E
		much longer than wide, the first not attenuate.....	F
D	{	Third and fourth joints subequal, narrow.....	Pseudotremia
		much longer than fourth, thicker than second.....	Bactropus
E	{	First joint gradually attenuate distad.....	Underwoodia
		distally broader, notched and toothed.....	Caseya
F	{	Second joint with a small chitinous knob, genitalia simple.....	G
		smooth; the first attached to posterior genitalia....	Conotyla
G	{	Second joint clavate; eyes present; segments 28.....	Trichopetalum
		obclavate; eyes wanting; segments 30.....	Zygonopus

It should be remembered, however, that these genera rest on other characters, and that for the present, at least, the ninth legs are not a necessity to the generic classification here adopted.

American species of this family have been referred to the following genera not here recognized as valid or as properly applied. It may be worth while to notice briefly the different reasons for such treatment.

Spirostrephon, Brandt (1840) was erected to contain *Lysio-petalum lactarium* (Say), then looked upon as one of the Iulidae. To use the name for species distinct from *lactarium* by differences of family importance was entirely unjustifiable.

Campos of C. L. Koch (1847), was referred to this family by its author, and was not heard from afterward until Mr. Bollman identified *Cryptotrichus caesioannulatus* (Wood) Packard with it. It was clear to us on reading Koch's description with specimens of *caesioannulatus* in hand that the description could not possibly apply to that species, and the idea suggested itself that Koch's description portrayed an animal astonishingly similar to *Iulus virgatus* Wood. On comparing specimens of that species we found the agreement with the description to be complete, down to the smallest detail mentioned. Both the varieties of coloration which Koch described as species are also common, so that the two can be united. Koch's specific name (1847) antedates that of Wood (1864), and the species must stand as *Iulus flavicornis* (Koch). The genus Campos never had any reason for its existence, and can be dismissed from the subject. It might be well to add that we have found sexually mature *I. flavicornis* with 30 segments. This species seems to be very nearly allied to the European *I. pusillus* Leach, described long before the time of Koch, but with which he did appear to be familiar.

Craspedosoma of Leach and Rawlins (1814), is the oldest genus of the family and contains a considerable number of European spe-

cies, but none of these seem to have the second pair of feet of the seventh segment with more than one joint, a club-shaped, perpendicular structure, thus differing distinctly from the more closely allied of the American genera: *Conotyla*, *Trichopetalum*, *Scoterpes* and *Zygonopus*.

Chordeuma, C. L. Koch. Latzel suggested the possibility that *Trichopetalum juloides* Harger would be placed here. Characters drawn from the genitalia, gnathochilarium and secondary sexual characters give ample reason for holding the American form distinct and erecting a new genus for its reception.

Striaria has been recognized as the type of a distinct family.

Cryptotrichus Packard, is replaced by *Cleidogona*.

In Austro-Hungary are found two genera of *Craspedosomatidæ* with broad lateral carinæ, *Atractostoma* closely resembling the *Polydesmidæ*, and *Rhiscosoma* the *Polyzonidæ*. Latzel failed to find bristles on an immature specimen of *Rhiscosoma*, but as other individuals referred to the same species had bristles we have not lost confidence that the bristles are universal in *Chordeumidæ*, more especially since finding them on *Pseudotremia* where Latzel asserted their non-existence.

Humbert and Saussure * proposed to include all the species of this family as here constituted under *Craspedosoma*, divided into two subgenera, *Craspedosoma*, in a stricter sense, and *Chordeuma*, alleging that in *Craspedosoma* there is a *promentum distinct* from the *mentum*, while in *Chordeuma* the *mentum* is entire, and rounded anteriorly. Latzel takes no notice of this distinction, and does not describe or figure the gnathochilarium of the only species, *Chordeuma sylvestre* Koch, leaving the implication, however, that there is no important difference in this respect, since the family description states that the *promentum* is "deutlich entwickelt, dreieckig."

Meinert united *Craspedosoma* with *Polydesmus*, but his reasons for so doing do not seem to include a knowledge of the more fundamental relationship, and were matters of generic descriptions based on external characters.

Dissection is an absolute necessity in studying the genitalia of the smaller forms, and the greatest caution must be exercised, for the different views of the same irregularly shaped genitalium will look like entirely different structures. The small size of the

* Etudes sur les Myriapodes, p. 59.

members of this family makes the study and preservation of the dissected parts difficult unless they are mounted on microscopic slides. This method has the further advantage of allowing corresponding parts to be viewed at the same angle, so that fictitious differences are not multiplied. Some genitalia are, however, so irregular in shape as to make it difficult to determine a species from one drawing alone. Descriptions of genitalia are nearly worthless without diagrams to aid in their interpretation.

In describing the antennæ we have adopted the form of a continued ratio for showing the comparative lengths of the joints. The third joint, the longest, is taken as the standard, and given the value 10, thus the ratio of each joint to any other can be readily seen.

We have not attempted to describe the immature stages of the species, since the material was not collected with a view to such study. Young individuals of this family are less commonly found than in the others, and are usually so delicate as to need special care in preservation. Such observations as we have been able to make have been entirely in the line of those of Latzel.

In the direction of describing forms and varieties we have done equally little. This is partly due to the fact that our material has been neither fresh nor very extensive, so that variations of color and external characters have not been seen to advantage. It is also due in part to the fact that we consider that in Diplopoda, as in Arachnida and Crustacea a different plan of male genitalia is to be looked upon as of specific importance. There is not in the habits and habitats of the Diplopoda apparent reason for the multiplication of external differences, but the differences of genitalia and secondary sexual characters are not therefore less important when they occur, but rather more so. Until we have a recognized criterion of what a species is, the matter of specific classification must remain largely a question of convenience. The characters of the genitalia indubitably have important bearing on the question of specific distinctness. The ultimate value of every difference, as a means of specific definition must of necessity be settled by *ascertaining the constancy of the particular character in the forms to be separated.* As a practical method we have proceeded on the assumption that species with evident and readily assignable differences in the genitalia should be considered distinct until the differences are shown not to be constant.

BRANNERIA Bollman, 1893.

Bulletin No. 46, U. S. Nat. Museum, p. 158.

Eyes of numerous (16) ocelli arranged in triangular patches.

Antennæ of moderate length, subclavate.

Segments depressed, with prominent lateral carinæ; dorsally with numerous longitudinal carinæ.

Male genitalia complex.

Segments of adult 26.

We have seen four specimens of this genus, one being a mature male, but dissection was not attempted, owing to scarcity of material and small size.

This genus does not appear to be closely related to any other, the sculpture of the dorsal surface being unique in the present family, as is also the small number of segments. This last peculiarity is the more interesting from the fact that European writers have insisted that the number of segments in this family is always 30, refusing to believe the statements of American writers to the effect that a less number occurs.

The mature male is in the collection of the University of Indiana, and we did not have opportunity of making drawings or a description of the genitalia. We were, however, able to assure ourselves that their complexity equals or exceeds that of any other species known to us.

Branneria carinata (Bollm.).

Craspedosoma carinatum Bollman: Ann. N. Y. Acad. IV., 109 (1888);

Bulletin 46, U. S. Nat. Museum, p. 83; 158.

Eyes triangular, ocelli 16, without regular arrangement.

Antennæ large in proportion to the size of the animal, subclavate, the two distal joints being equal in length, while the fifth and fourth are subequal, each about twice the length of the seventh. Sixth joint thickest, .14 mm. in diameter.

First segment semicircular, anteriorly rugulose and with irregular depressions; along the posterior edge a row of longitudinal ridges; in front of these are several similar ridges not arranged in a regular transverse series, and not placed with regularity in front of those of the posterior row. A setigerous tubercle situated at the posterior angle; another about midway between the anterior and posterior margins, a little closer to the median line than to the lateral corner; a third tubercle midway between the other two. Setæ .1 mm. long, slender, tapering.

Subsequent segments with the anterior subsegment covered with short,

rather irregular, longitudinal, subreticulate ridges; posterior portion anteriorly slightly rugulose, also finely reticulate, the reticulation extending over the entire posterior portion of the segment; on the posterior margin is a row of ridges similar to those of the first segment. Cephalad of these are also irregular ridges which are sometimes in a somewhat definite series and occasionally joined to those of the posterior row. Lateral carinæ well developed, the carinæ and lateral surface evidently reticulate. The three tubercles are situated, one at the posterior angle of the lateral carinæ, the second at the anterior origin of the carina, the third between the anterior and posterior sub-segments and about midway between the median line and the lateral carina. On posterior segments the tubercles come to be arranged in a straight line, as is usual in the other species of the family. Dorsal line not evident.

Anal segment rugulose, posteriorly nearly straight, not produced to cover the anal valves. A tubercle on each side close to the median line, near the middle of the segment.

Anal valves margined, rugulose.

Preanal scale, broadly and deeply emarginate; on each side of the emargination is a long, posteriorly directed bristle.

Length 2 mm.; width 1 mm. 26 segments.

Color horn-brown, the feet paler and the antennæ darker than the body.

Habitat: Beaver Creek, Jefferson Co., Tenn., Prof. J. C. Branner; Little Rock, Ark., Mr. C. H. Bollman, U. S. Nat. Museum, No. 164.

The head is proportionally smaller in this species than in the others known to us. The small size, fewer segments and polydesmoid characters seem to indicate a depauperate form.

The pair of large terminal spines with papillate bases were not present, but it is probable that they had been broken off. The small size of the animal makes it impossible to distinguish their sockets.

By "lateral plates distinct" Mr. Bollman probably intended to imply that the lateral carinæ are evident. There is nothing suggestive of the distinct pleuræ of the *Glomeridæ*.

PSEUDOTREMIA Cope, 1869.

Journ. Am. Philos. Soc., XI, p. 179.

Eyes moderately developed, of numerous (13-27) ocelli arranged in irregular patches.

Antennæ very long and slender, third joint longest.

Mandibles with 12 pectinate lamellæ.

Promentum present, triangular.

Segments with swollen, shoulder-like carinæ, the lateral surface longitudinally striate, the dorsal uneven with rounded tubercles; setæ short, clavate.

First two pairs of legs of male short and slender, the next five pairs longer and much crassate.

Anterior male legs hispid on the interior face of the last joint.

Ninth pair of legs of male four-jointed and clawed, the basal joint large and thick, inferiorly deeply sinuate; second joint slender, cylindrical; distal joints short, the apical conic. The basal joints embrace a bifid lamina (see fig. 6).

Tenth and eleventh legs of male with large coxal apertures; the coxæ of the eleventh legs with a conical process at base.

Pedigerous laminae with a vertical carina. Segments of adult 30.

The two known species of this genus inhabit caves, and have been collected in Virginia, Kentucky and Indiana. They are not, however, to be looked upon as cave animals in the strictest sense of the word, as they are provided with eyes. The eyes are less numerous and less prominent than in the other large species, and seem sometimes not to be fully pigmented. That the number has been reduced by cave life is an unsafe inference. The Polydesmidae have no eyes and yet very few are cave species.

The legs and antennæ are proportionally the longest of any Diplopoda known to us. That this is due to cave life cannot be maintained, for such thoroughly cavernicolous species as *Scotterpes copei* and *Zygonopus whitei* do not have longer antennæ than some of the open-air forms.

The proximal three or four pectinate lamellæ of *P. cavernarum* have the apices of the spines bifid. We have not made sufficiently numerous dissections to be confident that this is a constant character, but its occurrence is certainly worthy of note, for such a condition does not seem to have been recorded.

The sculpture of the dorsal surface is also characteristic, none of the subsequent genera being roughened except by very fine areolation, excepting also, of course, the six setigerous tubercles. The carinæ also are somewhat squarer and higher up, making the dorsal surface flatter than in other American genera, although the body as a whole is not depressed.

In a description of this genus, purporting to be drawn from specimens sent by Dr. A. S. Packard, Jr., Latzel* says: "*Die 6 Borsten und die zugehörigen Wärtzchen fehlen ganz.*" The bristles must have been rubbed off in sending, as is usually the case, though some of the bristles of the posterior segments can nearly always be found.

* Myr. d. Öst.-Ung. Mon. Bd. II. pp. 64 and 214.

Pseudotremia cavernarum Cope.

Pseudotremia cavernarum Cope : Journ. Am. Philos. Soc., XI, pp. 179 (1869); Trans. Am. Ent. Soc., May, 1870, p. 67.

Spirostrephon cavernarum Cope : Am. Nat. VI, 1872, pp. 409.

P. cavernarum Cope, Ryder : Proc. U. S. Nat. Mus. III, 1881, pp. 526; McNeill, Bull. No. 3, Brookville Soc. pp. 8 (1888); Bollman, Ibid. XI, 1888, pp. 405; Bulletin 46, U. S. N. M., pp. 106.

Body somewhat fusiform, broadest anteriorly at about the fifth or sixth segment, narrowed abruptly cephalad, and gradually caudad to the last two or three segments, which are narrowed very abruptly. Carinae moderate, situated above the middle line of side.

Clypeus near the middle with two well-pronounced depressions about the size of the antennal sockets; below are two smaller depressions subconfluent with the others.

Eyes more or less triangular in form, sometimes elongate or lunate, ocelli varying from 13 to 17, usually 15 or 16, without regularity of arrangement.

Antennae filiform, 4-4.5 mm. long, .18-.22 mm. thick, moderately pilose, approximate ratio of lengths of joints to each other, beginning with the seventh, 2: 3: 8: 6: 10: 4: 1:

Mentum subrectangular, twice as broad as long, the anterior and lateral margins convex, the posterior concave.

Promentum without hairs, triangular, broader than long (8:5), sides nearly straight, posterior corners not reaching the stipes.

Stipes with base of inner process more than half the length of outer process; lateral edge of outer process with cones nearly to base.

Lingual lobes subequal to lingual laminae, with five sense-cones.

Middle lobe nearly square in front, twice as broad as long, subequal to lingual laminae.

Styliform process deeply trilobed.

First segment anteriorly nearly semicircular, slightly concave behind, medianly broadly emarginate. Anterior margin elevated, as well as the posterior along the emargination. Surface smooth; a fine furrow on each side of a median ridge, beginning about the middle of the segment and extending to the posterior margin. On each side three setigerous tubercles, one situated near the longitudinal middle of the segment near the median line, a second close to the lateral angle, the third on the posterior edge of the corner. The lateral bristles measure .2 mm. in length.

Subsequent segments with the posterior subsegment coarsely tuberculate on its dorsal portion; laterally and ventrally with about 12 longitudinal striations; the superior striation is the largest, being on the portion of the segment laterally most prominent, and is directed obliquely, the posterior end lower down. On the superior edge of the posterior end of the carina is a slight protuberance bearing a short, clavate bristle; on the anterior edge of the elevated portion of the posterior subsegment are two similar slight protuberances the outer of which bears a similar clavate bristle. On the anterior segments the surface of the median portion of the posterior subsegments is smooth, the

tubercles being confined to the sides of the dorsal surface; tubercles become more numerous caudad to about the twentieth segment, where they begin to be gradually obliterated, so that the last few segments are nearly smooth. On the other hand, the bristle-bearing tubercles become larger and the bristles longer on the posterior segments. The tubercles, especially the lateral, are conical or papiliform, and tipped, especially the lateral and posterior ones, with a very short seta. The circular, light-colored bases of the other clavate or long setae distinguish them at once from ordinary tubercles. On posterior segments the six bristle-bearing protuberances become more and more arranged in a straight transverse row. The fine median ridge located in a shallow furrow is continued from the first segment to the penultimate.

In males the sixth and seventh segments are noticeably larger than the others, being both longer and broader.

Anal segment with surface smooth, very slightly hirsute with short hairs. Posterior margin deflexed, squarely notched in the middle, deeply sinuate on the sides. On each angle of the emargination is a setigerous tubercle.

Anal valves margined, slightly rugulose, the ridges running oblique to the anal opening, three setigerous tubercles at intervals, near the inner margins of the valves.

First pair of legs of male six-jointed, the joints, beginning with the coxa, respectively, .20, .06, .50, .20, .16, and .60 mm. long; width of third joint .14 mm. The joints are not specially modified, nor roughened except by sparse hairs. Two small superior secondary claws.

Second legs of male also six-jointed, the joints, excepting coxa, measuring .08, .50, .22, .16, and .60 mm. long; third joint .16 mm. wide.

Third legs of male seven-jointed, as are all the others (except the ninth), joints measuring .30, .08, .40, .60, .26, .20 and .64 mm. in length; width of first joint .40 mm. The seventh joint has the distal part of the inferior surface beset with fine bayonet-like processes, as described for *Conolyta fischeri*. Two small superior secondary claws.

Fourth legs of male with joints .34, .06, .40, .60, .26, .20 and .60 mm. long; width of first joint .34 mm.; seventh joint as on third legs. Two superior secondary claws.

Fifth legs of male with joints .34, .06, .60, .74, .34, .20 and .66 mm. long; first joint .34 mm. wide; otherwise as for third legs.

Sixth legs of male with joints .40, .06, .54, .72, .30, .20, and .64 mm. long; first joint .30 mm. wide.

Seventh legs of male with joints .40, .06, .56, .74, .30, .20 and .68 mm. long; width of first joint .30 mm. Inferior surface of coxa covered with small rounded knobs. Otherwise as for third legs.

Male genitalia (plate I, figs. 2 and 3) very complex, consisting of four different structures:

1. An irregular, deeply bifid lamina (fig. 2) broad at base, the lobes crossed by a very prominent, rounded, diagonal elevation, projecting mesad, beyond which they are narrowed to bidentate apex, the teeth diverging, one curved laterad, the other caudad. A side view (fig. 3) shows that the mesal edge of the inner tooth is continuous with a broad subvertical lamina,

concave on the outside. This whole structure is probably articulated to a large basal joint which bears a few spines along its lateral margin.

2. An unpaired median, slender curved spine, bifid at the tip, the teeth sharp-pointed, decurved and diverging. Proximally the spine is thicker, somewhat compressed laterally, broader dorso-ventrally, and projects through the fissure of the large lamina described above. Our drawing (fig. 2) might be thought to indicate that this structure comes from one side, but this is not the case.

3. Caudal and lateral is on either side a slender, two-jointed, apically bifid, styliform structure, curved cephalo-ventrad toward the apex. But one of these is shown in our drawing (fig. 3, to the right).

4. Between the enlarged basal joints of the ninth pair of legs is a subplane deeply bifid lamina, the lobes of which are more or less deeply bifid with divaricate subdivisions. Our drawing (plate I, fig. 6) is from a specimen in which the inner edge of the primary lobe is merely emarginate.

Ninth legs of male 4-jointed, the basal joint subequal in length to the others taken together, and of twice the diameter; on the mesal face this joint is deeply excavate near the base and again slightly above the middle, the sinuses separated by a large rounded knob, bearing on its upper side a conical chitinated tubercle. Second joint slender, cylindrical, much longer than two distal joints taken together, sometimes twice as long. Third joint about as long as broad; apical joint somewhat conic, exceeding the third in length. Claw sometimes large and distinctly hooked, at others reduced to a shapeless chitinous tubercle.

Tenth legs of male with joints .34, .06, .54, .74, .26, .20 and .80 mm. long. Distal inferior surface of coxa with a large slightly elevated cushion of small, rounded knobs. Third joint with the inferior surface sparsely covered with rounded knobs somewhat larger than those of the coxa. Fourth joint proximally with a few knobs similar to those of the third joint. Seventh joint and secondary claws, as given for third legs. The secondary claws of this species are situated farther distad on main claw than those described in the species of other genera.

