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CRESTED MILLIPEDS OF THE FAMILY LYSIOPETALIDAE IN NORTH AMERICA, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

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WITH AN INTRODUCTORY ACCOUNT OF DISTRIBUTION AND SPECIALIZED CHARACTERS
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STUDIES of humus faunas in different regions of the United States afford many data of geographic distribution in the several groups of arthropods that live in the soil. Most of the millipeds are definitely restricted to the humus conditions, and they afford some of the most striking contrasts in geographic distribution. The creatures that do not survive drying necessarily are confined to places where moisture is held through the dry season, and such limitations greatly restrict the distribution of species. The humus conditions prevail more widely and continuously in the rainfall regions of the Southeastern States, and in that region the species of millipeds have a relatively wide distribution, while in the arid climate of the Southwestern States localized species are the rule.

Very little of the southwestern country has continuous moisture in the soil, and favorable conditions for humus faunas usually are restricted to the higher altitudes. Wide stretches of open deserts intervene where no surface humus is found and only a few kinds of millipeds are able to exist by retreating to the burrows of the desert mammals. For most of the millipeds the deserts are impassable barriers that separate completely the more elevated districts where the animals can live. From the standpoint of the milli-

ped, the various groups of mountains that are scattered through the southwestern deserts afford phenomena of insular restriction, like groups of islands separated by the sea.

In the family Lysiopetalidae a notable contrast is presented in the distribution of the species, between the Southeastern and Southwestern States. In the humid region to the east of the Mississippi River the family is represented by a single species, commonly known as *Lysiopetalum lactarium*, though now referred to the genus *Spirostrephon*. In the arid Southwestern States the same family group is represented by numerous local species, and among them are found remarkable structural differences that require generic recognition. Though collections have been made in widely separated districts, the results presented in this paper no doubt will prove to be only a beginning in the work of discriminating the local forms of this specialized group in the Southwest.

The Lysiopetalidae are among the more hardy and active members of the milliped group, often living among rocks in rather dry, exposed places, but in situations where it is possible to take refuge underground in the dry seasons. When the animals are disturbed their movements are rather quick, and if touched or injured they emit a defensive "repugnatorial" secretion as a whitish fluid forming a line of small beadlike drops along each side of the body. This milky secretion has a very strong and disagreeable odor, entirely different from that of the repugnatorial fluids in other groups of millipeds.

GENERAL CHARACTERS OF THE FAMILY

The Lysiopetalidae are associated with two groups of millipeds in the order Coelocheta, which is characterized by numerous body segments, 30 and upward; normally developed mouth parts; slender flexible antennae; well-developed eyes, except in subterranean or cave species; gnathochilarium with large stipes and a triangular mentum behind well-developed lingual laminae; a distinct median suture on all the body segments; absence of pleural sutures or distinct pleurae; free pedigerous laminae; last segment terminated by a pair of slender papilliform setigerous spinnerets; legs long and slender, the first two pairs 6-jointed, the others 7-jointed, in a few cases 8-jointed; segment 3 legless; genital openings of males in large apertures of the basal joint of the second pair of legs; copulatory organs replacing both pairs of legs of the seventh segment, preceded by seven pairs of normal legs, or with some of the anterior legs modified as accessory organs.

Three suborders of Coelocheta are recognized, the Chordeumoidea, the Striaroidea, and the Lysiopetaloidea, the last containing a single

family distinguished by a much longer and slenderer body, with more numerous segments. The other suborders have 30 segments as the normal number, with rare exceptions 26, 28, or 32 segments, while all the Lysiopetaloidea have 40 segments and upward. Another radical distinction is the presence of repugnatorial glands, which are highly developed in the Lysiopetaloidea but are wanting in the other suborders. The external openings for the ejection of the repugnatorial secretion are located on prominent lateral carinae and form a continuous series beginning at segment 6. Sculpturing of the segments into prominent longitudinal crests also characterizes the Lysiopetaloidea, especially the American members of the group. A regular alternation of larger and smaller crests is found in most of the American genera. In some of the Old World genera the crests are less accentuated.

SPECIALIZATIONS OF DORSAL CRESTS

In this family the numbers and arrangements of the dorsal crests are remarkably definite and constant. Generic specializations are shown by differences in relative sizes of the crests rather than in number or arrangement. The most primitive or least specialized crests may be seen in the genus *Spirostrephon*, which is distributed eastward from Texas and Arkansas and has all the crests nearly equal. All the genera from the Western States have larger and smaller crests in regular alternation, so that it is easy to distinguish at once the primary and secondary crests and to observe their differences of size and arrangement. Such comparisons are facilitated by noting the fact that in all the members of this family the median line of the segments is marked by a fine longitudinal sulcus. On each side of the median line is a small or secondary crest, then large and small crests are repeated. The lateral crest or carina that bears the repugnatorial pore is obviously different from the others. The anterior segments have four primary dorsal crests, the other segments six.

The complete and typical number of the dorsal crests, between the pore-bearing carinae, is 14. On each side of the median line are three primary dorsal crests, alternating with four secondary crests, or seven crests on each side. The full number of crests is found on the segments at the middle of the body, and the number on these segments is the same for all the members of the group. Smaller numbers of dorsal crests are found on some of the anterior segments, but a transition occurs to the full number of crests, which then remains constant. Occasional irregularities, as suppression or doubling of one or two crests of individual segments, are sometimes found, but the pattern generally is maintained with remarkable pre-

cision. The same may be said of the numbers and positions of the crests on the segments that precede those with the full number. One of the primary crests and one of the secondary crests are omitted on each side of the middle, leaving only 10 dorsal crests, instead of 14, which occasions the abrupt transition.

Not only the numbers of crests are constant, but the transition to the full number of crests takes place regularly on the same segment in each species. That the point of transition should be constant in the species would hardly be expected in view of the fact that the transition occurs in a rather wide range of positions in the different members of the family. The precision in this character seems very remarkable, since no variations have been found in the material examined. The reduced numbers of crests on the anterior segments may be considered as a specialized feature, in view of the fact that the transition occurs in different segments in several of the species. Eight different points or positions where such transitions occur have been found among the species now recognized in North America, on segments 8, 9, 11, 12, 16, 17, 18, and 19. That no specimens have been found with transitions at segments 10, 13, 14, and 15 is a further indication of definite specialization. Moreover, the species of the same genus, though not changing the number of crests at the same point, are very closely grouped, within a range of only one point in each case, as 8 and 9, 11 and 12, 16 and 17, 18 and 19. The species that carries the reduced number of crests farthest back, that is, including segment 18, has the body slenderer than the others and also has narrower and less prominent crests.

Shortening of the secondary crests, in addition to the reduction in size, may be considered as a further stage of specialization. In two of the western genera, *Diactis* and *Tynomma*, the secondary crests are like those of *Spirostrephon* in being as long as the primary crests and attaining the posterior margins of the segments, while in the two other genera, *Colactis* and *Heptium*, the secondary crests do not reach the margins of the segments, and may be only half as long as the primary crests. On the anterior segments of *Colactis* and *Heptium* the tendency to reduction of the secondary crests is carried still further. On the first four segments the secondary crests have become obsolete, or are represented by very short rudiments, while on the first segment they are entirely absent. Thus in *Colactis* and *Heptium* the first segment has only 10 crests, contrasting with 16 or 18 crests in *Tynomma* and *Diactis*. The retention of the larger numbers of crests on the anterior segments is another indication of the affinities of *Tynomma* and *Diactis* with *Spirostrephon*, rather than with the other western genera.

The shortening of the secondary crests in *Colactis* and *Heptium* is occasioned or accompanied by an excavation of the surface of the

segments along the posterior margin, between the primary crests. In some of the species the surface is lowered very abruptly at the ends of the shortened secondary crests, forming a row of small depressed scallops or recesses along the posterior margin of the segment. In one of the species of *Heptium* the stepping-down of the surface of the segment is very abrupt, and the depressions appear to be bordered in front by a narrow rim, as if the secondary carinae had divided to form the excavated areas. A similarity may be noted between such bordered areas and the ring of channeled or fluted sculpturing of the surface around the posterior half of the anterior subsegments, which suggests that the theory of metaphanic variation may apply.

LATERAL CRESTS

Lateral crests also are found in all the genera of Lysiopetalidae, below the crests or carinae that bear the repugnatorial pores. In all the American genera two of the lateral crests are much more prominent than the others and larger than the dorsal crests. In the genus *Spirostrephon* two of the lateral crests are especially large and as prominent as the poriferous crest, so that a lateral view of these animals gives the impression of three conspicuous lateral crests of nearly equal size. In some of the western forms the lateral crests are less developed, but detailed comparisons have not been made.

POSITIONS OF DORSAL BRISTLES

The regular sculpturing of the segments is supplemented by a series of bristles located in definite patterns and in specialized relations with the crests. All the primary crests, both dorsal and lateral, as well as the pore-bearing carinae, are subtended by bristles, one bristle associated with each crest. Except on a few of the anterior segments, all the bristles are inserted along the posterior margins of the segments, not directly at the ends of the crests but slightly out of line with the crest, on the side toward the middle of the body. No deviation from this posterior position of the bristles is found in any of the pore-bearing segments, including segment 6, where the pores begin.