Eleventh leg with joints .46, .08, .56, .70, .26, .18 and .78 mm. in length; width of first joint .30 mm. The first joint with a cone .12 mm. long and .08 mm. wide about the middle of the inferior surface; just distad of this a convex area covered with small, rounded knobs, as is also the inferior surface of the third joint. Seventh joint as in the preceding. Two superior secondary claws.

Color, according to Cope, varying from nearly white to a pale red. We have seen only alcoholic specimens and these vary from a dirty white to pale horn-color.

Length of mature specimens 18 mm.; width 1.5 mm.

Habitat: Southern Virginia, first collected by Dr. E. D. Cope in Erhart's Cave, Montgomery Co., and in Spruce Run and Big Stony Creek Caves, Giles Co.; Tennessee, Lost Creek Cave, Granger Co., also Nickajack Cave (Dr. Cope); Indiana, Wyan-

dotte Cave, Bradford and Marengo Caves, Crawford Co. (Drs. Cope and Packard and Mr. Bollman).

We have examined about seventy specimens from Wyandotte and Marengo Caves. The proportions of the sexes are about equal. U. S. Nat. Museum, Nos. 87, 420, 421 and 438.

Dr. Cope remarks: "This animal inhabits the deepest recesses of the numerous caves which abound in Southern Virginia, as far as human steps can penetrate. I have not seen it near their mouths, though its eyes are not undeveloped, or smaller than those of many living in the forests. Judging from its remains, which one finds under stones, it is an abundant species, though rarely seen by the dim light of a candle even after considerable search. Five specimens only were procured from about a dozen caves."

In Indiana, on the contrary, Dr. Packard found specimens in a small grotto, and that these were paler and had more rudimentary eyes than those collected in the Senate Chamber of Great Wyandotte Cave, three miles from daylight.

According to Dr. Packard* the eyes of this species have no neural connection with the brain, or rather, he failed to find an optic nerve after cutting over 400 sections. The origin of the specimens sectioned is not stated, and the conditions may differ in the species, as does the development of the eyes. Dr. Packard considered *P. carterensis* to be a variety of the present species, but we are unwilling to believe that its well-developed eyes are functionless.

As might be expected in a species limited in habitat, but with an extensive range there seems to be a large amount of variation in nearly all the characters, even those of the genitalia. It will not be surprising if a further study shows that some of these forms are sufficiently differentiated to merit specific recognition. While our material was abundant it was all alcoholic, and the structure of these animals is so fragile that a thorough examination can scarcely be made without the destruction of the specimen.

The median process separates it from the other American genera, and indeed from all others. The genitalia of *Craspedosoma rawlini*, however, have two similarly placed slender processes suggestive of homology.

*The Cave Fauna of North America, p. 113.

***Pseudotremia carterensis* Bollman, 1888.**

P. cavernarum var. *carterensis* Packard: Proc. Am. Philos. Soc. XXI., p. 188 (1883).

P. carterensis Bollman: Proc. U. S. Nat. Museum XI., 1888, p. 405; Bulletin 46 U. S. Nat. Museum, p. 197.

Eyes of 17-25 ocelli, grouped in triangular patches, but usually not in regular rows.

Posterior subsegments dorsally densely and evenly tuberculate with rounded elevations of somewhat equal size.

Male genitalia (plate I, figs. 9, 10) consisting of three structures:

1. A thin subplane lamina, with subparallel sides, one of which turns distally at a sharp angle and is produced into a tapering though blunt-pointed process. The other margin is broadly sinuate, the distal half fimbriate with fine short hairs, the apical corner cut into longer lacineæ.

2. A thin lamina apically curved upon itself and tapering to a point. A duct can be traced from the base to the apex.

3. A bifid subplane lamina, lying between the bases of the ninth pair of legs, similar to that described for *P. cavernarum*.

Color above dark horn-brown, sometimes variously mottled with yellow on the the carinae; below, and basal joints of legs yellowish in alcoholic specimens, the apical joints and antennæ horn brown. Length 23-30 mm. in mature individuals; diameter 2.5-3 mm.

Habitat: "The Carter Caves, Kentucky, viz.: Bat Cave, X Cave and Zwinger's Cave, besides a cave across the road from the hotel, which is used as an ice-house," (Dr. Packard); Wyandotte Cave (Mr. Bollman). We have seen four individuals from Wyandotte Cave (U. S. N. M. 436).

This species is the largest member of the family yet known from North America, and appears very distinct from *P. cavernarum* in its dark brown color and larger size. A careful examination, however, reveals the closest similarity in minor details, and we have not made our description extensive, for beyond the characters noticed above all the statements made for *P. cavernarum* seem to apply to this species. The eyes are more prominent and better pigmented, the segments more evenly tuberculate, the color darker, the size usually larger, and the genitalia entirely different. The antennæ and the relative proportions of their joints are variable in both species and we have been unable to observe any constant difference.

That the species, however, is valid cannot be doubted. The male genitalia have but little similarity of detail with those of *P. cavernarum*. At the same time the legs of the ninth pair are

practically undistinguishable from those of the former species, thus showing that variation in the genitalia proper does not affect these neighboring structures, making their use as generic characters desirable.

According to Dr. Packard this is "what may be called a 'twilight' species, living in small caves in situations partially lighted." In this connection it ought to be remembered that nearly all Diplopoda are nocturnal and lucifugous. It would not be a surprise to us if careful collecting in the neighborhood of the caves should reveal many of the so-called species in dark corners and crevices of rocks along with the open air species. There has been much more careful collecting in the caves than outside.

CLEIDOGONA gen. nov.

Cryptotrichus || Packard, Proc. Am. Phil. Soc. XXI, p. 189 (1883).

Spirostrephon Wood, not of Brandt; *Pseudotremia* Cope pp.; *Campodes* Bollman, not of C. L. Koch.

Eyes well developed, of numerous (25-29) prominent ocelli arranged in triangular patches.

Antennæ filiform, very long and slender; third joint longest.

Mandibles with 12 pectinate lamellæ.

Pronotum present, triangular.

Segments with lateral carinae nearly obsolete; setigerous tubercles very small.

First two pairs of legs small and slender, the next five pairs in males moderately crassate.

Anterior male legs hispid on the interior face of the last joint.

Genitalia of male of two pairs of processes, the posterior articulated with the anterior at base.

Ninth legs of male 5-jointed and clawed; two basal joints large, subequal in length; three distal joints small, forming a hook.

Tenth and eleventh legs of male with large coxal apertures; coxa of eleventh leg with a conic process, the third joint unmodified.

Pedigerous lamina of twelfth legs of male produced at apex into a large conic process directed cephalad.

Segments of adult 30.

Distribution: Eastern States; reported from Minnesota and Arkansas; thus far we have been unable to find it in western Ontario, central New York, Long Island, Connecticut and the eastern shore of Maryland.

That the affinities of *Cleidogona* are with *Pseudotremia* may be inferred from the numerous characters common to both genera.

At the same time the differences are so great that to unite the genera as several authors have done seems unwarranted. In addition to the above diagnosis, the following description applies to the species noticed in this paper:—

Body fusiform, broadest in the anterior portion, narrowed very abruptly cephalad, very gradually caudad; in cross-section circular, slightly compressed dorso-ventrally in front of the middle, slightly compressed laterally caudad. Carinae very small, placed near the middle line of side.

Vertex prominent, nearly smooth, shining.

Clypeus sparsely hirsute with short and long hairs; a prominent transverse supralabral ridge, above which are a few more or less evident fine transverse wrinkles. Along the lateral margins a deep, somewhat oblique furrow curving mesad below, above the transverse ridge.

Eyes in a triangular patch, arranged in several transverse rows; as in other genera there is usually one ocellus on the lateral margin above the upper row, with which it is usually counted.

Antennae moderately hirsute, the distal joints more hirsute than the basal. Approximate proportions of lengths of joints beginning with the seventh, 3: 3: 7: 5.5: 10: 5: 2.

First segment, viewed from above, pointed reniform; surface smooth, excepting three very small light-colored protuberances on each side; the lateral located at the extreme corner of the superior surface of the segment; the second a short distance mesad and cephalad from the first; the third nearer to the median line than to the second. The bristles measure as much as .15 mm. in length.

Subsequent segments with the lateral carinae more pronounced for six or seven segments, whence they decrease in size. On the anterior segments the lateral bristle-bearing protuberance is close to the posterior margin; on succeeding segments it is not so close, until the antepenultimate is reached. As the carinae decrease the bristles of the lateral protuberances increase, posteriorly; they are directed horizontally and appressed to the side of the body. The middle pair of protuberances approach the median line on posterior segments, and the six bristles are more and more nearly arranged in a straight transverse row. A fine median ridge placed in a furrow runs from the first to the last segment.

Anal segment without median furrow or ridge; broadly truncate or slightly emarginate posteriorly and deeply sinuate on the sides; with eight bristles, of which two are located on the anterior portion, near the median line; the others are directed more or less horizontally from the posterior margin. The median pair have thickened conical bases nearly as long as the slender bristles rising from them. The other bristles are located at the corners of the truncation and the upper part of the lateral sinuation. Posterior margin very thick and slightly grooved posteriorly.

Anal valves slightly exceeding the anal segment, not strongly convex, more prominent above the middle, and angulate, the margins scarcely raised; above on each side with three bristles at equal distances from each other.

Preanal scale semi-elliptical, broader than long, broadly truncate posteriorly; with two long slender bristles directed backward from near the posterior margin, and appressed to the anal valves.

First two pairs of legs much smaller than the others; next five pairs in male crassate. Legs 10-12 longest, the legs decreasing both in length and thickness caudad, so that the last pairs are very slender.

Second legs of male with a regular row of spines bordering the last joint on the ventral edge.

Legs 3-7 not specially modified, further than being crassate, and hispid on the ventral face of the last joint.

Male genitalia of two pairs of appendages, the posterior jointed at base to the anterior. The anterior pairs larger than the other and curved backward, the posterior is more or less clavate or capitate.

Ninth legs of male 5-jointed, the two proximal joints subequal in size and length; the other three very small; the last joint somewhat longer than either of the two preceding. The shape of the joints differs somewhat in the different species.

Tenth leg of male with a conic process on the ventral face somewhat beyond the middle of the proximal joint.

Tenth and eleventh legs of male with large apertures in the basal portion of the coxae. Sometimes the apertures have raised rims which alter the outline of the joint when viewed from in front or behind, and sometimes a membrane or hardened secretion projects from the aperture.

Color purplish horn-brown, usually dark, mottled and marbled with pinkish or dirty white.

Cleidogona caesioannulata (Wood).

Spirostrephon caesioannulatus Wood: Trans. Am. Philos. Soc. XIII, p. 194 (1865).

Pseudotremia caesioannulatus Cope: Journ. Am. Philos. Soc. XI, p. 179.

Spirostrephon caesioannulatus Ryder: Proc. U. S. Nat. Museum III, p. 526 (1881).

Cryptotrichus caesioannulatus (Wood) Packard: Proc. Am. Philos. Soc. XXI, p. 190 (1883); McNeill, Proc. U. S. Nat. Museum X, p. 333 (1887); Bull. No. 3, Brookville Soc. p. 8 (1888).

Camptodes flavicornis Bollman (not C. L. Koch): Entomologica Americana IV, p. 1 (1888) (*Camptodes fuscicornis* and *Pseudotremia rudii* are also here placed as synonyms by Bollman) Ann. N. Y. Acad. Sci. X, p. 109 (1888); Proc. U. S. Nat. Museum XI, pp. 340, 344 and 405 (1888); Bulletin 46 U. S. Nat. Mus. pp. 73, 83, 91, 96, 106, 120, 150, 181 and 183.

Eyes more or less triangular in form, of about 25 ocelli, six of which border on the margin of the vertex, and if grouped in rows parallel to these appear to be arranged 6 : 5 : 5 : 4 : 3 : 2 : (sometimes) 1 = 25 or 26. If the rows are looked upon as transverse the numbers are, beginning posteriorly, 1 : 1 : 2 : 3 : 4 : 5 : 5 : 4 = 25, or diagonally 1 : 6 : 6 : 5 : 4 : 3 = 25.

Antennæ filiform, 3 mm. long, .16 mm. thick.

Male genitalia (figs. 138, 139, 145-148, 150), with the anterior and larger arm bent abruptly caudad (or dorsal). At apex it is more or less bifid, with the outer lobe longer, so that seen from below the end appears either more or less truncate, or if the animal is tilted so as to look more directly at the apical portion of the genitalia the appearance is that of figures 139 and 146. This last is somewhat of a side view as well. The longer lobe is at apex more or less fimbriate on the posterior side.

Posterior arm of genitalium clavate, the apex curved toward the anterior arm. The shape will be seen to vary considerably in the three figures 138, 147, 150; from the explanation of plates it will be seen that the figures are from different localities, and further study may necessitate another disposition of the different forms.

Ninth legs of male (figs. 144-145) with basal joint moderately emarginate on the ventral side, near the base; toward the apex, on the same side, is a sharp tubercle directed distad. Second joint nearly half as broad as long, the greatest diameter at about two-thirds of its length, gradually narrower below, more abruptly so above. Three distal joints small, together equal in length to about half the second joint. Last joint nearly equal in length to the two preceding, constricted above the middle and obliquely crossed on the anterior side, just below the constriction, by an oblique ridge the edge of which is sharp and spinose-laciniate, giving the appearance of another joint. Two proximal joints with few hairs, the three distal increasingly hirsute. Claw nearly normal, one evident supplementary claw.

Color of alcoholic specimens: Head dark brown, lighter above; the mandibular stipes areolate, pale lines separating darker areas; antennæ dark brown.

Body usually with a yellowish median longitudinal line of greater or less width, on each side of which is a usually broader dark line, below this a narrower yellow one, and then another dark line or longitudinal row of dark spots. Ventral surface yellow, legs pallid, or the distal joints dark. On each segment the brown color is much darker on the posterior subsegments; that of the anterior portion has sometimes a bluish tinge. The median yellow line is frequently obsolete, and the lateral reduced to a row of transversely oblong spots. In the dorsal dark lines there are, on each segment, two longitudinally oval or circular small yellow spots, in which the small bristle-bearing protuberances are located. Even when the lateral yellow line is present there is, below the outer of these spots a brighter, longitudinally oval spot. The lateral bristle-bearing protuberance is located in the upper part of the lateral dark line and is colored yellow. Length 14-16 mm; width 1.5.

Habitat: In the U. S. Nat. Museum are the following numbers labeled *Campodes flavicornis* by Bollman. While there was supposed to be but one species in the genus determination was comparatively easy, but it is now impossible to assign specimens to the different species without a dissection or at least a

very careful examination of the male genitalia. Hence the determination of the female and young specimens is in the present state of our knowledge impossible, and these and the other reports of the species have value only in showing the distribution of the genus. Sometimes two species were found in the same bottle. Nos. 18 and 28, Bloomington, Indiana, largely young specimens. The whole ones have 26 segments; No. 67, Fort Snelling, Minnesota, a female; No. 159 Little Rock, Arkansas, a female; No. 197, Mossy Creek, Tennessee, a female; No. 247, Chapel Hill, N. C., a male, but not dissected; No. 325, Winona Minnesota, immature; Nos. 16, 442, 444, 448 no localities given, probably from Indiana.

Besides the localities mentioned, specimens of this species have been reported under one or the other of its synonyms, from the following places:

Alleghany county, Pennsylvania (Wood); Culmana, Alabama, or Ocean Springs, Mississippi (Packard); Monroe county, Indiana (McNeill); Beaver Creek, Jefferson county, East Tennessee (Bollman); Washington, D. C. (Bollman); Bloomington, Ia Fayette and Salem, Indiana (Bollman). We found about a dozen specimens among leaves in rather dry woods near the Catholic University, Washington, D. C., October, 1894. These are represented by figures 138-143.

The above description was made from the U. S. Nat. Museum material (No. 16, no locality given, but probably from Indiana) from which figures 145-148 were drawn. We cannot, however, be confident that either the description or figures apply to the original *cæcioannulatus*. Descriptions under this name have been published by Wood, Packard and McNeill. None of the characters given by the earlier writers are more than generic, with the possible exception of the size. According to Wood's original description the length was "about an inch." The only species known to us to which this is applicable is *C. major*, from Washington, D. C. Wood's type specimen was from Alleghany County, Pa., and is probably no longer in existence. The only specimens of the genus in the museum of the Philadelphia Academy are a female specimen and a half labeled, probably by Dr. Wood, *cæcioannulatus*. They were collected by Dr. Leidy in West Virginia, and are rather large, of light color, and perhaps more fusiform than usual, in which characters they agree with *C. major*.

Packard's material was from Alabama or Mississippi. The length is given as 15 mm., from which facts if we may infer anything it is that the species studied by Dr. Packard is likely to have been different from the type of Wood. The matter is further complicated by the fact that we have found two distinct species in the vicinity of Washington, D. C., and three in the material referred by Bollman, and probably also by McNeill, to *C. caesiannulata*. One of these Indiana species was described by McNeill, who was the first to give characters available in drawing specific distinctions.

The description was confined to the ninth leg of the male. He says: "The eight * pairs of legs are modified as follows: joints six, *i. e.*, femur and tibia, and four tarsal joints united to form a hook. The basal joint is slightly lengthened and curved upward nearly parallel to the body. The tibia is compressed, and gradually enlarged to a point one-third its length from the distal end; from this point it is abruptly constricted so that the diameter of the proximal and distal ends is about the same. The enlargement of the tibia is on its ventral side and ends in a tubercle which does not bear a seta. The four tarsal joints (with the distal third of the tibia) form a semicircular hook tipped with a normal claw. The two proximal joints of the hook are equal in size, cylindrical, length equal to the diameter. The last joints are conical and very small. The length of the four tarsal joints is equal to the greatest diameter of the tibia. Femur and tibia are white and not pilose, the hook is brown and pilose."

If we interpret this by the light of the accompanying drawing (reproduced as fig. 149), it will be seen that the ninth leg differs considerably from those studied by us (*cf.* figures 117, 127, 140, 145, 162, 163, 167, 168). The number of distal joints is different,† as well as the shape of the large proximal joint. What appears like a small basal joint is not explained in the description quoted. The description also mentions a tubercle on the tibia, but the figure does not show it. One of the Indiana species, however, has such a tubercle (*cf.* fig. 163). This suggests that the drawing and the description may not have been made from the same

* Not counting the genitalia.

† This is probably to be explained by the fact that in the specimen represented by fig. 145 there is a somewhat oblique ridge across the last joint (*cf.* figs. 145 and 145a).

specimens, since it is extremely likely, to judge from the Indiana material we have studied, that Mr. McNeill's numerous specimens represented more than one species.

In addition to that of the ninth leg, Mr. McNeill gives a figure of the genitalia. In his explanation this is said to be plate xii, figure 5. This figure bears no resemblance to the genitalia of Chordeumidae, but has evidently been transposed with figure 5 of the preceding plate, which we here reproduce (fig. 150). It so far resembles figure 147 as to make its specific distinctness a matter of doubt. The resemblance between figures 150 and 138 is more striking. Figure 138 represents a specimen collected at Washington, D. C., which would give the species a considerable range, leaving it entirely probable that it may be found in Alleghany county, Pa.; thus the question of what *Cleidogona caesioannulata* really is seems likely to be settled in one of two ways. Either we must retain McNeill's form as representing the species because he was the first to describe it in a tangible way, or we must find by collecting what species is found in the indicated part of Pennsylvania. The only clue seems to be the size. The Indiana material we have seen is only 14-16 mm. long. If there should prove to be one species in Alleghany county 'about an inch' in length, we must call it *caesioannulata*. In the meantime species indicated by McNeill should have the use of the name unless a new one is to be made.