A different arrangement of the bristles appears on segment 5 (fig. 18, *k*), where only six bristles are found along the posterior margin of the segment, three on each side of the median line, at the second, third, and fifth crests. As if to replace the missing bristles of the first and fourth crests, two other bristles are found at the front of these crests, and on the opposite side of the crests, away from the middle of the segment. On segment 4, all the bristles have the anterior position, like the two bristles that stand in front on each side of segment 5, and this arrangement obtains also on segments 3 and 2.

The first four segments have no bristles along the posterior margin, but only at the front of the crests. On the first segment the bristles no longer appear in a regular transverse line, but the 10 bristles are still found as a constant number.

The two positions of the bristles suggest that the ancestral forms of the Lysiopetalidae may have had two or more rows of bristles across the segments, as do some of the other groups of millipeds. The alternative view would be that the bristles belong to a single primitive row, which has changed to these different positions on the segments. The bristles possibly are older than the crests in the phylogeny of the group, so that on the anterior segments crests may have developed behind the bristles but in front of the bristles on posterior segments. The crests may have arisen from the tubercles that bore the bristles in the primitive forms. Although the bristles are now separate from the crests, they seem to be associated definitely with them.

Under the assumption of two primitive rows of bristles it would need to be inferred that the posterior row has been suppressed on the anterior segments, while the anterior bristles have been suppressed on the posterior segments. The different positions of the bristles on segment 5 would seem at first to support the assumption of two original rows, but less confidence is felt in this explanation when account is taken of the strict limitation in the number of bristles and the remarkable precision of arrangement shown at the point of transition from anterior to posterior bristles, on segment 5. If the bristles of this segment are supposed to represent two primitive rows, it is difficult to understand why neither of the rows should ever be complete, or why some of the crests, at least, should not have two bristles. So great an accuracy in the suppression of particular bristles of two original series is as difficult to credit as that the contrasted positional relationships on the different segments have developed in one row of bristles.

With either view of the development of the bristles a scarcely imaginable accuracy of adjustment of the hereditary controls of the characters has to be admitted to account for the constant number and the exact positional relations of the bristles on segment 5, to say nothing of the other segments. That the transition point should be so definitely fixed upon a single segment is sufficiently wonderful, but that it should be held at so definite a point that four of the crests of segment 5 have their bristles in front, while the other six crests have their bristles behind, is a wonder of accurate adjustment of heredity that leaves all our adjectives inadequate.

On account of the repetition of the same features in so many segments, the millipeds afford unusual opportunities for observing the precision of adjustment of the characters, as in the study of heredity in twins or in pure lines, which are supposed not to vary. With many segments the same, even slight changes of the characters are noticeable and significant, as are small deviations when using an instrument that carries a vernier.

SPECIALIZED CHARACTERS OF THE LEGS

The anterior legs of both sexes of Lysiopetalidae, in all the species examined, have a comblike row of bristles along the inferior face of the terminal joint. These combs are regularly present on the first and second pairs of legs, and in some cases they are found on the third pair. Extension of the combs to the third pair of legs has been noted in the females of *Spirostrephon* and in males of *Colactis* and *Heptium*.

The males of most of the species have the terminal joints of some legs provided with fleshy, pubescent pads on the under side. The number of legs so provided is not the same in the different species, and a few species lack this feature. The pads are absent in two species of *Colactis* and in the genus *Heptium*.

In all cases where the pads are found they begin on the legs immediately following those provided with combs, and all the remaining legs in front of the gonopods have pads, and at least a few of those behind the gonopods. In one species, *Diactis soleata*, the pads extend far back, within 10 or 12 legs of the end of the body. In a related species, *D. triangula*, the pads do not reach the middle segments.

Males of the genus *Diactis* have a process on the basal joint of the anterior pair of legs of many segments near the middle of the body, a feature not present in the other genera.

The seventh pair of legs of the male is specially reduced and modified in the genus *Heptium*, leaving only six pairs of normal legs in front of the gonopods. The basal joint of the seventh leg is produced into a long erect spine, standing in front of the gonopod and nearly its equal in length. The outer joints of the modified leg are very small, especially beyond the third joint, but the number of joints apparently is the same as in the normal legs. In one individual of *Heptium* a marked difference between the legs of the seventh pair was observed, one of the legs being but slightly reduced and having the spine of the basal joint replaced by a setiferous papilla. It may be inferred from this variation that the specialization of the seventh legs is relatively recent. Also it is possible to consider the development of a spine on these legs as a carry-over from the gonopods.