The Washington, D. C. specimens (figs. 138-143) differ somewhat in the shape of the genitalia and ninth legs of male, especially in that the distal joints of the latter are in the Washington specimens short and thick, while those of figure 145 are the longest we have seen. Notwithstanding, there is not the same necessity of distinguishing the forms specifically as appears in the other species in which the genitalia are so different as to leave no room for doubt.

***Cleidogona major* sp. n.**

Plates VI and VII, figures 110-137.

Eyes triangular, the ocelli in transverse rows as follows: 1 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 29, in oblique rows: 1 + 1 + 2 + 3 + 4 + 5 + 6 + 7 = or in vertical rows: 8 + 6 + 5 + 4 + 3 + 2 + 1.

Male genitalia (figs. 128-130) with anterior arm much curved at base, nearly straight at apex and bilobed, but not deeply as in *C. caesioannulata*; apical sinus broad and rounded (cf. fig. 129, an apical view). On the anterior

ventral face there is a deep groove, and some distance below the apex a broad lateral emargination. Near the base of the posterior arm are a few long bristles. Posterior arm abruptly capitate, laterally with a rounded projection above.

Ninth legs of male (fig. 127) with basal joint broadly emarginate on the ventral side, very prominent above, sometimes truncate; without tubercle. Second joint three times as long as broad, the line of the ventral side being gently curved, not with a sharp turn at the greatest diameter. Distal joints rather stout, with a similar ridge across the anterior side as described for *C. cæcioannulata*. Claw rather small.

Color horn-brown, mottled with pinkish white. Head dark brown, especially the vertex, more or less mottled with white in fine points arranged in irregular areas, with more or less bilateral symmetry. Lower part of clypeus nearly white. Margin of labrum transparent yellowish.

Segments with exposed portion dark brown above, dirty-white below. Anterior subsegment pale, except where exposed. A pale transverse line is usually present along the suture between the subsegments; dorsally the suture is especially on anterior segments, sinuate, and sometimes the lighter color runs back on the median line. The six setæ of each segment are located in light spots, and between the outer pairs of setæ there is a large transverse area coarsely mottled, bounded in front and behind by a dark line. The posterior line is extended below the outer seta and is broader, so that the animal appears to have a row of lateral spots. Below the spots the color rapidly fades to yellowish white. On posterior segments the dark color of the dorsum is darker than on the anterior, the lighter spots smaller, but more vivid.

Legs with basal joints dirty white, the distal dark brown.

Antennæ very dark, except a short pale ring at the base of each joint.

Length of mature males 18-20 mm., width 2.2-2.4 mm.; length of females 20-24 mm., width 2 mm.

Habitat: Washington, D. C. Nine mature specimens, including three males, were collected among leaves on a wooded hillside in the Zoölogical Park, Washington, D. C., October, 1894.

This species, from its great size, seems likely to have been the original of *cæcioannulata*, and may be taken as the type of the genus *Cleidogona*. It also seems more related to the species identified by McNeill as *cæcioannulata* than do the three following species. It is possible that this species is among those reported as *Campodes flavicornis*, but we did not recognize it among the specimens from the National Museum.

***Cleidogona laminata* sp. n.**

Plate IX, figures 164-171.

Eyes as in *C. major*, ocelli of the same number, arranged in transverse row: 8+6; 5+4+3; 2+1.

Genitalia of male (figs. 165, 166) with the anterior arms oblique, deeply bifid at apex, the lobes subequal, but of different shape; the inner somewhat resembling in outline the head of a bird; the outer more or less truncate and fimbriate along the inner edge distad. Posterior arms clavate, somewhat acuminate at apex and with a notch on the median face. Below, attached to the anterior arm, and somewhat embracing the posterior is on each side a thin lamina.

Ninth legs of male (figs. 167, 168) with the basal joint broad below and deeply emarginate above. From the posterior face projects mesad a triangular plate dentate on the proximal edge, partly covering the emargination, and giving the appearance of a deep notch when the leg is viewed from the posterior side. Second joint more slender than in the other species, more than three times as long as broad 7:2. Proximal joints with scattering hairs, the distal increasingly hirsute. Claw rather small.

Tenth legs of male (fig. 170) with margins of coxal apertures produced, and the inner edge of the coxa somewhat emarginate.

Eleventh legs of male (fig. 171) with the conic process rather short and blunt.

Color of alcoholic specimens, probably faded, horn brown, darker above, gradually changing to dirty white below. The spots described for the preceding species are present, but are less distinct, so that the animal appears nearly concolorous unless more closely examined.

Length of male 15.5 mm.; width 2 mm.

Habitat: Locality unknown, probably Indiana, U. S. Nat. Museum, No. 427, a male and two female specimens. In the form of the genitalia and ninth legs this species seems very distinct.

***Cleidogona forceps* sp. n.**

Plate IX, figures 159-163.

Male genitalia with anterior arms broad below, gradually narrowed, then dilated and again narrowed, deeply bilobed at apex, not decurved; superior lobe broadly notched at apex, one of the divaricate divisions serrate; inferior lobe longer, the apex slightly notched, twisted.

Posterior arm attached at about one-third the height of the anterior, slender, deeply divided, forcipate.

Ninth legs of male with basal joint moderately emarginate below on the ventral face, slightly so above on the dorsal face. Second joint scarcely twice as long as wide, at about the middle on the ventral side swollen into a large rounded prominence; above is a broad sinus into which the distal joints are folded.

The specimen on which this species was founded was taken from the same bottle (U. S. Nat. Museum No. 16, no locality), with those represented by figures 144-148, and not apparently

differing from the others in external appearance. The form of the genitalia and ninth male legs is so distinct and characteristic as to make identification easy.

***Cleidogona fustis* sp. n.**

Plate VIII, figures 151-153.

First legs of male six-jointed, the joints, beginning with the coxa, .20, .06, .30, .12, .10 and .38 mm. long; third and fourth joints .10 mm. Two superior secondary claws and a small inferior one.

Second legs of male also six-jointed, the joints .20, .06, .32, .14, .10 and .32 mm. in length; width of third joint .12 mm.

Third legs of male seven-jointed, .22, .04, .32, .36, .14, .10 and .40 mm. in length; width of third joint .20 mm., somewhat enlarged toward the distal end. Seventh joint with hook-like transparent roughenings like those of *Conotyla fischeri*, but smaller. The third joint with a few conic or knob-like protuberances on the inferior surface.

Fourth legs of male seven-jointed, the joints, beginning with the coxa, .24, .04, .40, .44, .14, .12 and .44 mm. long. Seventh joint roughened as on third legs. The third joint with a few knobs, as on the fifth leg.

Fifth legs of male with joints .24, .04, .48, .46, .18, .10 and .44 mm. in length. Inferior surface of third joint covered with small knobs about .04 mm. in diameter. Seventh joint with inferior secondary claw, apex with process like the twelfth legs.

Sixth legs of male with joints .28, .04, .44, .46, .18, .12, .44 mm. Third joint sparsely covered with cones and knobs. Seventh joint as given for seventh legs.

Seventh legs of male with joints .28, .04, .42, .48, .16, .10, .42 mm. long, .26 mm. wide; coxa with a large transparent rounded protuberance, about as long as wide (.06 mm), covered, like the surface of the coxa, with sparse small knobs, smaller than those of the third joint. Third and seventh joints as for the sixth leg. Distal two-thirds of inferior surface of seventh joint roughened with crowded, appressed, distally directed short, sharp, bayonet-like processes. One superior and one inferior secondary claw.

Tenth legs of male with joints respectively .36, .04, .38, .46, .16, .10, and .48 mm. long, width of third joint .20 mm. First joint thickened distad, and with two large protuberances, one conical, the other larger; and of irregular shape. The first is chitinous, the second membranous, apparently protruded from an aperture. Inferior surface of third joint thickly covered with very flat knobs. Seventh joint with distal half as on seventh legs. The superior apical angle of this joint seems to be produced into a curved, claw-like, chitinized process nearly equalling the true claw in size. A small inferior secondary claw.

Eleventh legs of male with joints respectively .36, .04, .32, .46, .14, .12 and .50 mm. long; third joint .18 mm. wide. Coxa with a large irregular process at about the middle of the inferior surface, directed meso-caudad. Seventh

joint with distal half as on seventh leg; near the apex of the joint, and on the upper side a lanceolate, thin, transparent, twisted process as long as the claw. No secondary claws.

Twelfth legs of male with a large, blunt, conical median process on the pedigerous lamina, directed ventro-cephalad.

Genitalia of male (figs. 151-153) viewed from below (anterior face) with the anterior arms dilated above the middle, suddenly twisted at apex and deeply bifid, one of the divisions long and gently curved, the other broad and in some cases at least, perforate.

Posterior arm simple, clavate, the anterior corner above sharp and somewhat produced; on the same side a short distance below is a tooth-like prominence.

Tenth legs of male with the coxal aperture near the middle of the joint.

We have examined two male specimens, U. S. Nat. Museum, No. 446, no locality given, but probably from Indiana. Externally they did not appear different from the other species.

The measurements of the joints of the legs were made with a view of finding out whether specific differences existed. The relative proportions appear to be maintained, so that it does not seem necessary to introduce measurements for the other species.

***Cleidogona vudii* (Cope), 1869.**

Pseudotremia vudii Cope: Proc. Amer. Philos. Soc., XI. p. 180.

"This species differs from the last (*Pseudotremia cavernarum*) and resembles rather *P. cæcioannulatus* of Wood. The points separating it from the latter will be pointed out below.

"Number of segments the same as in the *P. cavernarum*, twenty-nine, but they are neither convex or rugose nor coarsely striate, but marked with a very minute, irregular longitudinal striation. Segments cylindric, without shoulder, but with a small directed backwards on the posterior margin of the lower part of the annulus, which is enlarged on the front segments. This elevation is furnished on the anterior and posterior regions, and probably everywhere in an uninjured condition, with a bristle. On the anterior segments a hair in front of each pore. Front plane, with finer and coarser hairs sparsely distributed. Lateral margin with an open notch. Antennæ hairy, with a bristle at the distal extremity of each joint. Lengths, 3d, 5th, 4th, 2d, 8th, 7th, 1st; the eighth joint longer than in *P. cavernarum*. Eye patch triangular, not in a depression. Posterior segments considerably compressed, the last segment with four transparent marginal bristles; extremity of body slightly recurved. Total length eleven lines.

"Color pinkish-brown, with a pale band from below to the external pore on each side of each annulus. Top of head black.

"A single specimen, to exact locality not preserved, but probably from Montgomery Co. (Va.), and, I think, not from a cave. I have conferred on it the name of my friend, Dr. H. C. Wood, Jr., to whom we are indebted for a system of the Myriapoda and the means of studying the American species. It differs from the *A. cæsiomnulus* of his monograph in the rounded dorsum without keel or groove, the 29 instead of 32 segments, and the coloration. The eye patches are not in a depression, nor is the labrum deeply emarginate, as Wood describes."

***Cleidogona mexicanus* (Humb. et Sauss.).**

Craspedosoma mexicanum Humb. et Sauss.: Revue et Magasin de Zoologie, 1869, p. 153; Etude sur les Myriapodes (Zoologie du Mexique), p. 59, 1872.

Plate VI, figures 105-109.

Body cylindrical, smooth; shining, slightly attenuate cephalad, strongly so caudad, laterally compressed toward the extremity and terminating in a point.

Head flattened in front, its lateral and superior parts swollen and projecting, the vertex forming an arched prominence concave behind.

Eyes forming a triangular plate behind the antennæ.

Gnathochilarum (see plate).

First segment narrower than the second, forming a constriction behind the head; anterior border sinuate, the middle projecting and arcuate, corresponding to the emargination of the occiput; its lateral lobes sharp and bent downward, bearing a small horizontal carina which is continued along the anterior border as a marginal thread-like elevation.

Subsequent segments gradually larger, truncate below with rounded angles; dorsal line extremely fine. Each segment (the preanal excepted) carrying at half-height a small, pointed tubercle, directed backward, and terminated by a long bristle; and besides, on each side, between this line of tubercles and the dorsal line, two other lines of very small piligerous granules, looking sometimes like piligerous points. On the anterior segments the lateral region situated below the line of tubercles is striated.

Last segment forming a triangular arch, compressed, moderately truncated at the extremity; the truncated border ornamented with small spines (3?).

Anal valves narrow, compressed, forming a crest which projects as far backwards as the extremity of the last segment.

Preanal scale rounded.

Legs long, slender, completely covered by a fine villosity.

Color chocolate brown, paler below, posterior border of segments ornamented by a gray band; the small tubercles forming spots of lighter color surrounded by a pale ring. Feet and antennæ pale.

Length 22 mm.; width 2.5 mm.; number of segments .....?

Habitat: Eastern Cordilleras of Mexico.

The above is a translation, partly rearranged, of the description given in the 'Etudes.' It seems to have been based on one female specimen. The authors add the following remark:

"This species is evidently very nearly related to *Spirostrephon cæcioannulatus*, Wood. But judging from the description and figure, Mr. Wood's species seems not to have upon the sides a row of tubercles larger than those of the dorsal surface. If Mr. Wood had not given thirty-two segments for his species, instead of thirty, we would not doubt that it should be included in the genus *Chordeuma* or *Craspedosoma*. Our species approaches *Craspedosoma*, Leach, in the form of the gnathochilarium, and the development of the piligerous tubercles, and *Chordeuma*, Koch, in the cylindrical form of the body."

BACTROPUS gen. nov.

Eyes of numerous (27) prominent ocelli arranged in triangular patches.

Antennæ long and slender, third joint longest, nearly equalled by the fifth (10:9), followed by joints 4, 2, 6, 7, 1.

Mandibles with ten pectinate lamellæ.*

Pronotum not distinct.

Segments with lateral carinae represented by a gentle bulging of the surface; not striate; setigerous tubercles obsolete, the setæ short.

Male genitalia simple, lamate.

Ninth legs of male five-jointed and with a small claw; coxa much larger than the other joints taken together.

Segments of adult 30.

This genus resembles *Cleidogona* in general appearance, but the body is smaller and more slender. It also has characters in common with *Pseudotremia*, *Trichopetalum*, and *Conotyia*. From *Pseudotremia* it differs in the better development of the eyes, being evidently an open-air creature; also in the lateral carinae nearly obsolete and the lateral surface not striate. It resembles *Pseudotremia* and *Cleidogona* in the slight development of setigerous tubercles and in the number of joints of the ninth male legs. This last resemblance is, however, only apparent, for the form and function is very different. In *Pseudotremia* and *Cleidogona* the ninth legs are capable of use as clasping organs, while in *Bactropus*, as in *Trichopetalum*, it is difficult to understand how the ninth legs could serve such a purpose. Bac-

*The condition of the specimen was such as to make the number somewhat uncertain.

tropus also differs from the genera mentioned in the number and shape of the joints of the ninth legs, the slight development of carinae, tubercles, and bristles, and in the want of a distinct pronotum.

Bactropus conifer sp. n.

Plate IX, figures 172-176.

Body tapering more gradually behind than in *Cleidogona*.

Vertex slightly rugulose, sparsely hirsute, sulcus indistinct.

Eyes triangular, arranged in six rows, beginning posteriorly, 7+6+5+4+3+2=27.

Antennae slightly clavate, approximate ratio of lengths of joints, beginning with the seventh, 3, 4, 9, 5, 10, 4, 1.

First segment rugulose, semi-circular, the tubercles very nearly obsolete. The furrow in which the dorsal ridge is situated runs nearly, if not quite to the anterior margin.

Subsequent segments slightly rugulose, anterior portions finely reticulated, carinae small, tubercles and hairs very small and indistinct. Posterior margin gently sinuate on each side behind the outer setigerous tubercles.

Last segment, anal valves and preanal scale (fig. 176) much as in *Cleidogona*.

Male genitalia (fig. 174) simple, with broad base and attenuate apex, curved backward.

Ninth legs of male (figs. 174 and 175) with a few hairs on the two proximal joints; the claw very small.

Color dark brown, the posterior margin of each segment and a very fine median line yellowish. A light spot at each setigerous tubercle, the outer two spots on each side subconfluent, giving the appearance of a light longitudinal line. Ventral parts and basal joints of feet dirty brown; apical joints darker. Antennae nearly black, darker than those of any other species known to us.

Length about 9 mm.

Habitat: Indiana. We have examined one male and three female specimens collected by Bollman in the vicinity of Bloomington, and deposited in the National Museum (No. 43) under the name "*Craspedosoma lunatum*."

The material is in poor condition so that many important facts cannot be determined. Further study will probably multiply minor similarities with *Cleidogona*.

The joints of the ninth legs of male are not, in the specimen examined, easy to distinguish, the second, third and fourth appearing nearly coalesced. This suggests the idea that the second joint of the ninth leg of *Scoterpes*, *Trichopetalum*, *Zygonopus* and *Conotyla* may have been formed by the gradual coalescence

of the four distal joints. Indeed, this idea becomes reasonably probable when we consider that there is a claw in *Scoterpes*, and a similarly located chitinous bunch in *Zygonopus* and *Trichopetalum*, which may be interpreted as the rudiment of a claw. It should also be noticed that in *Pseudotremia* and *Cleidogona* there is evidently a tendency toward the development of two large proximal joints at the expense of the distal.

SCOTERPES Cope. 1872.

Am. Nat. VI. p. 414.

Spirostrephon (*Pseudotremia*) Packard and Ryder, not Brandt.

Craspedosoma (*Scoterpes*) Latzel: Myr. Oest. Ung. Mon. II., p. 209 (1884);

Haase: Zeitsch. f. Entom., N. F., XI., p. 60 (1886).

Eyes wanting.

Antennæ of moderate length, third joint longest.

Segments with moderately prominent shoulder-like carinæ.

Ninth pair of legs of male two-jointed, the distal joint with a strong claw.

Segments of adult 30.

The single species of this genus is from Mammoth Cave. It is known to us only from descriptions and figures, but there can be little doubt of its close relationship with *Zygonopus* and *Trichopetalum*, from both of which it is distinct in the large claw of the ninth legs of the male. We reproduce Dr. Packard's figures of the genitalia and ninth pair of legs, but it is not possible to get from these or from his descriptions a satisfactory idea of these structures, nor one which will enable us to compare them with allied forms. Indeed, we are not certain that the ninth legs of males ought not to be spoken of as three-jointed. In Dr. Packard's figure they appear entirely detached, and if the two joints are correctly drawn another would seem necessary to connect them with the body.

It is in this genus that the six dorsal bristles peculiar to the present family have their greatest development. According to Drs. Cope and Packard these bristles approximate in length the diameter of the body, giving the animal very much the appearance of a caterpillar.

Scoterpes copei (Packard) Cope.

Spirostrephon (*Pseudotremia*) *copei* Packard: Am. Nat. V., 748 (1871).

Scoterpes copei (Packard) Cope: Am. Nat. VI., p. 414 (1872); Packard:

Proc. Am. Phil. Soc. XXI., p. 193 (1883); McNeill: Bull. No. 3,

Brookville Soc., p. 8 (1888).

Plate I., figures 12-13.

"Head with rather short, dense hairs; no eyes, and no ocular depression behind the antennæ, the surface of the epicranium being well rounded to the antennal sockets; behind the insertion of the antennæ the sides of the head are much more swollen than in *S. lactarius*.*"

Antennæ slender, with short, thick hairs; relative length of joints, the 6th being longest; 6th, 4th, 5th, 3d, 8th, 7th, 1st, the 7th being much thicker than the 8th.

Twenty-eight segments behind the head; they are entirely smooth, striated neither longitudinally nor transversely; a few of the anterior segments rapidly decrease in diameter toward the head. The segments are but slightly convex, and on each side is a shoulder, bearing three tubercles in a transverse row, each giving rise to a long stiff hair one-half to two-thirds as long as the segment is thick; these hairs stand up thickly all over the back, and may serve at once to distinguish the species.