7-JOINTED AND 8-JOINTED LEGS

In *Spirostrephon*, *Diactis*, and *Tynomma* all the legs are 7-jointed, being composed of a basal or coxal joint, a very short second joint, a third joint longer than any of the three succeeding joints, which are subequal, and a seventh or outer joint distinctly longest of all. In *Colactis* and *Heptium* some of the anterior legs are 7-jointed, but all the remaining legs have an eighth joint, which is formed by a division of what corresponds to joint 7 of the first few legs. In these two genera the transition to 8-jointed legs is not always distinct, since in some females it obviously occurs on the third pair of legs, while in other females the eighth joint is not observed with certainty until somewhat farther back. In the males the first three pairs of legs are plainly 7-jointed, and in the species with the next four pairs of legs lacking ventral pads on the last joint the legs usually are seen to be 8-jointed. In males of the species with ventral pads on the last joint of some of the anterior legs, the transition to eight joints appears to take place gradually and somewhat farther back, so that only the last few pairs of pad-bearing legs and the legs thereafter may show unmistakably the eighth joint.

SYSTEMATIC TREATMENT

KEY TO THE NORTH AMERICAN GENERA OF LYSIOPETALIDAE

1. Segment 1 with 20 crests; anterior segments with secondary crests scarcely smaller than primary crests..... **Spirostrephon**
 Segment 1 with less than 20 crests; secondary crests distinctly smaller than primary crests on all segments..... 2
2. Transition to full number of dorsal crests occurring on segment 8 or 9; segments 2, 3, and 4 with crests distinctly oblique and divergent, inner primary crests close to median line in front, widely separated at posterior margin; males with a small acute process projecting forward from basal joint of anterior pair of legs on numerous segments near middle of body..... **Diactis**
 Transition to full number of dorsal crests occurring on segment 11 or later; segments 2, 3, and 4 with crests nearly parallel, or median crests slightly diverging backward; males without special processes on any of legs near middle of body..... 3
3. Transition occurring on segment 11 or 12; segment 1 with 16 to 18 crests; secondary crests as long as primary crests, reaching posterior margin of segments and remaining distinct on anterior segments..... **Tynomma**
 Transition occurring on segment 16 or beyond; segment 1 with 10 crests; secondary crests notably shorter than primary crests, not reaching posterior margin of segments, usually obsolete on segments 2, 3, and 4..... 4
4. Transition occurring on segment 16 or 17; males with seventh pair of legs of normal size and structure..... **Colactis**
 Transition occurring on segment 18 or 19; males with seventh pair of legs greatly reduced in size and with a long erect spine on coxa..... **Heptium**

The first member of the Lysiopetalidae discovered in North America was described by Say in 1821 under the name *Julus lactarius*. Brandt, in 1840, recognized the generic distinctness of this species from the European members of the family and placed it in a new genus, *Spirostrephon*. Many subsequent writers have treated this genus as a synonym of *Lysiopetalum* or of *Callipus*, although the error of so doing was pointed out in 1895.¹

Until quite recent years no additions have been made to the family in this country since the description of *lactarium* in 1821, although in 1880 Karsch described two species of *Lysiopetalum*, supposed to have come from North America, but they probably came from some part of the Old World instead. In comparison with *lactarium*, these species were described as cylindrical, instead of depressed, with the lateral crests not stronger than the dorsal ones. In all the American species the pore-bearing carinae and two other large crests on each side of the body are more prominent than the dorsal crests. In Karsch's *Lysiopetalum setigerum* the segments are said to be clothed ("vestitis") with hairs, while in *L. costatum* the dorsal carinae are not interrupted along the front of the first segment, except that a small median area is nearly smooth.

In the present study of this family the published generic and specific descriptions of *Spirostrephon lactarium* were found to be too inadequate in details for satisfactory comparisons to be made with other North American members of the family, so that it appears necessary to include supplementary descriptions.

Genus SPIROSTREPHON Brandt

Body small, slender, subcylindric, slightly depressed, 25 to 40 mm long, 15 to 17 times longer than broad. Males less flattened than the females and slightly more attenuate in front.

Eyes forming a triangular cluster of 50 to 60 ocelli in 10 or 11 rows, counting from the top of the head; the adjacent sense organ about as large as an ocellus.