No pores.

Feet long and slender, nearly as long as the antennæ, being very slender towards the claws.

Color entirely white.

Length of body .35 inch; thickness .04 inch."

Habitat: Mammoth Cave, Kentucky.

The above description is that originally given for this species. The importance of several of the included statements is questionable, especially since the accompanying diagrams do not agree with the description.

The antennæ are said to have eight joints, while in the diagram but seven appear. In giving the "relative length of joints" the second is entirely omitted, so that we have no ground for supposing that there was a small basal joint not given in the diagram and are obliged to fall back on the fact that in this family the antennæ have, as far as known, but seven joints. It might also be noticed that if "2d" is understood for "3d," "3d" for "4th" and so on, the relative length of joints will be the same as *Trichopetalum*, 5th, 3d, 4th, 2d, 7th, 6th, 1st.

The drawing of the entire animal also gives thirty segments instead of twenty-eight, as in the description.

At a later date Dr. Packard gives a more extended description† of this species and genus, differing, besides, from the former description in some important particulars, so that it seems desirable to add a transcription of it. These descriptions con-

* Dr. Packard wrote this while believing the present species to be congeneric with *Lysioptalum lactarium* (Say).

† Proc. Am. Philos. Soc., XXI, p. 177, Sept. 1883.

tain, however, many statements which we look upon as of doubtful import or questionable truth, and such are given in italics, our reasons for doubt being stated later on.

"Body very long and slender, *not fusiform*; consisting of thirty segments besides the head, *with about fifty-two pairs of legs, with the penultimate joint very long*. Head rather large, and unusually broad; no eyes present; the gena unusually large, but not so globose as in *Trichopetalum*; *the front is also carried farther up on the vertex than usual, and is much broader than long*; the clypeus flat, slightly bilobed on the front edge. The antennae are moderately long and hairy, with the sixth segment scarcely longer than in *Trichopetalum*, but more uniform in thickness, scarcely longer than thick; the terminal joint as long as the sixth, the end conical, more produced than in *Trichopetalum* or *Zygonopus*; at the tip are four rather long sense-setae. *Body segments becoming as usual smaller next to the head*; the anterior of each division of the arthromere much swollen high up on the sides; each shoulder with three tubercles, which are arranged in a scalene triangle and bearing much longer setae than in the other genera, though not quite so long as the body is thick. The legs are long and slender, more so than in *Trichopetalum*, and somewhat more than in *Zygonopus*. In the male the eighth pair of legs are rudimentary, being two-jointed, the second joint *only one-fourth longer than the basal*, and ending in a well-developed stout claw. The genital armature minute and very rudimentary, pale, scarcely chitinous; the outer lamina short and thick, with a stout external recurved spine, and two terminal obtuse points; the inner lamina shorter, forming a truncated angular spine, and not much more than half as long as the outer lamina; between the inner and outer lamina, its base next to the inner lamina is a middle spine ending in an irregular tuft of fine spinules.

"This genus is distinguished from *Trichopetalum* by its want of eyes, its broader head, its long slender body, with long setae, by the eighth pair of *female* rudimentary legs ending in a claw. From *Zygonopus* it differs in the shorter sixth antennal joint; its broader head; its slenderer legs, the sixth pair in the *female* not being unlike the others, and by the more prominent shoulders and longer setae. The species of the two genera are of the same general form and size."

"About 20 ♂ and ♀ examined. Body white, with no dusky discolorations; 30 segments behind the head in specimens 11 mm. in length and 52 pairs of legs; in one female individual 8 mm. long there were 49 pairs of legs, including the eighth or rudimentary pair; in another individual 6 mm. long there are 24 segments behind the head. The head is provided with short, fine erect hairs of different lengths, especially on the sides of the gena."

"Males and females are alike in size and form."

That the body is "not fusiform," but that the segments become, "as usual smaller next to the head," seem to us mutually contradictory statements. In all the Chordeumidae known to us the last joint of the legs is longest, not the penultimate, though

this is not necessarily the implication of Dr. Packard's statement, What is intended by the front being carried up on the vertex, we cannot imagine. In the species known to us it is practically impossible to make out any definite lines of division between these parts of the head. "Female," is twice used where "male" was evidently intended. Dr. Packard was of course aware that in chilognaths the eighth legs of females are unmodified. 52 legs would be a most unusual number, for allowing one pair of legs each for the 1st, 2d, 4th and 28th segments, and none for the 3d, 29th and 30th, there can be but 50 legs on a female chordeumid, 48 or 49 on a male.

Dr. Packard's figure (see pl. I., fig. 13) of the ninth pair of legs and the genitalia gives us no idea of the method of attachment of the former, and the length of the second joint does not correspond to that given in the description. A lacinate process is probably present as in *Zygonopus* and *Trichopetalum*. but in other respects there is a wide difference from those types, and a further study of the species will probably prove very interesting.

Reasoning from analogy and from the statements of the writers quoted, we suppose that this species has undergone the same deterioration of the exoskeleton as is described for *Zygonopus whitei*.

Regarding the distribution of this species, Dr. Packard adds :

"The specimens were most abundant in the Labyrinth in Mammoth Cave, but also occurred in other localities in the cave. It is also common in Diamond Cave, where I collected it, and was discovered by Mr. Sanborn in Poynter's Cave, 300 yards from daylight. In one of the specimens from the last-mentioned cave, the antennæ are rather more slender than usual.

"The genus *Scoterpes*, and its single species *capri*, appears to be limited to Mammoth Cave and the others near, in apparently the same system of caves. It was erroneously reported by me to occur in Weyer's and the Luray Caves, as the specimens collected belong to *Zygonopus whitei*. Without doubt the genus is a modified *Trichopetalum*, which has become longer and slenderer in body, with longer legs and antennæ as well as setæ ; whether it is a descendant of *Trichopetalum lunatum* or not is uncertain ; it may have descended from a different species ; but there seems to be no reasonable doubt that it is a modified form of a small hairy lysiotetalid form, with antennæ exactly like those of *Trichopetalum*."

Dr. Packard's sections led him to the conclusion that the present species is as truly eyeless as a *Polydesmus*. All traces

of eyes, with their accompanying nerves and ganglia having disappeared. A compensating hypertrophy of the olfactory organs is noted.

ZYGONOPUS Ryder. 1881.

Proc. U. S. Nat. Museum, Vol. III, p. 524.

Zygounopus, Packard: Proc. Amer. Philos. Soc. XXI, p. 194 (1833).

Eyes wanting.

Antennae rather stout, subelavate, fifth joint longest and thickest.

Mandibles with eight pectinate lamellae.

Pronotum not distinct.*

Segments with moderate, shoulder-like carinae, the surface delicately areolate, appearing smooth; setigerous tubercles prominent, setae long.

Male legs with last joint not hispid.

Coxae of second male legs with conic processes; legs without the cushion-like processes present in *Conotyla*.

Sixth legs of male much crassate, especially the fourth joint.

Male genitalia simple, consisting of a deeply bifid lamina and two lacinate processes.

Ninth legs of male two-jointed, the distal stout, obelavate, with a small chitinous knob on its outer face.

Segments of adult 30.

Distribution: Luray Cave, Virginia.

On account of the small size of the animal and special difficulty of manipulation, we were not able to satisfy ourselves whether the coxae of the tenth and eleventh pairs of legs of the male are perforate.

In many of its characters this genus shows such evident and close relationship with *Trichopetalum* that we have sometimes doubted its validity. On the other hand the characters by which it is distinct from that genus (*e. g.*, want of eyes, swollen sixth legs of males, conic process of second legs, and 30 segments) are so numerous that there seems ample ground for retaining it.

The similarity to *Scoterpes* is probably even more striking, since both are cave animals, lack eyes, and are more or less soft-bodied. We have not had the opportunity of making a study of *Scoterpes*, but retain both genera, believing that the differences in the sixth and ninth male legs are sufficiently important to warrant such a course, and that these are indicative of the probable existence of still other differential characters.

*The microscopic preparation was not sufficiently successful to make this certain.

The importance of differences in the ninth male legs as diagnostic generic characters is evidenced by the fact that forms so different as *Trichopetalum* and *Zygonopus* have these legs almost undistinguishable (cf. figs. 21 and 43) even to the presence of the small, more or less chitinous bunch, possibly the rudiment of a claw on the lateral face, near the apex. *Conotyla* has a similar form of ninth leg, but does not have this bunch, and differs widely in other characters. These facts are suggestive of the probable importance of the large claw on the ninth legs of *Scoterpes* as described and figured by Dr. Packard (cf. our figure 13).

***Zygonopus whitei* Ryder.**

Spirostrephon copei Packard *pro parte*: Am. Nat. XV, p. 231 (1881); Proc. Amer. Philos. Soc. XXI, p. 194 (1883).

Zygonopus whitei Ryder: Proc. U. S. Nat. Museum III, p. 527 (1881); McNeill, Bull. No. 3, Brookville Soc. p. 9 (1888).

Plates I-II, figures 14-21.

Body scarcely fusiform, slightly broadest toward the front, narrowed very abruptly on the last few posterior segments.

Vertex with a large, shallow, transversely oval depression between the antennae.

Clypeus with a large transversely oval depression in the upper part.

Antennae of moderate length, subclavate, moderately pilose.

Lingual lobes with three sense-cones.

Styliiform process deeply quadridentate.

First segment longer than semi-circular, regularly rounded in front, nearly straight behind, lateral corners not produced. Outer bristle directed outwardly and upwardly, and located at the posterior corner. Second bristle mesad and cephalad from the outer, and about as far from the anterior margin of the segment as from the lateral bristle. Inside bristle mesad from the second, and about equally distant from it and from the median line.

Second segment shorter than the first, and with longer bristles.

Third and subsequent segments with rather small lateral carinae, on which are located the two outer bristles, the inner one of which is somewhat anterior to, and but little above the outer. The inside bristle is rather close to the others, receding from the median line. All the bristles are slightly curved, and the length of the longer is about two-thirds the diameter of the body. Surface of the segments dorsally with irregular longitudinal wrinkles. Below the carinae the sides of the body are very delicately striate, after the manner of the *Iulidae*, except that the striations are much finer and more curved, especially the upper ones. These striations are very much slighter than those of *Pseudotremia* and are much more numerous, numbering about twenty. On the anterior portion of the subsegment they are reticulately joined. All the segments, including the last, have a fine median sulcus. On

posterior segments the bristles tend to separate from each other and to arrange themselves in a transverse row; the inside pair approach on the posterior segments very close to the median line.

Anal segment short, posteriorly broadly truncate-emarginate, with eight bristles. The anterior two located near the median line and close to the anterior edge of the segment. Posterior six bristles much more slender than the others, located along the posterior margin at about equal distances from each other. The middle pair are not quite so close together as the others, and have papilliform enlarged bases about one-fifth as long as the exceedingly fine flexible hair that proceeds from them. This segment, as well as a few preceeding, and the anal-valves, is supplied with a scanty, short pubescence.

Anal valves moderately convex, produced posteriorly into a rather sharp point, considerably exceeding the last segment. Surface finely vertically striate-wrinkled. Margins not raised, the three bristles very slender, about equally distant from each other and from the apex of the anal segment.

Pre-anal scale small, semi-circular, with two very fine long bristles.

Male genitalia (plate II, figs. 20, 21) simple, of a thin deeply bilobed lamina, the lobes apically decurved and bidentate, the teeth long and connivent. The anterior face is hispid at base with short hairs, which grade distad into papillae; a few long variously curved hairs near the bottom of the fissure, and a few others near the margin distad. On the posterior side (fig. 21) springing from near the base of the lamina are two pairs of plumose-laciniate processes, the inner pair much shorter, and laciniate on both sides.

Ninth legs of male two-jointed, the basal joint perpendicular, clavate, with a few long bristles toward the apex, one of which is longer than the others and curved basally. This joint passes insensibly into a membranous lamina which connects the two joints and is not interrupted medianly. Second joint oblong-oval, with a few bristles near the upper and lower margins. On the lateral face near the apex is a rounded chitinous knob, which may be interpreted as the rudiment of a claw.

Color in alcohol, dull white.

Length 9 mm.; width .4 mm.

We have had for study one male specimen collected by Dr. L. M. Underwood at Luray Cave, Virginia, September, 1887.

The body of this species is nearly cylindrical, that is, less fusiform than any other known to us.

Owing probably to the cave life of this species, the exoskeleton usually so hard and brittle, is soft and flexible. *Pseudotremia* has not suffered so much modification, as the presence of eyes also testifies. There appears to be very little carbonate of lime present, so that on drying the skin of an alcoholic specimen shrivels up like that of a spider. The legs and other parts wrinkle instead of breaking, and tend to become distorted in manipulation. Even the mouth-parts are evidently softer than in the open-air genera.

Another result of this condition of things is that the joints and sutures are not so evident, and the distinction between the mentum and promentum appears to be obliterated. The mentum, as well as the surrounding parts, is merely membranous, and no flexibility would be added if the usual joint were present.

TRICHOPETALUM Harger, 1872 (emended).

Am. Journ. Sci. and Arts IV, 117.

Craspedosoma, Latzel and Bollman; *Scoterpes* Bollman.

Eyes moderately developed, of several (10-14) ocelli arranged innately in two or three curved rows.

Antennæ rather short, clavate; third and fifth joints subequal in length.

Mandibles with nine pectinate lamellæ.

Promentum present, triangular.

Segments with moderately prominent, shoulder-like carinae.

Male legs with first joint not hispid.

Third, fourth, fifth and sixth legs of males strongly crassate.

Ninth pair of legs of male two-jointed, the distal joint broadly clavate, unarmed except that on the outer face of the last joint, near the apex is a small, blunt, chitinized knob, possibly the rudiment of a claw.

Tenth and eleventh legs of male with the coxæ perforate.

Genitalia of male consisting of a single pair of decurved structures hirsute antero-basally and with plumose-laciniate processes posteriorly.

Segments of adult 28.

Distribution: Northeastern North America.

The original description of this genus reads as follows:

"Sterna not closely united with scuta; third and fifth joints of the antennæ elongated; scuta furnished with bristles; no lateral pores; eyes present."

It will be seen that these characters, with the exception of "eyes present," are applicable to all *Craspedosomatidæ*. Indeed, it is probable that the genus *Trichopetalum* would not have been erected had not its author been misled by Gervais' figure into the supposition that in *Craspedosoma* the pedigerous laminae are coalesced. But notwithstanding that the generic characters originally alleged are entirely insufficient, there can be no doubt that in Harger's *Trichopetalum lunatum* was discovered a generic type, and we have preferred to retain the name, supplying other characters for the generic diagnosis.

In comparison with this genus the anterior legs of the males of *Zygonopus* are remarkable for their slenderness, only the sixth legs being comparable in size with the corresponding ones of *Trichopetalum*.

The species of *Trichopetalum* which we have studied have the ninth legs of the male (Fig. 43), apparently exactly alike. They differ from those of *Zygonopus* in being somewhat clavate, instead of obclavate.

The fifth joint of the antennæ is equal to or longer than the third in this genus, *Zygonopus* and *Underwoodia*, while in all other American species of the family the fifth is shorter than the third, never bearing a greater ratio to it than 8.5:10. In this species, too, the fourth joint is about half the length of the fifth, while in *Conotyla* the fourth and fifth are subequal.

We are acquainted with three species falling under this genus, as here characterized. The original description of *Trichopetalum lunatum* gives no characters not common to all three, but the figure of the genitalia, on the other hand, does not bear any close resemblance to those of either of the species known to us, although it is possible to imagine it as having been made from either of them. It is thus impossible, without a study of his type, to know which of our species, if any, was described by Harger. Under these circumstances it would seem that the course least likely to cause confusion is to describe our three species new, giving figures of the genitalia, so that when the type of *T. lunatum* is studied a definite conclusion may be facilitated and the specific name not misapplied.

***Trichopetalum lunatum* Harger.**

Trichopetalum lunatum Harger: Am. Journ. Sci. and Arts, IV, p. 118 (1872);

Ryder: Proc. U. S. Nat. Mus., V, 527 (1882); Packard, Proc. Am.

Philos. Soc. XXI, 192 (1883); McNeill, Bull. No. 3, Brookville Soc.

8, (1883).

Scoterpes lunatus Bollman: Proc. U. S. Nat. Museum, XI, 405 (1888);

Bulletin 46 U. S. Nat. Museum, pp. 106 and 121 (1893).

Plate III, figures 52-54.

"Dirty white, banded transversely and mottled with light brown anteriorly. Segments 28; males with 45, females with 46 pairs of legs. Head large, dilated laterally, covered with short, erect, bristly hairs. Eyes of 10 ocelli, in a lunate group, convex toward the bases of the antennæ. Antennæ pilose, seven-jointed; the joints measure, the first .07 mm., second .10 mm., third .23 mm., fourth .11 mm., fifth .22 mm., sixth .09 mm., seventh .07 mm. First scutum nearly semicircular, with the posterior margin slightly concave. Near the outer angles of this scutum are two small tubercles on each side, each bearing a stout bristle, and higher up a third tubercle on each side also bears a bristle. The remaining scuta throughout are furnished with three bristles

on each side, springing from tubercles, the lower two being approximate and situated on the upper surface of the short lateral processes, and the third higher up on the scutum. On a few of the posterior segments these bristles are in a transverse row, and on the last scutum, which is broad and truncate, the two inner ones are thickened at their bases. There is an impressed dorsal line. Legs slender, white, hairy, with the penultimate joint lengthened. The under side of the seventh segment of the male is furnished anteriorly with a pair of appendages directed backward and curved upward, and posteriorly with a pair of cylindrical jointed organs, directed horizontally outward, tipped with a short bristle, and appearing like modified legs of the posterior subsegment. In crawling these organs have a motion similar to that of the basal joints of the adjacent legs. Length 6 mm.

"This species is not uncommon under or among decaying leaves in moist woods about New Haven."

— — — We have copied above the original description of this species, although a large part of it consists in an enumeration of characters common to all Craspedosomatidae, and nothing diagnostic of a species is mentioned, with the possible exception of the form of the ninth legs of the male. The accompanying diagram of the genitalia and ninth legs, we reproduce (plate III, fig. 54). If correctly drawn by Harger, it certainly represents a species not seen by us, as a comparison with our diagrams of corresponding parts will show.

***Trichopetalum album* sp. n.**

Plates II-III, figs. 22-29, 36-45.

Eyes in a lunate patch; the ocelli counted from the exterior edge show the following arrangement: $4+2+2+1+1=10$, or $4+2+2+2+1=11$.

Antennae somewhat clavate, .7-.8 mm. long, the fifth joint thickest, .12 mm. in diameter; approximate ratios of length of joints 3:5:10-11:5.5:10:5:3.

Lingual lobes with three sense-cones.

First segment broadly reniform, with rather pointed ends, not twice as broad as long (5:3), with three setigerous tubercles on each side, one near the posterior angle; the second cephalad, and somewhat mesad of the first, near the anterior margin of the segment; the third about midway between the first and the median line, and situated in a large shallow depression. A delicate raised anterior margin. Posteriorly the segment is broadly emarginate. A delicate median line begins in front of the middle and extends to the posterior margin. Surface smooth and shining, or faintly areolate.

Subsequent segments with the lateral carinae gradually increasing in size to about the middle of the body, and then decreasing so that the posterior segments have no distinct carinae. The second pair of bristles are gradually placed more directly mesad from the outer pair, and on the terminal segments the six bristles are arranged in a straight transverse line. The anterior seg-

ments are broadly emarginate posteriorly. Posterior dorsal part of segment smoother than the anterior, and divided from it by a more or less definite transverse gently curved line. In front of this line the surface is finely areolate, behind it smooth and shining, with a few faint, usually longitudinal lines dividing it into larger areolations. A very fine median ridge, located in a nearly obsolete furrow. Below the lateral carina the posterior subsegment is longitudinally striate.

Anal segment short, broadly truncate, laterally broadly sinuate; medianly the margin of the truncation is slightly produced, giving a convex edge between the thickened papilliform bases of two long, exceedingly fine hairs which are, bases included, three times as long as the exposed part of the anal segment. At the ends of the truncation are two slender bristles, and one farther down on the sinuation. Two small bristle-bearing tubercles on anterior part of the segment close to the median line.

Anal valves smooth, not strongly convex, more prominent above the middle, and with a rounded angle, faintly margined; near the margin on each side three slender bristles, one close to the superior edge of the valves, the second near the angle, the third about half-way from the angle to the edge of the preanal scale.

Prenal scale semi-elliptical, posteriorly truncate; two tubercles with long posteriorly directed setae, near the posterior margin; surface smooth.

Male genitalia (figs. 36-43) simple, consisting of a pair of more or less arcuate, basally and laterally hirsute structures, behind which are two pairs of lacinate processes. The apices of the genitalia of different specimens appear to vary considerably, but in all cases the end is somewhat broadened and emarginate, so as to leave the corners more or less produced, as shown in figure 36. The apical portion is flattened and very thin and the different ways it may be bent and the different angles at which it is consequently viewed will largely explain the apparent variation. The form shown in figure 41 is nearly or quite the same as the others, the apparent difference being caused by the fact that one of the corners is invisible on account of perspective, while the other is recurved.

Ninth legs of male oblong-clavate, with a few scattered hairs.

Color white, sometimes reticulately mottled with light horn-brown. The exo-skeleton is so transparent that the contents of the alimentary canal, if dark-colored, show through as a dark median line.

Length 6 mm.; width .6 mm.

Habitat: Common in moist, wooded localities in central New York and western Ontario. We have examined about 200 individuals collected at Onativia, Marcellus, Syracuse, Pratt's Falls and Kirkville, New York; also at Orillia, Ontario, and Chief Island, Lake Couchiching.

On the anterior segments the setigerous tubercles are little

more than a circular ring-like base for the setae, while toward the posterior end of the body they become distinct prominences.

We describe this species with the expectation that it will prove to be Harger's *lunatum*, and consequently the type of the genus *Trichopetalum*, if the original specimens can be re-examined. For the present, however, it does not appear warrantable to make a determination, for the reasons stated under *T. lunatum*.

***Trichopetalum cornutum* sp. n.**

Plate III, figures 46-49.

Very similar to *T. album*, but somewhat larger, the lateral striations more regular and more pronounced, the elevations lateral from the median seta more prominent, the arrangement of the ocelli somewhat different, but differing more especially in the male genitalia. These differ from *album* in having the apex deeply bilobed, the lobes more or less connivent, figure 49 being a lateral view. Figures 46 and 48 we were able to understand as being the same in form as 49, the apparent differences being caused as in *album* by the fact that the apical portion is so thin as to be bent in different ways, and is viewed at different angles. Figure 47 did not so easily homologize, but it is not impossible that it may do so, and as we had but one specimen it seemed best to include it here for the present.

The specimens of this species are in rather poor condition, with the setae nearly all rubbed off. The remaining setae are considerably shorter than in *album*, but may not be entire. The color is uniform dirty yellowish, without a trace of the brownish mottlings of *T. album*. This may result from their being cave animals.

Habitat: Indiana, Bloomington and Coon's Cave (Bollman). U. S. National Museum. Numbers 24, 42 and 441.

The Bloomington specimens are mixed with those of the following species. Eight specimens referred to the present species have been examined, but in their present condition the determination cannot be made with confidence without dissection sufficient to show the male genitalia.

***Trichopetalum uncum* sp. n.**

Plate III, figure 51.

Very similar externally to the two preceding species, but evidently distinct in that the male genitalia are bi-hamate with the

inner branch large and very deeply bifid, the divisions pointed and slender.

Habitat: Bloomington, Indiana, collected by Bollman. A single specimen was found in vial No. 42, of the National Museum collection, along with material of the preceding species. It should be noted that none of the Indiana material which we have examined is the same as that from the East, and that the two species here established are founded on material which Mr. Bollman determined as *T. lunatum*, so that it becomes improbable that the last species is found in Indiana. A comparison will show that if Harger's descriptions and figures cannot be reconciled with our eastern specimens, still less is this probable in the case of the Indiana material.

The genitalia of this species show an evident approximation to the *Zygonopus* type, for the lateral hooks may be looked upon as homologous with the outer tooth of *Z. whitei*, while the inner tooth of that species is replaced by the forcipate process. Our specimen did not show plumose processes, but was not in proper condition to warrant the supposition that they are absent.

Trichopetalum flavidum (Bollman).

Craspedosoma flavidum, Bollman: Entomologica Americana. Vol. iv, p. 2 (April 1888).

Plate III, figure 50.

"Yellowish brown, feet and antennæ lighter. Robust, segments not constricted, lateral carinæ small, and body strongly resembling that of *Campodes*. Antennæ longer than width of body. Ocelli 12-14, distinct, arranged in a triangular patch and in 5 or 6 series. Dorsal plates rather smooth, setigerous granules small, setæ rather large. Male feet crassate, those of female slender."

"Length of body 5.8 mm.; width .7 mm.

"Hab.—Okolona.

"This species strongly resembles a *Campodes*. In life the individuals are a dusky yellow. This description is based upon a male and female."

In the National Museum collection is a small yellow female specimen with 26 segments purporting to be the type of this species. Supposing that it is one of the specimens mentioned by Mr. Bollman it is difficult to understand his reiterated statement of its strong resemblance to *Cleidogona* (*Campodes*). The size and habit are certainly that of *Trichopetalum*, although the carinæ are somewhat less developed than in the other species known to us. The sides are striate and the dorsal surface areo-

late as in *T. album*. That this is really a *Trichopetalum* we are not confident, but judging from the exterior it is nearer to *Trichopetalum* than to the other genera. One of Mr. Bollman's specimens is mentioned as being a male, and it may be reasonably supposed that he would have recognized and mentioned the conspicuous and characteristic ninth pair of legs. The eyes depart somewhat though not seriously, from the *Trichopetalum* type, for they have a third row of ocelli in addition to the lunate arrangement in two rows (fig. 50).

A further difference consists in the fact that the setæ are smaller and arranged more nearly in a transverse line, even on the anterior segments.

***Trichopetalum* (?) *ocellatum* (Packard).**

Polydesmus ocellatus Packard: Am. Nat. XVII, 428 (1883).

Craspedosoma packardii Stuxberg: Am. Nat. XIX, p. 400 (1885).

Craspedosoma ocellatum (Packard) Bollman: Bull. 46 U. S. Nat. Museum p. 120 (1893).

Plate III, figures 30-35.

"The body is small, rather short, somewhat spindle-shaped, and unusually cylindrical. There are twenty-nine segments behind the head; the setæ are provided with the usual prominent lateral ridges. There is a row of dorsal setæ on each side of the median line; the surface of the scutes is finely granulated. The sides (genæ) of the head are full and swollen, somewhat wider than the first scute but about as wide as the body behind. Ocelli 12-13 in number, conspicuous and black. Antennæ with joint 4 half as long as 3, joint 5 remarkably thick, increasing in thickness to the end, longer than joints 6 and 7 taken together. Joint 6 not quite as long as thick; joint 7 small, conical; broad at base where it is nearly as thick as the 6th; the joints rather setose; there are two terminal flattened sense-setæ on the tip of the seventh joint. The end of the body is moderately blunt, with four setæ on each side of the last segment (anal valves). It is of a pale horn color. Length 4 mm.

"This aberrant form would not at first be regarded as a *Polydesmus*, but would be easily mistaken for a *Trichopetalus*. The individuals were mature or nearly so, as they were horn-brown. In the cylindrical body and thick antennæ it approaches *Polydesmus cavicola* Pack., from a cave on the shores of the Great Salt Lake. It differs from that species, which is eyeless, in the fusiform body, much thicker antennæ, and the finer granulations as well as the larger number of segments."

The above is Dr. Packard's original description. The species seems to have been placed in *Polydesmus* because of carinæ larger than those of *Trichopetalum*, and the granulations of the dorsal surface. From the number of segments, shape of antennæ, size,

and other characters, it seems that the present species is more related to *Trichopetalum* than to any other genus described in this paper. It is possible that a closer study will show that it is the type of a new genus.

In using Dr. Packard's description, the fact that he was comparing with species of *Polydesmus* should not be forgotten, and the "usual prominent lateral ridges" appear to be much larger than those of any American craspedosomatid known to us. Dr. Packard also counted the anal valves as a segment, which is not customary.

That there is but one row of bristles on each side of the median line, that there are but two olfactory cones, and that these are flattened, are such anomalous characters that we hesitate to credit their actual existence.

Two years after the original description was published, Dr. Packard printed a note he had received from Dr. Anton Stuxberg, of Gothenburg, Sweden, relative to the "Generic position of *Polydesmus ocellatus*." The species is referred to the European genus *Craspedosoma* on account of the general fact that this genus has eyes and thirty segments, Dr. Stuxberg having had no opportunity of examining specimens.

A change in the specific name is also proposed, on the following ground:

"In consequence of the necessity of ranging your species in another genus, all the members of which are provided with eyes, the specific name *ocellatus* should be removed and another introduced instead of it. I propose the name *Craspedosoma packardii*."

Distinctive specific names are of course desirable, but a general application of Dr. Stuxberg's principle would necessitate too many changes to make possible its admission as a rule of nomenclature, hence the original name is here retained.

Dr. Stuxberg also implies his belief that Dr. Packard's specimens were immature, being credited with but 28 segments (29 if the anal valves are counted), but we are convinced that 28 is the normal number for *Trichopetalum*. Dr. Stuxberg's statement that immature specimens of *Craspedosoma* have 29 and 27 segments, does not agree with other European writers, according to whom the stages are 26, 28, 30.

CONOTYLA gen. nov.

Eyes of numerous (16-19)* prominent ocelli arranged in triangular patches.

Antennae long or very long, slender or sub-clavate; third joint longest.

Mandibles with eleven pectinate lamellae.

Pronotum not distinct.*

Segments with moderately prominent, shoulder-like carinae.

Anterior male legs with ventral face of the last joint hispid with fine bayonet-like spines.

First two pairs of legs much smaller than the others; legs 4, 5 and 6 of males somewhat crassate.

Second legs of males with a cushion-like, cone-bearing process on the third joint; legs 4 and 5 with a similar process on the fourth joint.

Male genitalia of two distinct pairs, the posterior larger, attached to the bases of the ninth legs.

Ninth legs of male two-jointed, the distal joint oval, unarmed, without a chitinous knob.

Tenth and eleventh legs of male with large coxal apertures directed meso-caudad.

Eleventh legs of male with a meso-proximally directed process arising from the base of the third joint.

Segments of adult 30.

Distribution—Northeastern North America.

In addition to the above, the following characters are common to all the species we have examined:—

Body fusiform, broadest at about the 9th segment, narrowed abruptly cephalad, and very gradually caudad; in cross-section nearly circular, with rather prominent lateral elevations.

Labrum with the lateral teeth exceeding the middle one, but not projecting as far as the sides of the labrum.

Antennae with average ratio of length of joints 2.5:4.5:7-8.5:7:10:5:1.5.

Antepenultimate segment without carinae, that is, the surface between the bristle-bearing tubercles is not elevated.

Penultimate with its ventral portion nearly covered by the preceding segment.

Anal segment with two long transparent papillae on the posterior truncation; from each papilla springs a long slender bristle.

The genitalia of the species of this genus are, as far as known, double, that is consist of two entirely distinct pairs of structures (e. g., plate IV, fig. 73), and in this respect offer a sharp distinction from those of *Zygonopus* and *Trichopetalum*, the nearest

*The ocelli number 24, and a pronotum is present in *Conotyla leibergeri* sp. n., which is provisionally placed in the present genus, with which it apparently has most affinity. Males are not known.

generic relatives. We have little faith in the homologies of these structures suggested by European writers, for though in some special cases they may sometimes appear reasonable, a general application is not evident. In dissecting *C. fischeri* we found that the posterior pair of genital processes always remained attached to the ninth pair of legs, while the anterior pair remained in the body, and on account of their small size were at first overlooked. An examination of other species showed in each the two pairs of structures, though the anterior is much reduced, and perhaps functionless. The posterior pair of genitalia may perhaps be homologous to the larger of the plumose processes of *Trichopetalum*.

This genus much resembles in characters of form, carinae and spines the three genera *Zygonopus*, *Scoterpes* and *Trichopetalum*. From the first two of these it is distinct in the possession of well-developed eyes, and from the last in having 30 segments.

The spines of the pectinate lamellae are sometimes bifid at the tip, especially in the middle rows.

In this genus the bayonet-like spines of the last joint are found on all or nearly all the male legs, becoming fewer and smaller on the posterior legs.

In describing the species of this genus we have made frequent comparisons with *Conotyla fischeri*, the type of the genus, a new species of which we have abundant material and are hence able to describe more thoroughly than the other species.

***Conotyla fischeri* sp. n.**

Plates IV-V, figures 55-78.

Eyes prominent, broadly triangular, the ocelli arranged in four rows, 2+4+6+7=19, the short rows being towards the antennae. The direction of the rows is oblique to the posterior margin of the vertex, and diverging mesad.

Antennae filiform, 2.8 to 3.2 mm. long, .14 to .16 mm. thick; approximate ratio of lengths of joints beginning with the seventh, 2.5: 4: 8: 7: 10: 5: 1.5.

First segment viewed from above semicircular-reniform; a fine ridge, or rather row of minute, bead-like protuberances; a small plane or slightly depressed area on each side of the median line near the centre of the surface of the segment; on each side the customary three bristles and accompanying prominences, the outer and larger bristle being usually directed horizontally outward and located on the small carina or lateral corner of the segment. Second bristle much smaller, located a little mesad and cephalad of the other, near the margin of the segment; third bristle about midway between the second and the median line, and directly mesad from the first bristle.

Mentum semi-elliptical, about twice as broad as long. It is difficult to determine the posterior edge, as the chitin is gradually thinner, passing into a transparent membrane. A cross-section, however, shows that the chitinized membrane extends back to a transverse ridge and furrow, giving the mentum the proportions assigned above.

Promentum obsolete, the pointed triangular space between the rounded anterior edge of the mentum and the lingual laminae is covered by a transparent membrane, sometimes appearing chitinized, but not to the same extent as the surrounding parts.

Stipes of gnathochilarium with two cardos, an exterior, subtriangular, and a larger interior, sharply serrated along its anterior edge (see plate). Including the processes, the stipes are five times as long as their greatest width, which occurs anteriorly; sparsely hirsute posteriorly with short bristles; a row of longer bristles along the lateral margin anteriorly; one long bristle about the middle, considerably removed from the anterior margin. Exterior process with nine cones, 4 on the apex, the others on the exterior face. Inferior process thicker than the exterior, with 12-10 cones, all on the apex.

Lingual laminae about three times as long as broad, the anterior and posterior edges nearly straight, converging mesad; a few (7-8) scattered bristles, a very long one near the anterior-exterior corner. Lingual lobes semicircular, subequal to base of inner process; with 4-5 cones, the inner of which is larger, longer, sharp-pointed and curved mesad.

Middle lobe of tongue subequal to the lingual laminae, equal in width to inner process; anterior edges straight, meeting at a right angle, or rounded.

Lingual process longer than broad; middle tooth large, one or both of the small lateral teeth frequently obsolete.

Second segment about half as long as the first, the two outer bristles located on the upper side of the carina, the second nearly directly cephalad from the first, the third about midway between the first and the median line.

Third and subsequent segments gradually longer, and with larger, somewhat oblique, carinae, on which the two outer bristles are located. The third bristle is gradually farther away from the median line on the succeeding segments, and directed more obliquely backward. The anterior subsegments have about five transverse parallel lines connected by fine longitudinal lines. Beginning at the middle of the first segment, and extending caudad over all the segments except the anal, is a fine median ridge, with a fine furrow on each side. Near the ventral edge of each segment, beginning with the second, is a thin oblique carina, nearly parallel to the thickened ventral margin, so that its posterior end is higher; this carina has a downward curve or angle on the anterior segments, and is straighter on the posterior.

Posterior segments have the carinae gradually smaller, and the middle pair of bristles come closer to the median line. The surface of all the segments is finely areolate; on the lateral and ventral surfaces are fine parallel furrows suggesting the striated condition in Iulidae. Posterior middle portion of the segment frequently with a few oblique wrinkles or depressions.

Antepenultimate segment shortest, without keel, that is the surface be-

tween the bristle-bearing protuberances is scarcely elevated, and the bristles are nearly in a traverse line.

Penultimate segment almost covered by the preceding; bristles in a straight row; posterior margin very finely serrate, as is also that of the preceding segments, but to a less degree.

Anal segment truncate posteriorly, slightly emarginate in the middle, laterally broadly sinuate. There are eight bristles, two close to the median line, near the middle of the segment, the others close to the posterior margin; at the emargination, one on each side of the median line, a pair of very slender bristles with large conic bases as long as the anterior pair of bristles; one bristle at each angle of the truncation; below these a third pair in the upper part of the sinuation. All the bristles of this segment are more slender than those of the preceding segments.

Anal valves subequal to the anal segment, above with a blunt angle, convex; a slight ridge near the somewhat faintly raised margins bears three slender bristles at equal distances from each other; the superior bristle is much closer to the anal segment than the inferior one is to the preanal scale.

Preanal scale semicircular, faintly truncate or medianly emarginate, bearing on each side, not far from the median line a setigerous tubercle; the bristles very slender, nearly twice as long as those of the anal valves, directed posteriorly and upward, lying close to the anal valves.

First pair of legs of male small, six-jointed, the joints beyond the coxae measuring respectively .08, .34, .18, .12, and .42 mm., third and fourth joints widest, .12 mm.; no roughenings or protuberances; claw large, with two large secondary claws on the superior edge.

Second pair of legs of male also six-jointed, larger than first pair, measurements of corresponding joints, .10, .40, .18, .12 and .44 mm.; second joint thickest, .14 mm., not including a large rounded protuberance near the middle of the inferior surface of the joint. The diameter of this protuberance is about half that of the joint, and its surface is covered with transparent chitinous cones of various sizes. Claw as for the first legs.

Third pair of legs of male seven-jointed, lengths of joints, from coxa, .20, .04, .34, .46, .16, .12, .48 mm.; width of third joint .22 mm. The inferior surface of the distal half of the seventh joint is covered with hook-like, transparent processes arranged in longitudinal rows. Claw without evident secondary claws.

Fourth pair of legs of male with joints measuring .20, .04, .34, .54, .20, .14 and .46 mm., width of third and fourth joints .24 mm. About one-third of the distance from the distal end of the fourth joint a large subclavate protuberance about as broad as long, the surface covered with cones like the protuberance of the second leg. The seventh joint is roughened like that of the third leg. No secondary claws.

Fifth legs of male; joints .14, .01, .40, .52, .18, .14 and .54 mm., third joint .24 mm. wide. A large protuberance similar to that of the fourth legs. No secondary claws.

Sixth legs same as fifth in proportion of joints, etc. Third joint similar to second joint of second leg.

Seventh legs of male with joints of similar proportions; on the side of the proximal end of the fourth joint a long, nearly cylindrical process, at the end with four large teeth, between which its surface is beset with small cones. The distal end of the coxa has a rounded protuberance covered with small knobs. This protuberance is on the inferior-posterior surface of the coxa, and it appears to fit against the anterior of the two pairs of genitalia.

Tenth legs of male with nearly the same proportions as the seventh, slightly more slender, coxæ closely approximate, each produced into a protuberance next to the median line; the protuberance is distally of soft tissue, and very irregular in shape and size. Seventh joint roughened below with hooks. Claw with two small secondary claws on superior edge.

Eleventh legs of male with similar proportions; third joint inferiorly and proximally with a cylindrical process directed mesad. Seventh joint with hook-like roughenings more confined to distal portion; two secondary claws.

Twelfth legs of male slightly longer and more slender than the others. Seventh joint as for eleventh legs. Two secondary claws; inferior surface of coxæ with small knobs.

The legs of females are in a general way similar in size and shape to those of males, but the anterior are more slender, and all are destitute of the peculiar knobs, processes, and protuberances.

The normal legs of the body are more slender than the anterior pairs. The bayonet-like structures of the seventh joint gradually decrease in number, and disappear at the forty-fifth pair. The surface of the coxæ of all the legs is roughened with small conical knobs, as is also the surface of the pediferous laminae.

In the inferior groove of the claw of all the legs of this species is a very delicate hair extending considerably beyond the claw, to which it lies closely appressed. We have not been able to find any similar structure in other species.

Color obscure horn-brown, with dark brown points, especially on the exposed posterior portions of the segments; ventral portions mottled. Proximal joints of legs paler, the distal dark brown; antennæ fuscous. Penultimate segment pale, the last segment dark.

Length of large specimen 18 mm.; width 1.6 mm.

Habitat.—Central New York. We have collected about 100 specimens from the following localities:—Syracuse, Jamesville, Onativia and Marcellus, Onondaga county; Wolcott, Wayne county; Farmington, Ontario county. At Marcellus several individuals were found under the loose bark of a fallen butternut tree (*Juglans cinerea*). All the other specimens were found among leaves and rotting vegetable matter in moist woods.

It gives us great pleasure to name this species for our friend, Prof. J. T. Fischer, of Syracuse University, whose keen powers of vision and lively company contributed greatly to the success and pleasure of many collecting expeditions in central New York.

Conotyla atrolineata (Bollm.).

Craspedosoma atrolineatum Bollman: Proc. U. S. Nat. Mus. X, p. 618 (1887); Bulletin 46 U. S. Nat. Museum, pp. 35 and 183 (1893).

Plate VI, figures 95-100.

Eyes rounded triangular in shape, the ocelli in diagonal rows beginning posteriorly $7+6+4+3=20$, or $7+6+4+2=19$.

Antennae filiform, 2.5 mm. long, .14 thick, ratio of lengths of joints beginning with the seventh, 3:4.5:8:7.5:10:5.5:1.5, the seventh being proportionally longer than in other species of the genus. The antennae are somewhat stouter than in *fischeri* and *bollmani*, cf. figs. 64, 83 and 95.

Gnathochilarium apparently not different from *C. fischeri*, except that the lingual processes are strongly tridentate.

First segment reniform; anterior margin and setigerous tubercles as in *C. fischeri*.

Subsequent segments with carinae rather large, swollen, surface finely reticulated, anterior subsegment with about three transverse parallel ridges, sometimes concealed by the preceding segment. Between the anterior and posterior subsegments there sometimes appears a row of small, bead-like ridges.

Anal segment smooth, the posterior scarcely or not at all depressed. The two anterior setae very close together, the others as in *C. fischeri*.

Anal valves slightly convex, the posterior margins nearly straight up to the angulation which is quite sharp and equal to the anal segment.

Preanal scale as in *C. fischeri*.

Male genitalia of the anterior pair with (fig. 97) a large bulbous base, bifid distally, the larger division lacinate-dentate at apex. The posterior pair of genitalia (fig. 96) are much more complex than in *bollmani* or *fischeri*.

Color light horn-brown, the carinae and a rather broad dorsal line darker, sometimes very dark.

Length 14 mm.; width 1.3 mm.

We have examined nine specimens referred to this species. One mature male and two females. U. S. N. M. No. 439, from Glacier, B. C.; five immature specimens U. S. N. M. 332, from the same place, and one female from Winona, Minnesota (No. 331).

The type of this species was from Glacier, B. C., and we have examined specimens from that locality. Mr. Bollman also reported this species from Winona, Minn. (Coll. Holzinger). The single female specimen is now in the National Museum. It has three dark longitudinal lines, but the color is lighter than the typical specimen, the animal considerably more robust, less attenuate posteriorly. The arrangement of the ocelli is also different in specimens from the two localities, cf. figs. 99 and 100.

We would not be surprised if when the males are collected the species will prove to be distinct. The great difference in habitat

also indicates probable distinctness, for with the possible exception of *Underwoodia inloides* (Harger) there is no chordeumid species known from localities so widely separated.

Conotyla bollmani (McNeill).

Trichopetatum bollmani McNeill: Proc. U. S. Nat. Museum X, 330 (1887); Bull. Brookville Soc. III, 8 (1888).

Craspedosoma bollmani (McNeill) Bollman: Proc. U. S. Nat. Mus. X, p. 619; Bull. 46 U. S. Nat. Mus., p. 36.

Scoterpes bollmani (McNeill) Bollman: Proc. U. S. Nat. Mus. XI, 405, 1888; Bull. 46 U. S. Nat. Mus., 106.

Plate V, figures 79-94.

Eyes triangular of about 19 ocelli, arranged in four rows, as in *C. fischeri*, 2:4:6:7, though this formula is varied by the interposition of small ocelli, and the curving of the rows.

Antennae filiform, 3.5 mm. long, .16 mm. thick; ratio of lengths of joints beginning with the seventh, 2.5:4.5:8:7.5:10:4.5:1.

Gnathochilarium as in *C. fischeri*.

First segment semicircular or subreniform; about half way from the median line to the lateral angle is a well-pronounced depression about the size of the base of an antenna; the middle tubercle is also situated in a smaller, more shallow depression. Tubercles arranged as in *C. fischeri*. Surface nearly smooth, a very fine median furrow beginning about the middle of the segment, and extending to the posterior margin. Anterior margin raised.

Subsequent segments nearly the same as in *C. fischeri*. The ridge of the dorsal furrow is somewhat fainter, and the oblique wrinkles of the posterior portion of the segment do not appear. Moreover the whole dorsal surface of the segments is very minutely hispid with microscopic point-like bristles, either not present or scarce in *C. fischeri*. Posterior setae as long as the segments.

Anal segment without median furrow or ridge, truncate behind for a distance of about half the breadth of the segment, the eight setae arranged as in *C. fischeri*, except that the outside pair are farther away from those above them than in that species. Surface more finely areolate punctate than the other segments and with the microscopic point-like hairs.

Anal valves not strongly convex, more prominent above the middle, and almost angulate, with three setigerous tubercles along the margin somewhat more prominent than in *C. fischeri*. The surface of the valves is like that of the anal segment.

Precanal scale as in *C. fischeri*.

Color uniform light horn-brown.

Length 17 mm.; width 1.7 mm.

Habitat: Caves near Bloomington, Indiana. We have examined about 40 specimens, as follows: Bloomington U. S.

N. M. No. 3; Truitt's Cave, No. 234; Neal's Cave, No. 235; Coon's Cave, Nos. 236 and 443; also Nos. 419 and 447, with no locality given. McNeill's types were from Mayfield's Cave, five miles northwest of Bloomington. The species is reported by Bollman from all the above localities and from Phitt's and Donehue's Caves, Bedford, Indiana, and said to be abundant.

Conotyla leibergi sp. n.

Plate VI, figures 102-104.

Eyes subtriangular, the posterior dorsal side straight, other sides curved, beginning at posterior dorsal side arranged $9:6+5:3+1=24$, the first row with two small ocelli.

Antennae subelavate, length 1.7 mm., 6th joint thickest, .16 mm. in diameter; ratio of lengths of joints, beginning with the seventh, 2:4:7:6.5:10:5:5.

Gnathochilarium differing from that of the three preceding species in the possession of a small, broadly triangular promontum.

First segment anteriorly nearly semicircular, posteriorly slightly emarginate, margined anteriorly to the lateral angles; a fine dorsal line posteriorly; the three tubercles located as in *C. fischeri*.

Subsequent segments with gradually swollen carinae of moderate size, proportionally not so large and abruptly elevated as in *C. fischeri*. The lines and reticulations as in that species, but more pronounced.

Anal segment broadly truncate, more so than in *C. fischeri*. Bristles arranged as in that species.

Anal valves subequal to anal segment, the angle more pronounced than in *C. fischeri*; moderately convex, margined, with three bristles, arranged as in *C. fischeri*.

Anal scale small, nearly semicircular; two tubercles, with long setae appressed to the anal valves.

Color: Dorsum dark fuscous-brown, nearly black, a fine median line, a line along the tubercles, the ventral portions, feet and extremities of the body paler, horn-brown or sordid. Antennae dark brown. On some paler specimens the darker color of the posterior subsegments gives the appearance of a series of transverse dark bands and a row of dark spots along the sides.

The carinae of this species are proportionally not so large and abruptly elevated as in *C. fischeri*.

Length 14 mm.; width 1.4 mm.

Habitat: Lake Pend d'Oreille, Idaho.

We have examined three female specimens collected on "dry granite ledges, in tufts of moss." The material was sent us by Mr. J. B. Leiberg, for whom we take pleasure in naming this species.

We attempted to identify this species with *Trichopetalum glomeratum* Harger, but the differences in color, size and number of ocelli are too great to permit this.

The characters of the antennæ, gnathochilarium and ocelli render this species quite distinct from *atrolineata*. Indeed, it is probable that when the males are found this species will prove generically distinct from *Conotyla*.

***Conotyla glomerata* (Harger).**

Trichopetalum glomeratum Harger: Am. Journ. Sci. and Arts, IV, pp. 118 (1872).

— *Craspedosoma glomeratum* (Harger) Bollman: Proc. U. S. Nat. Museum X, 619 (1887); Bull. 46 U. S. Nat. Mus. pp. 36 and 120.

Plate VI, figure 104a.

"This species is somewhat larger than the preceding (*lunatum*), but closely resembles it, except in the following points: The general color is somewhat darker. The eyes of 19 ocelli in a subtriangular patch. There are 31 segments, and the fifth joint of the antennæ is much shorter than the third. These joints, except the first, measure: second .20 mm.; third .40 mm.; fourth .24 mm.; fifth .33 mm.; sixth .18 mm.; seventh .12 mm. Length of animal 10 mm.

"A single specimen of this species was collected by the writer in the valley of the John Day River, Oregon, in October, 1871."

The original description of this species is so brief that the generic position must remain in doubt. A general resemblance to *Trichopetalum lunatum* is alleged, but the thirty(-one) segments, the shorter fifth joint of the antennæ and the triangular eyes show a close approximation with *Conotyla*.

***Conotyla wyandotte* (Bollman).**

Scotherpes wyandotte Bollman: Proc. U. S. Nat. Museum XI, p. 405 (1888).

Bull. 46 U. S. Nat. Museum p. 106 (1893).

Plate VI, figure 101.

"*Diagnosis*: Related to *Cr. lunatum* (Harger), but the color dark, ocelli arranged in a triangular patch, and the body larger and more robust.

Habitat: Wyandotte, Indiana.

Type: U. S. National Museum.

Description: Body stout, short, scarcely depressed. Dorsal plates reticulated; lateral carinae as in *lunatum*. Ocelli 16-4, in a triangular patch. Yellowish-brown; legs pale. Length .10 mm.; width, 1.5 mm.

This new species is described from a female which was found a few miles north of Wyandotte Cave, Crawford County [Indiana]."

The triangular eyes, dark color and larger size indicate that this species has more characters in common with *Conotyia* than with *Trichopetalum*, though when males are found it is likely to prove distinct from both genera.

We examined the type specimen, U. S. Nat. Museum No. 440, and made the following notes:—

Eyes (fig. 101) triangular, the ocelli in diagonal rows beginning posteriorly $1+6+5+3+1=16$. Three ocelli border on the lateral margin of the head.

First segment with posterior margin convex, otherwise as in *C. fischeri*.

Subsequent segments with the median bristles longer than the exterior ones, at least on posterior segments. The tubercle on which the interior bristle is located is just mesad of the much swollen carina. An elevated ridge runs above both the exterior tubercles. Segments of the middle of the body short, bristles rather close together, the median pair located well ahead. Anterior subsegments with four or five rows of small, oblong elevations set close together. The usual median furrows and ridge present, but faint. On the posterior segments the carinae gradually disappear, and the protuberances tend to become arranged in a straight line.

Penultimate segment equal in length to the antepenultimate.

Anal segment contracted posteriorly, viewed from above it appears squarely truncate. The usual eight bristles present.

Anal valves not prominent, margins scarcely raised; above slightly exceeding last segment, and faintly angled; each with three bristles, the superior one close to the apex of the anal segment.

In September 1893 two female specimens of a species bearing a general resemblance to *wyandotte* were collected in a swampy pasture at Grass Lake, near Jackson, Michigan.

Habitat: Known only from the vicinity of Bloomington, Indiana.

UNDERWOODIA gen. nov.

Eyes moderately developed, of numerous (13) ocelli arranged in triangular patches.

Antennae moderately robust, subclavate, third joint longest, or the fifth subequal.

Mandibles with eight pectinate lamellae.

Pronotum present, triangular.

Segments with lateral carinae striaform, appearing only on the anterior segments; setigerous tubercles minute.

Legs rather robust; terminal joints of male legs not hispid.

First pair of legs of male robust.

Second legs of male strongly crassate, the coxae produced, hamate; claw very small.

Third legs of male moderately crissate; coxae produced, third joint much swollen.

Legs 4-7 not specially modified.

Genitalia of male of two pairs of laminae, the anterior broad, the posterior slender.

Ninth legs of male two-jointed; basal joint bulbous, attenuate above; second joint broadly oval.

Tenth legs with coxa much enlarged, the other joints reduced.

Segments of adult 30.

Distribution: Northeastern North America.

This genus is named for Dr. L. M. Underwood, to whose kindness we are indebted for the opportunity of studying *Myriapoda*.

The following new species is made the type of the genus because the male is known, and the generic secondary sexual characters are drawn from this species. In the other characters the two species agree, except in the proportions of the antennal joints.

A noteworthy fact regarding this genus is the enormous preponderance of females. We have collected nearly 300 specimens, of which but two are males. In most *Diplopoda* the females are more numerous than the males, but such a proportion as this is not reached elsewhere, as far as we are aware. The other genera of *Craspedosomatidae* do not seem to have the sexes especially unequal in number.

***Underwoodia polygama* sp. n.**

Plate X, figures 180-190.

Body fusiform, broadest about the middle, narrowed gradually to both ends.

Vertex prominent, smooth and shining, without evident sulcus.

Clypeus sparsely hirsute below; evenly convex.

Eyes broadly triangular, of 13 ocelli arranged in three rows 6+5+2. The external ocellus of the upper row is somewhat above the line of those with which it is counted.

Antennae moderately robust, slightly clavate; the approximate ratios of lengths of joints, beginning with the seventh: 3:4.5:9:5:10:5:3. Joints all hirsute, the distal more than the proximal.

Mentum rounded in front and behind.

Promentum triangular, the posterior side concave.

Stipes and lingual laminae with a few long hairs.

Lingual lobes with three sense-cones.

Styliform processes deeply trifid, the middle tooth smallest.

First segment broadly reniform, the posterior corners rather square; not medianly emarginate behind. Outer setigerous tubercles somewhat mesad

from the posterior corner; second tubercle about midway between the first and third; the third rather close to the median line. Tubercles very small, located in very slight depressions; the setæ slender and if horizontal would nearly reach the posterior margin of the segment.

Surface of all the segments apparently smooth and shining, but if sufficiently magnified it appears finely reticulate-areolate, the areas being irregularly hexagonal or quadrate. On the anterior subsegments the areolation is somewhat coarser and more regular, consisting of rectangles in transverse rows. On the sides of the segments and below the longitudinal lines of the reticulations become more distinct giving the appearance of longitudinal striations. The usual fine median line distinct.

Carinae very fine, linear, striaform, oblique, the anterior end being higher; the carinae gradually decrease in size from the first segment and disappear about the tenth. Below, near to and parallel with the ventral edge of the segments is a fine furrow, more evident on posterior segments.

Setigerous tubercles and setæ also decreasing in size from the first segment, almost disappearing on the middle segments. On posterior segments the tubercles and setæ increase in size, extending beyond the posterior margins of their segments.

Posterior segments not much shorter than the anterior.

Anal segment without median line; broadly truncate; the dorsal pair of tubercles very small and close together, located in a very slight transverse furrow, the setæ not reaching the posterior margin of the segment. The conic processes of the posterior margin as long as the distance from their bases to the anterior pair of tubercles; from their apices extend very slender hairs (frequently broken off) equalling in length the conic bases. The next pair of marginal setæ located near the corners of the truncation, and as long as the conic processes.

Anal valves smooth or with faint vertical wrinkles; three setigerous tubercles somewhat removed from the slightly compressed margin.

Preanal scale semicircular, broadly emarginate; two tubercles and slender setæ.

Pedigerous laminae plain in front, reticulate-areolate, mucronate between the bases of the legs.

Legs of both sexes rather robust.

First legs of male (fig. 180) six-jointed, rather robust; basal joint with apex hirsute with fine hairs; second joint broader than long; last joint with a comb of coarser hairs along the ventral side; claw large; two supplementary claws.

Second legs of male (fig. 181) six-jointed, strongly crassate; basal joint produced into a long chitinous hook; second joint very small; joints 3-6 very stout and hirsute with fine flexuous hairs; last joint densely clothed with long flexuous hairs, especially long at apex, and far exceeding the very small claw.

Third legs of male (fig. 182) seven-jointed; basal joint produced into rounded processes with a tuft of flexuous hairs at apex; second joint very small, concealed (in the drawing) behind the first and third joints; third joint

strongly crassate; fourth joint less crassate, the others nearly normal, except that all are hirsute; claw very small, but larger than on the second legs.

Legs 4-7 not specially modified.

Male genitalia (figs. 186-187) consisting of an anterior lamina deeply bifid at apex, the divisions subequal, curved backward; anterior lamina simple, narrow, subequal in length to the other; a median subclavate process arising from the pedigerous lamina.

Ninth legs of male (figs. 186-187) two jointed, the basal joint large and bulbous at base, gradually attenuate distad into a point, subequal to the genitalia in length; second joint broadly oval, attached by a narrow base to the outer side of the first joint; outer face of second joint somewhat flattened, hirsute externally (anterior face) and distally, also with a few papillæ.

Tenth legs of male with the coxæ (fig. 185) greatly enlarged and with an irregular mass of membrane or hardened secretion attached to the ventral side; other joints normal but reduced in size.

Color dark horn-brown, lighter below. The shade varies, some specimens being much lighter than others. The darkest color is upon the head and the exposed portion of the anterior subsegments, giving the animal alternate bands of darker and lighter brown, if examined more closely. Last segment and anal valves dark. Excepting the dark band the segments are spotted and mottled with light brown or whitish. A fine median line pale or whitish. Feet pale, the distal joints darker than the proximal. Antennæ dark, each joint finely ringed with white at base.

Length about 8 mm.; width .65 mm.

Habitat: We have collected about 80 specimens on the north shore of Long Island, New York, May, 1893, at two stations about seven miles apart, Centreport and Cold Spring.

The habitat was in both cases quite the same, among rotting leaves on a heavily wooded hillside where the ground was springy and moist all the year. The Cold Spring station is near the building of the New York State Fish Commission. Of the nearly 80 specimens but two were males, hence the specific name. Specimens were not abundant and several hours were spent collecting them, in the hope of finding more males, so that the material for study might be more abundant, the animal being so small that nothing can be made out with accuracy without dissection.

The species differs from *U. iuloides* in being slightly larger, of dark color, in the better development of the eyes, and in having the third joint of the antennæ longer than the fifth.

Underwoodia iuloides (Harger).

Trichopetalum iuloides Harger: Am. Journ. Sci. and Arts, IV, 118 (1872);
Ryder: Proc. U. S. Nat. Mus. III, 527 1881; Packard: Proc. Am.
Philos. Soc. XXI, 192 (1883).

Chordeuma iuloides (Harger) Bollman: Bull. 46 U. S. Nat. Mus. 121 (1893).

Plate X, figures 177-179.

Eyes more or less triangular, of about 13 ocelli, without evident arrangement into rows.

Antennae moderately clavate .75 to .85 mm. long, fifth joint thickest, .10 to .12 mm. in diameter; ratio of lengths of joints, beginning with the seventh, 3: 4.5: 8-10: 5.5: 10: 5: 3. Olfactory cones very slender and sharp-pointed.

First segment smooth, nearly semi-circular in front, straight behind, except a slight emargination in the middle; with a very fine raised margin anteriorly to the lateral angles. Median furrow indistinct. Three fine, hair-like setae on each side, one close to the lateral angle, one a short distance from the median line and one midway between.

Subsequent segments nearly smooth, a very fine dorsal line, the first five or six segments with a slight trace of lateral carinae, the others smooth, as in Iulidae. Each segment has three small bristles on each side, situated as on the first segment. On posterior segments the bristles become larger, have a prominent base, and are closer to the posterior margin of the segment. The ventral edges of anterior segments, at least, are sharply and finely serrate.

Anal segment smooth, as viewed from above having a semi-circular outline, posteriorly truncate. From the posterior margin of the truncation, near the middle, come two long conic papillae, each tipped with a very slender flexuous hair. At each corner of the truncation, a little removed from the margin is a slender bristle directed backward; another posteriorly-directed slender bristle some distance below, near the sinuation. The other two dorsal bristles are near the median line, some distance behind the middle of the segment, and each located in a depression.

Color light horn-brown, mottled with white, many specimens show very little brown and are dirty white in color, especially in alcohol. The body is so transparent that the contents of the alimentary canal frequently give the appearance of a dark dorsal stripe.

Length 6.5-8 mm.; width .6 mm.

Habitat: North Eastern North America. Harger's type was from Simmons' Harbor, north shore of Lake Superior. We have collected specimens at Orillia, Ontario; abundant on Chief Island, Lake Couchiching; Grass Lake, near Jackson, Michigan; and at several localities in central New York; Syracuse, Kirkville, Marcellus. A careful search is likely to be successful in any wooded locality which is so situated as to soil and drainage as to be always moist, without being submerged. Individuals are

however, seldom abundant, and we have spent considerable time in collecting about 200. None of these are males, so that the generic position of the species must remain somewhat in doubt. We were very unwilling to believe that so large a number of specimens were all females, and re-examined them several times; finally, in order to make sure that the internal structure corresponded with the external appearance, longitudinal sections of about 30 were cut, all of which showed more or less developed eggs. We had begun to suspect parthenogenesis or some other reproductive arrangement novel in Diplopoda when the specimens of *U. polygama* were collected. Males were in that case found, but with a disproportion of sexes so great as to encourage the hope that the males of *uloides* will be discovered by persistent collecting.

Some specimens of this species have the fifth joint of the antennæ equal to the third, a character otherwise found only in Trichopetalum. The length, however, is not entirely the same in specimens from the different localities.

CASEYA gen. nov.

Eyes well developed, of numerous (23) ocelli, arranged in subtriangular patches.

Antennæ moderately robust, clavate, third joint longest.

Mandibles with eleven pectinate lamellæ.

Pronotum present, triangular.

Segments cylindrical, without lateral carinae, longitudinally striate; setigerous tubercles minute.

Legs slender; terminal joint of male legs not hispid.

First legs of male small and slender.

Second legs of male very slender, the coxæ produced into a curved process; third joint tuberculate on the ventral face; claw normal.

Third legs of male not crassate; coxæ produced, third joint not swollen.

Legs 4 and 5 not specially modified.

Sixth legs with coxa somewhat enlarged, and with a tuft of hairs.

Seventh legs of male with the coxa much enlarged, the other joints reduced.

Genitalia of male of two pairs of laminae, the anterior large, the posterior smaller, both pairs complex.

Ninth legs of male two-jointed, the basal joint broad at base, produced distad, second joint broadly oval.

Tenth legs of male with coxæ much enlarged, the other joints reduced.

Segments of adult 30.

Distribution: California.

This genus is named for Captain Thomas L. Casey, to whom our thanks are due for a collection of Californian Myriapoda including this and other interesting forms.

Caseya differs from Underwoodia in the more numerous ocelli and pectinate lamellæ, the entire absence of carinæ, the pronounced lateral striæ, the slender anterior male legs, and the greatly enlarged coxæ of the seventh legs of the male. Many other differences of the same or less importance might be enumerated, such as the shape of the modified coxæ of the second and third pairs of male legs; the slight modification of the coxæ of the sixth male legs, the process of the coxæ of the tenth legs, and the oblique carinæ of the coxæ of the tenth and following legs; also the form of the male genitalia and ninth male legs, for these differences are not paralleled among the species of the other genera.

On the other hand there can be no doubt that these two genera form a natural group and have more affinity with the European genus *Chordeuma* than with the other American types.

The mandibular cardo is apparently smaller and more coalesced than in *Cleidogona*; no sulcus is evident, but a suture becomes apparent as the alcohol dries out.

The body is somewhat more gradually tapering caudad, and slightly less so cephalad than *Cleidogona*, which this form much resembles in external appearance. The head is, however, not wider than the first segment, and the whole appearance of the animal is the most iuliform of any of our *Craspedosomatidæ*. The entire absence of carinæ, the rudimentary character of the setigerous tubercles, which are sunk in depressions, as though to more thoroughly dispose of them, and the presence of longitudinal striations, also give force to the fact that in the iuliform *Craspedosomatidæ* we have another of the strange approximations of external form between animals widely separated by the more important structural characters.

***Caseya heteropus* sp. n.**

Body fusiform, broadest about the middle, narrowed gradually to both ends.

Vertex prominent, smooth and shining; a few scattered punctations (perhaps the bases of hairs); posteriorly emarginate-excavate, with a short median suture extending from the posterior margin and not reaching an imaginary line connecting the eyes.

Clypeus sparsely hirsute below, rather plane, a transverse depression above the labrum.

Eyes broadly subtriangular, the ocelli not arranged with much regularity, the vertical rows being usually more evident than the horizontal. Ocelli counted horizontally from above: $7+6+5+4+2=24$, or $6+5+4+3+3=21$, $1+6+5+4+3+2+1=22$.

Antennæ moderately robust, somewhat clavate, ratio of lengths of joints, beginning with the seventh: 2:4:8:6:10:6:2.

Proximal joints sparsely, the distal more densely hirsute. Below and laterad from the antennal socket the margin of the head has a deep rounded notch.

Mentum broadly quadrangular-arcuate, all the sides curved, convex in front, concave behind.

Promentum triangular, subequilateral, posteriorly broadly emarginate; sparsely hirsute.

Stipes and lingual laminae sparsely hirsute.

Lingual lobes with five sense cones.

Styliform processes quadridentate.

First segment broadly reniform, slightly emarginate in the middle posteriorly. A fine raised anterior margin; dorsal median line beginning just back of the middle of segment; outer setigerous tubercles somewhat mesad from the outer corners of the segment; second tubercle about midway between the first and third. Tubercles minute, rather closer to the posterior margin than in *Underwoodia*.

Surface of segments appearing smooth, but reticulate-arcolate as described for *Underwoodia polygama*. On the sides and below the posterior subsegments are longitudinally striate as in *Iulidæ*. On the first segment are no striations; the second with but one above the lower tubercle; the third with two; the succeeding segments with three or four; below the lower tubercle about ten striations, very distinct, at equal distances, somewhat oblique, the posterior end lower. The suture between the subsegments is sinuate medianly, the anterior subsegment extending somewhat into the posterior. Tubercles minute, located in depressions, on all segments except the first and last arranged in a transverse line. No trace of lateral carinae, the striations of the side not larger than those below. On posterior segments the striae below the tubercles are somewhat more numerous. Corners of the segments below evenly rounded, the margin somewhat thickened; the lower side of the submarginal furrow is extended into a minute sharp tooth.

Last segment truncate, tubercles located as usual; conic processes and setae not seen.

Anal valves with the usual tubercles and long setae.

Prenal scale semicircular, subtruncate posteriorly; two long bristles somewhat remote from the posterior margin and located upon a transverse thickening of the scale.

Pedigerous laminae very small, coarsely areolate, subcarinate in front, acuminate distad.

Legs rather slender, moderately hirsute, the coxae approximate, reticulate-areolate, especially on posterior legs.

First legs of male (fig. 198) slender, apparently of the usual form, our specimen somewhat broken and distal joint lost.

Second legs of male (figs. 199-200) more slender than the first; coxa produced from the anterior face into a blunt process curved backward; the process is partly concealed by a tuft of long hairs which arise from the coxa behind the process, extend distad and mesad and are curved around the process; third joint very long, thickly tuberculate on the middle of the ventral face.

Third legs of male (figs. 201-203) with coxa much enlarged and produced into conic processes, clothed at apex with a tuft of long hairs; both surfaces of the joint are sparsely hirsute with shorter hairs; other joints not specially modified, except that the distal joints are more hirsute; claw normal, equal to that of the second legs.

Sixth male legs (fig. 206) with coxa slightly enlarged, the meso-distal corner prominent, clothed with long hairs.

Seventh male legs (figs. 207-209) with coxa greatly enlarged; on the middle of the distal side a conic process truncate at apex and surmounted with a tuft of long hairs; in front of the process are other long hairs, and another tuft at the inner distal corner of this joint. The second joint inserted at the outer corner of the coxa. Other joints somewhat reduced in size, so that the length of the seventh legs does not exceed that of the sixth. The third joint is shortened more than the others.

Male genitalia complex, (figs. 216-217) and as we had but one male, dissection was not carried far enough to make plain the relations of the parts. The posterior arm seems to be perforate, the anterior part of it extending up into the complicate anterior arm as two slender columns (fig. 216).

Ninth legs of male (fig. 218) with basal joint produced above and angled near the apex with a deep, rounded notch subtended by a sharp tooth; second joint narrower than in *Underwoodia*, hirsute distally and on the lateral face. The pedigerous lamina has long curved ends and is medianly prominent. It may be that this medial prominence is homologous with the long median process of *Underwoodia*.

Tenth legs of male (figs. 210-211) with coxae much enlarged, similar to those of *Underwoodia*; on the posterior side near the aperture a large rounded prominence; also an oblique carina; other joints evidently reduced.

Eleventh and twelfth legs of male (figs. 212-213) slightly thicker than the normal (fig. 214). Third joint with a few small tubercles on the ventral face; coxae obliquely carinate on the posterior face.

Color in alcohol, dark brown with a bluish tinge. This may be due to the fact that the specimens are old. Iulidae sometimes turn blue in alcohol. The segments have light spots and are coarsely marbled. Legs and antennae dark brown, especially the distal joints.

Length 15 mm.; width 1.7 mm.

Exact locality not known, but the specimens, a mature male and female, are evidently from California. In the same bottle was a

specimen of *Pæromopus* which is known with certainty to have been taken on the hills back of Sausalito, across the Golden Gate from San Francisco.

NOTES ON EXOTIC CRASPEDOSOMATIDÆ.

As likely to be of interest in connection with a study of the American forms, we add brief notes on the other genera and species, as far as they have been described sufficiently to state the more important characters.

RHISCOSOMA Latzel. 1884.

Myr. Ost. Ung. Mon. Zweite Hälfte, p. 173.

Eyes distinct, ocelli numerous (11).

Antennæ moderately long, rather slender, slightly clavate, fifth joint longest.

Segments above strongly arched, with large, continuous carinæ which are decurved in the direction of the dorsal arch; setigerous tubercles very small.

Distribution: Austro-Hungary.

This very curious genus was described from individuals supposed to be immature, with 23 segments, and measuring 3.5 mm. by .6 mm. The carinæ are so large as to reach down to the ground when the animal is crawling, so that the animal is hollowed out below. The resemblance to a *Polyzonium* is very great.

ATRACTOSOMA Fanzago, 1876.

Annuario d. Soc. d. Naturaliste in Modena X, p. 70.

Eyes distinct, of numerous ocelli (25-29) arranged in triangular or semi-circular patches.

Antennæ very long and slender, third joint longest.

Segments with lateral carinæ large, horizontal, rounded in front, hooked behind; setæ rather long.

Seventh segment nearly normal.

First two pairs of legs small and slender, the next five pairs strongly crassate in the male.

Legs 3-7 of male with a very short claw, the ventral face of the last joint hispid. Coxa of seventh leg with a conic process. Genitalia of male complex, of three pairs of lamellæ.

Ninth legs of male simple, oblong (cf. Verheff).

Tenth and eleventh legs of male with a wart-like process on the coxa, the terminal joint somewhat hispid.

The above characters are drawn from Latzel's description of *A. meridionale* Fanzago, the type species.

Atractosoma carpathicum Latzel.

Seventh segment of male with the ventral margin produced into two long slender teeth.

Genitalia totally different from those of *A. meridionale*, of two pairs of lamellæ.

Ninth legs of male very simple, reduced to a somewhat conic process with an apical bristle.

Atractosoma bohemicum Rosicky.

Anterior male legs with the terminal joint not cushioned or hispid.

Ninth male legs simple, without processes or teeth, their sternum also simple.

The North American Craspedosomatidae, as far as known, show no close resemblances with the species of *Atractosoma*, either in form of body or structure of genitalia and ninth male legs.

CRASPEDOSOMA Leach and Rawlins, 1814.

Trans. Linn. Soc. XI. 2, p. 380.

Eyes well developed, of numerous (23-28) ocelli arranged in triangular patches.

Antennæ very long, slender, third joint longest.

Segments rather depressed, with traces of obtuse carinae, especially in front; tubercles and setæ very small.

Seventh segment ventrally inflated.

First and second male legs small, the last joint fringed on the inner edge.

Legs 3-7 of male scarcely thicker than the normal, the last joint pulvinate.*

Male genitalia of two pairs of processes, the larger simple, broad, the others approximate, very slender.

Ninth legs of male replaced by a pelviform structure with median processes.

Tenth and eleventh male legs with a verruciform process.

Distribution: Many species, reported from nearly all parts of Europe.

The above characters are drawn from Latzel's description and plates of *Cr. rawlinsii*, the type of the genus. Numerous species have been referred to *Craspedosoma*, many of them without proper study of the secondary sexual characters, and without giving them such systematic weight as they seem to us to be entitled.

Among characters of this kind some of the more noteworthy are as follows:—

*Whether these legs differ from those we have called hispid is not clear.

***Craspedosoma oribates* Latzel.**

Genitalia apparently similar in plan to those of *C. ruelinsii*, but the ninth pair of legs consisting of two clavate structures united at base, diverging at apex and beset with bristles. Seventh pair of legs decidedly smaller than the sixth.

***Craspedosoma stygium* Latzel.**

Genitalia, according to Latzel, of four pairs of structures, one clavate (probably ninth legs) and three pairs of smaller structures between.

Seventh pair of male legs wanting, that is, there are but six pairs in front of the genitalia.

Legs 4-6 stump-like, though the author of the species doubts whether this character may not be accidental.

***Craspedosoma moniliforme* Latzel.**

Legs 3-7 not noticeably crassate, the terminal joint rather thick, pulvinate.

Seventh legs reduced, their coxae enlarged, posteriorly with a hirsute process, the pedigerous laminae posteriorly with a sharp cuneiform process.

Ninth legs clavate, more or less evidently jointed, with bristles at the end. Pedigerous lamina medianly produced between the clavate structures and hollowed out in front.

***Craspedosoma mutabile* Latzel.**

Legs 3-7 strongly crassate, more sparsely hairy, shining, the terminal joint compressed, scarcely pulvinate.

Ninth legs in the young five-jointed, attenuate, falcate; in adult modified into a complex structure apically with long compound bristles; basally giving rise to a long flagellum, suggestive as the author says of the flagellum of Iulidae, and apparently indicating a functional difference from other Chordeumidae.

Tenth and eleventh legs with an inwardly projecting hamate process from the distal end of the coxae, also a pear-shaped wart on the base of the coxae.

It is also stated that the females do not have the legs of the second segment developed, a character apparently of great importance. The species has, however, according to Latzel, several varieties and in one of these a female had the usual number of legs. Judging from the American forms it is very remarkable that such a character should not be constant. The difficulty of correctly determining females is very great, especially when the species are incompletely known.

***Craspedosoma flavescens* Latzel.**

Legs 3-7 strongly crassate, distal half of the last joint cushioned.

Ninth legs clavate, hirsute, separated by a pair of small structures basally

broad, apically clavate, with a pointed triangular transparent lamina rising from the base of each.

Tenth legs much reduced; coxae swollen, on the inner side with a clavate process bearing a bristle, also a small wart below the process.

Eleventh legs normal excepting a small wart on the coxa.

It is to the present genus that the European writers have referred a considerable number of American species. To us it appears that the genus as treated in European works is not a natural one, and that the American species are all generically distinct from any of the European, as far as the sexual characters of either are sufficiently known to give basis for an opinion. To judge by the characters of the ninth male legs the European forms are all more diverged from the primitive than any of the American, and the greater complexity of the genitalia in most of them is in accordance with such an idea.

HAASIA. Bollman, 1893 (as subgenus).

Bulletin No. 46, U. S. N. Museum, p. 153.

Eyes entirely absent.

Antennae slightly clavate, slender, much longer than the width of the body, the seventh joint longer than the sixth.

Segments with exterior two pairs of setae approximate, rather large.

Legs very slender and densely hirsute.

The establishment of the subgenus appears somewhat premature, as both species placed under it are incompletely described. *Craspedosoma troglodytes* Latzel, is known only from a female specimen, and no characters of generic value are stated except the above. *Craspedosoma mamillatum* was described from a male specimen but only a rough sketch of the genitalia is given. From this it would appear that like the open air species of *Craspedosoma* the ninth male legs are reduced to a single joint, without a claw. If this is the case, and if *troglodytes* and *mamillatum* are congeneric, *Haasia* will prove valid.

CHORDEUMA C. L. Koch, 1847.

System der Myriap., p. 51, also p. 124.

Eyes well developed, of numerous ocelli (27-28) arranged in triangular patches.

Antennae very long, twice the diameter of the body, slender, third joint longest.

Segments without carinae; setae and tubercles nearly obsolete, somewhat more evident on the posterior end of the body.

Males with 6 ambulatory legs in front of the genitalia and 39 behind.

First two pairs of male legs with the last joint pectinately spined.

Legs 3-6 of male distinctly crassate, the inner side of the last joint tomentose pulvillate.

Seventh legs of males three-jointed, the basal joint large, produced, the others small clavate; an indistinct very small fourth joint (rudimentary claw?).

Genitalia very complex, the anterior large, somewhat hood-like, with an included lamella; the posterior pair slender, apically bifid. There is present a clavate, distally hirsute structure much resembling the ninth legs of some of the species of *Craspedosoma*, but Dr. Latzel does not so interpret it.

The tenth male legs have also been completely modified for copulatory purposes, consisting of slender processes.

In females are but 49 ambulatory legs, and the sternum of the third segment projects cephalad covering the genitalia.

The above characters are from Latzel's description of *Chordeuma sylvestre*, the type of the genus. The description and figures of Verhoeff* differ considerably from those of Latzel, in the shape of the genitalia as well as in that of the seventh and ninth legs.

***Chordeuma rhenanum* Verhoeff.**

Seventh legs reduced to a single squamiform joint.

Tenth legs also of one joint, irregular in shape, with rounded prominences.

***Chordeuma germanicum* Verhoeff.**

Differs greatly in the genitalia, but has the table-like ninth legs of the other species as figured by Verhoeff.

Chordeuma has, perhaps, nearer relatives in America than the other European genera, as already noted under the genus *Caseya*. The rudimentary seventh and tenth legs of the males of *Chordeuma*, as well as other secondary sexual characters, give distinct lines of generic separation.

In addition to the European genera of *Craspedosomatidæ* already noted there have been described three others, *Hyphanturgus* of Waga, *Megalosoma* of Fedrizzi, and *Prinosoma* of Berlese, but these have not been recognized by Latzel and Haase, and stand as synonyms of *Atractosoma* and *Craspedosoma*.

HETEROCHORDEUMA Pocock, 1893.

Ann. Mus. Storia Nat. d. Genova XIII, p. 387.

Eyes of numerous ocelli (11) arranged in four transverse rows.

Antennæ moderately long, third and fifth segments longest.

*Berliner Entom. Zeitschr., xxxvi, p. 132 (1891).

Segments with broad horizontal carinae, like those of Polydesmidae; setigerous tubercles very small, only two pairs observed; surface covered with short hairs.

Genitalia composed of the two pairs of legs, of the seventh segment, completely external.

Segments of adult 32.

Habitat: Karen Hills, Burmah, at 1200-1500 m. altitude.

This anomalous genus presents several unique features, and its family disposition must remain a matter of some doubt until the characters of the legs and mouth-parts are known. No other Craspedosomatidae are known from southern Asia, but the discovery of this form suggests the probable existence of others in the neighboring regions.

INDEX OF GENERA, SPECIES AND SYNONYMS.

	Page		Page
album	64	conifer	54
Atractosoma	88	Conotyla	70
bohemicum	89	atrolineata	75
carpathicum	89	bollmani	76
meridionale	88	fischeri	71
atrolineata	75	glomerata	78
Bactropus	53	leibergeri	77
conifer	54	wyandotte	78
bohemicum	89	copei	55
bollmani	76	cornutum	66
Branneria	33	Craspedosoma	55, 62, 89
carinata	33	atrolineatum	75
caesioannulata	43	bollmani	76
Campodes	41	carinatum	33
flavicornis	43	flavescens	90
fuscicornis	43	flavidum	67
carinata	33	glomeratum	78
carpathicum	89	moniliforme	90
carterensis	40	mutabile	90
Caseya	84	ocellatum	68
heteropus	85	oribates	90
cavernarum	36	packardii	68
Chordeuma	91	rawlinsii	39, 89
germanicum	92	stygium	90
uloides	83	fischeri	71
rhenanum	92	flavescens	90
sylvestre	92	flavidum	67
Cryptotrichus	41	flavicornis	43
caesioannulatus	43	forceps	49
rudii	51	fuscicornis	43
Cleidogona	41	fustis	50
caesioannulata	43	germanicum	92
forceps	49	glomerata	78
fustis	59	Haasia	91
laminata	48	mamillata	91
major	47	troglodytes	91
mexicana	52	Heterochordeuma	92
rudii	51	heteropus	85

	Page		Page
Hyphanturgus	92	<i>lunatus</i>	63
fulvipes	83	<i>wyandotte</i>	78
laminata	48	<i>Spirostrephon</i>	41, 55
leibergeri	77	<i>caesiannulatus</i>	43
lunatum	63	<i>cavernarum</i>	36
major	47	<i>copei</i>	55, 60
mamillatum	91	Striaria	31
Megalosoma	92	<i>stygium</i>	90
meridionale	88	<i>sylvestre</i>	92
mexicana	52	Trichopetalum	62
moniliforme	90	<i>album</i>	64
mutabile	90	<i>bollmani</i>	76
ocellatum	68	<i>cornutum</i>	66
orilates	90	<i>flavidum</i>	67
<i>packardii</i>	69	<i>glomeratum</i>	78
<i>Polydesmus</i>	68	<i>lunatum</i>	63
polygama	80	<i>ocellatum</i>	68
Prionosoma	92	<i>uncum</i>	66
Pseudotremia	34, 41, 55	trogodytes	91
<i>caesiannulata</i>	43	<i>uncum</i>	66
<i>carterensis</i>	40	Underwoodia	79
<i>cavernarum</i>	36	<i>fulvipes</i>	83
<i>rudii</i>	43, 51	<i>polygama</i>	80
rawlinsoni	39	<i>vudii</i>	51
Rhiscosoma	88	<i>whitei</i>	60
Scoterpes	55	<i>wyandotte</i>	78
<i>bollmani</i>	76	Zygonopus	59
<i>copei</i>	55	<i>whitei</i>	60

EXPLANATION OF THE PLATES.

PLATE I.

Branneria carinata.Fig. 1.—Antenna, three distal joints, $\times 56$.*Pseudotremia cavernarum*.

Fig. 2.—Genitalia of male, anterior view.

Fig. 3.—Same, lateral view.

Fig. 4.—Gnathochilarium. U. S. N. M. No. 420.

Fig. 5.—Antenna, $\times 24$ .Fig. 6.—Ninth legs of male with lamella, $\times 24$. U. S. N. M. No. 420.Fig. 7.—Eleventh legs of male, $\times 24$. U. S. N. M. No. 436.*Pseudotremia carterensis*.

Fig. 8.—Ninth legs of male, posterior view.

Fig. 9.—Lamella embraced between the ninth legs of male, $\times 35$ .Fig. 10.—Genitalia of male, $\times 50$.*Pseudotremia cavernarum*.

Fig. 11.—Body, dorsal view.

Scoterpes copel.

Fig. 12.—Genitalia of male, after Packard.

Fig. 13.—Same, less magnified; also ninth legs, after Packard.

Zygonopus whitel.

Fig. 14.—Antenna, $\times 27$.

Fig. 15.—First leg of male, $\times 50$.

Fig. 16.—Second leg of male, $\times 50$.

PLATE II.

Zygonopus whitel.

Fig. 17.—Fourth legs of male, $\times 50$.

Fig. 18.—Sixth legs of male, $\times 50$.

Fig. 19.—Twelfth leg of male, $\times 50$.

Fig. 20.—Genitalia of male, anterior face.

Fig. 21.—Same, posterior face, also ninth legs.

Trichopetalum album.

Fig. 22.—Antennæ of male, $\times 105$.

Fig. 23.—First leg of male, $\times 105$.

Fig. 23a.—Second leg of male, $\times 105$.

Fig. 24.—Third leg of male, $\times 105$.

Fig. 25.—Fourth leg of male, $\times 105$.

Fig. 26.—Fifth leg of male, $\times 105$.

Fig. 27.—Seventh leg of male, $\times 105$.

Fig. 28.—Tenth leg of male, $\times 105$.

Fig. 29.—Normal leg of male, $\times 105$.

PLATE III.

Trichopetalum ocellatum.

Fig. 30.—Head and three segments, after Packard.

Fig. 31.—Antenna, after Packard.

Fig. 32.—Eye, after Packard.

Fig. 33.—Segments, lateral view, after Packard.

Fig. 34.—Segments, dorsal view, after Packard.

Fig. 35.—Last six segments, lateral view, after Packard.

Trichopetalum album.

Figs. 36 ($\times 312$), 37 ($\times 250$), 38, 39, 40 ($\times 312$), 41.—Apices of male genitalia, different views, from different specimens.

Fig. 42.—Male genitalia, anterior face, $\times 187$.

Fig. 43.—Same, posterior view, also ninth legs.

Fig. 44.—Distal portion of gnathochilarium $\times 160$.

Fig. 45.—Eye.

Trichopetalum cornutum.

Figs. 46, 47 ($\times 294$), 48 ($\times 333$).—Apices of male genitalia, different specimens and views.

Fig. 49.—Male genitalium, lateral view.

Trichopetalum flavidum.

Fig. 50.—Eye.

Trichopetalum unicum. Fig. 51.—Genitalia of male, anterior face, $\times 169$.**Trichopetalum lunatum.**

Fig. 52.—Antenna, after Harger.

Fig. 53.—Eye, after Harger.

Fig. 54.—Male genitalia, after Harger.

PLATE IV.

Conotyla fischeri.

Fig. 55.—Head and first three segments, dorsal aspect.

Fig. 56.—Same, lateral aspect.

Fig. 57.—Last four segments, lateral aspect.

Fig. 58.—Labrum.

Fig. 59.—Distal portion of half of gnathochilarium.

Fig. 60.—Last four segments, ventral view.

Fig. 61.—Two distal joints of antenna, $\times 50$.

Fig. 62.—Distal portion of half of gnathochilarium, dorsal face.

Fig. 63.—Gnathochilarium.

Fig. 64.—Antenna, $\times 25$ .Fig. 65.—First leg of male, $\times 25$ .Fig. 66.—Second leg of male, $\times 25$ .Fig. 67.—Third leg of male, $\times 25$ .Fig. 68.—Fourth leg of male, posterior view, $\times 25$ .Fig. 69.—Fifth leg of male, posterior view, $\times 25$ .Fig. 70.—Seventh leg of male, anterior view, $\times 25$.

Fig. 71.—Process of the fourth joint of the seventh leg, more magnified.

Fig. 72.—Male genitalia, anterior view.

Fig. 73.—Ventral portion of segments 5–8, male genitalia, and basal joints of legs, lateral view.

Fig. 74.—Male genitalia, lateral view.

Fig. 75.—Anterior pair of male genitalia, anterior view.

PLATE V.

Conotyla fischeri. Fig. 76.—Tenth pair of legs of male, $\times 25$ .Fig. 77.—Eleventh pair of legs of male, $\times 25$ .Fig. 78.—Twelfth pair of legs of male, $\times 37$.**Conotyla bollmani.**

Fig. 79.—Male genitalia, anterior view, U. S. N. M. No. 419.

Fig. 80.—Same, lateral view.

Fig. 81.—Right eye.

Fig. 82.—Left eye.

Fig. 83.—Antenna, $\times 25$.

- Fig. 84.—Head and first eight segments.
Fig. 85.—Last six segments.
Fig. 86.—First leg of male, $\times 45$. U. S. N. M. No. 443.
Fig. 87.—Second leg of male, $\times 28$.
Fig. 88.—Third leg of male, posterior view.
Fig. 89.—Fourth leg of male, posterior view, $\times 25$.
Fig. 90.—Seventh leg of male, anterior view.
Fig. 91.—Tenth leg of male, posterior view, $\times 25$.
Fig. 92.—Eleventh leg of male, posterior view, $\times 25$.
Fig. 93.—Normal leg of male, anterior view.
Fig. 94.—Longitudinal section of spine, drawn from *C. fischeri*.

PLATE VI.

***Conotyla atrolineata*.**

- Fig. 95.—Antenna, $\times 57$.
Fig. 96.—Male genitalium of posterior pair, $\times 127$.
Fig. 97.—Male genitalium of anterior pair, $\times 127$.
Fig. 98.—Ninth leg of male, $\times 16$.
Fig. 99.—Eye, drawn from Winona specimen.
Fig. 100.—Eye, drawn from Glacier, B. C., specimen.

***Conotyla wyandotte*.**

- Fig. 101.—Eye. The photo-engravers omitted the number on the plate. The figure is above 100, at the right-hand margin of the plate.

***Conotyla leibergeri*.**

- Fig. 102.—Antenna.
Fig. 103.—Gnathochilarium.
Fig. 104.—Eye.

***Conotyla glomerata*.**

- Fig. 104a.—Antenna and eye, after Harger.

***Cleidogona mexicana*.**

Figures copied from Saussure and Humbert.

- Fig. 105.—Gnathochilarium.
Fig. 106.—Segment, ventral view.
Fig. 107.—Antenna.
Fig. 108.—Posterior part of body, lateral view.
Fig. 109.—Same, dorsal view.

***Cleidogona major*.**

- Fig. 110.—First pair of legs of male, $\times 16$.
Fig. 111.—Second pair of legs of male, $\times 16$.
Fig. 112.—Third pair of legs of male, $\times 16$.
Fig. 113.—Fourth pair of legs of male, $\times 16$.
Fig. 114.—Fifth pair of legs of male, $\times 16$.
Fig. 115.—Sixth pair of legs of male, $\times 16$.

Fig. 116.—Seventh pair of legs of male, $\times 16$.

Fig. 117.—Ninth pair of legs of male, $\times 16$.

Fig. 118.—Tenth pair of legs of male, $\times 16$.

PLATE VII.

Cleldogona major concluded.

Fig. 119.—Eleventh pair of legs of male, $\times 16$.

Fig. 120.—Twelfth pair of legs of male, $\times 16$.

Fig. 121.—Thirteenth pair of legs of male, $\times 16$.

Fig. 122.—Twentieth pair of legs of male, $\times 16$.

Fig. 123.—Fiftieth (last) pair of legs of male, $\times 16$.

Fig. 124.—Apical joints of second leg, $\times 143$.

Fig. 125.—Antenna, $\times 31$.

Fig. 126.—Apex of sixth joint of second leg, $\times 160$.

Fig. 127.—Ninth leg of male.

Fig. 128.—Male genitalia lateral view, $\times 46$.

Fig. 129.—Apices of same, apical view, $\times 46$.

Fig. 130.—Male genitalia, posterior view $\times 46$.

Fig. 131.—Legs 7-12, drawn *in situ*.

Fig. 132.—Gnathochilarium.

Fig. 133.—Head, lateral view.

Fig. 134.—Head and six segments, dorsal view.

Fig. 135.—Last five segments, lateral view.

Fig. 136.—Same, dorsal view.

Fig. 137.—Pre-anal scale.

PLATE VIII.

Cleldogona cæcioannulata.

Fig. 138.—Genitalia of male, lateral view.

Fig. 139.—Same, dorsal (anterior view).

Fig. 140.—Ninth leg of male.

Fig. 141.—Eleventh leg of male.

Fig. 142.—Twelfth leg of male.

Fig. 143.—Antenna.

The above six figures were drawn from specimens collected near the Catholic University, Washington, D. C.

Fig. 144.—Last joint of ninth male leg.

Fig. 145.—Ninth legs, $\times 25$.

Fig. 146.—Anterior aspect of genitalia.

Fig. 147.—Lateral view of genitalia.

Fig. 148.—Posterior view of genitalia.

Figures 144-148 were drawn from National Museum material, with no record of locality.

Fig. 149.—Ninth leg.

Fig. 150.—Genitalia; this and the preceding figure after McNeill. His material was collected in Monroe County, Indiana.

Cleidogona fustia.

- Fig. 151.—Male genitalia, anterior view.
Fig. 152.—Same, lateral view.
Fig. 153.—Same, drawn from another specimen and at a different angle.
Fig. 154.—First leg of male.
Fig. 155.—Second leg of male.
Fig. 156.—Seventh leg of male.
Fig. 157.—Tenth leg of male.
Fig. 158.—Eleventh leg of male.

PLATE IX.

Cleidogona forceps.

- Fig. 159.—Male genitalia, lateral view.
Fig. 160.—Same, anterior view.
Fig. 161.—Same, posterior view.
Fig. 162.—Ninth leg of male, $\times 30$.
Fig. 163.—Apical portion of same, $\times 105$.

Cleidogona laminata.

- Fig. 164.—Genitalia and legs 9–12, drawn *in situ*.
Fig. 165.—Male genitalia, anterior view.
Fig. 166.—Same, posterior view.
Fig. 167.—Ninth leg of male, posterior view.
Fig. 168.—Same, anterior view.
Fig. 169.—Antenna, $\times 31$.
Fig. 170.—Tenth legs of male.
Fig. 171.—Eleventh legs of male.

Bactropus conifer.

- Fig. 172.—Antenna.
Fig. 173.—Gnathochilarium, $\times 105$.
Fig. 174.—Genitalia of male, anterior view, with ninth legs.
Fig. 175.—Apical joints of ninth leg of male.
Fig. 176.—Last two segments, lateral view.

PLATE X.

Underwoodia fulvipes.

- Fig. 177.—Eye and part of antennal socket.
Fig. 178.—Antenna, $\times 80$.
Fig. 179.—Second pair of legs of female.

Underwoodia polygama.

- Fig. 180.—First legs of male, $\times 50$.
Fig. 181.—Second legs of male, posterior view, $\times 50$.
Fig. 182.—Third legs of male, posterior view, $\times 50$.
Fig. 183.—Fourth legs of male, $\times 50$.
Fig. 184.—Fifth legs of male, $\times 50$.

- Fig. 185.—Eleventh legs of male, $\times 45$.
 Fig. 186.—Male genitalia and ninth leg, posterior view.
 Fig. 187.—Same, anterior view.
 Fig. 188.—Gnathochilarium.
 Fig. 189.—Antenna, $\times 57$.
 Fig. 190.—Distal joints of antenna.

PLATE XI.

Caseya heteropus.

- Fig. 191.—Head and first six segments, lateral view, $\times 10$.
 Fig. 192.—Head, anterior view, $\times 25$.
 Fig. 193.—Eye, antennal socket, margin of cephalic plate and post-antennal organ, the last indicated by the small ring immediately below the ocelli.
 Fig. 194.—Labrum.
 Fig. 195.—Gnathochilarium.
 Fig. 196.—Lingual lobe, lingual lamina with conic sense organs, and tridentate styliform process, $\times 105$.
 Fig. 197.—Antenna, $\times 25$.
 Fig. 198.—First leg of male; the specimen was injured, $\times 25$.
 Fig. 199.—Second legs of male, posterior view, $\times 25$.
 Fig. 200.—Proximal portion of same, anterior view, $\times 105$.
 Fig. 201.—Third legs of male, posterior view, $\times 25$.
 Fig. 202.—Proximal portions of same, anterior view, $\times 25$.
 Fig. 203.—Same, $\times 105$.
 Fig. 204.—Fourth legs of male, posterior view, $\times 25$.
 Fig. 205.—Fifth legs of male, anterior view, $\times 25$.
 Fig. 206.—Sixth legs of male, anterior view, $\times 25$.
 Fig. 207.—Seventh legs of male, anterior view, $\times 25$.
 Fig. 208.—Proximal joints of same, posterior view, $\times 25$.

PLATE XII.

Caseya heteropus.

- Fig. 209.—Portion of basal joint of seventh leg of male, anterior view, $\times 105$.
 Fig. 210.—Basal joints of tenth leg of male, anterior view.
 Fig. 211.—Same legs, posterior view, $\times 25$.
 Fig. 212.—Eleventh leg of male, anterior view.
 Fig. 213.—Twelfth leg of male, posterior view.
 Fig. 214.—Normal leg of male, anterior, $\times 31$.
 Fig. 215.—Male genitalia and ninth legs, ventral (anterior) view, drawn *in situ*.
 Fig. 216.—Ventral portion of segments 5-8, legs 7-10, and male genitalia, lateral view, drawn *in situ*, $\times 25$.
 Fig. 217.—Male genitalium, median view. The small unshaded part near the middle is open to the other side.
 Fig. 218.—Ninth legs of male, anterior view, $\times 40$.
 Fig. 219.—Ninth legs of male, posterior view, $\times 40$.