Antennae with joint 2 longer than any other, though not much exceeding joints 3 and 5, which are equal in length, and joint 4, which is nearly as long; joint 6 about two-thirds as long as joint 5 and about three times as long as joint 7.

First segment semicircular, with 20 longitudinal crests of uniform height along the posterior margin of the segment; the median crests about two-thirds as long as the segment, the submedian crests shorter than the middle or lateral crests; across the segment there are 10 setae arranged in a subtriarcuate series extending forward and in-

¹ Cook, O. F., Amer. Nat., vol. 29, pp. 1017-1019, 1895.

ward from near the hind angle on each side; counting inward the fourth seta on each side is set slightly behind seta 3 or 5.

Transition to the full number of dorsal crests occurs on segment 12.

Primary and secondary crests extending from the front margin of the posterior subsegments to the hind margin, the crests on the anterior segments subequal in size, but on the middle and posterior segments the crests are distinctly differentiated; surface between and on the sides of the crests with strong raised reticulations, the top of the crests of uniform height and moderately shining; the setae at the ends of the primary crests are short, those on the posterior segments not over a third as long as the crests.

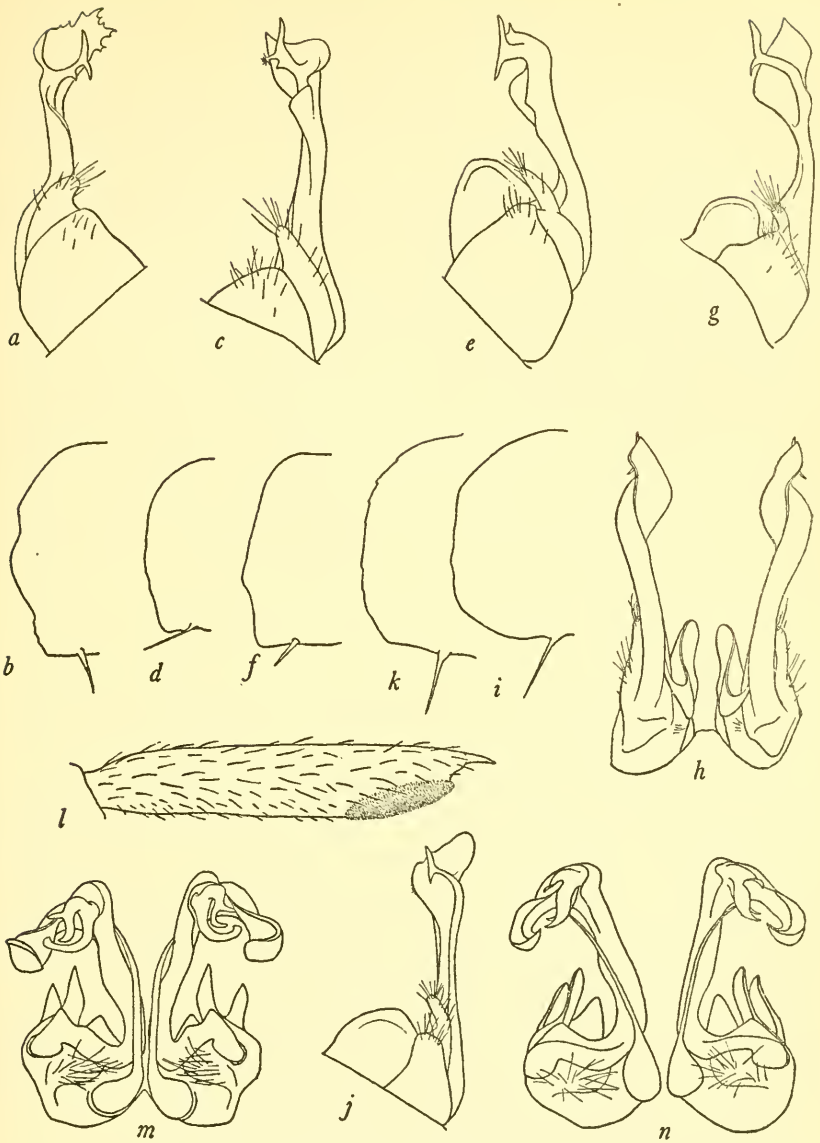
Poriferous carinae hardly more prominent than the dorsal crests; on the posterior segments the impressed poriferous area occupies only the front half of the lateral margin, but on the other segments almost the entire margin is included and the impression is elongate-elliptic in shape.

Last segment rather short, broadly truncate at apex, when viewed from above; surface without ridges but with six tuberculate setae in a biarcuate row close to the hind margin, from the thickened apical portion of which the two long papillate hairs project.

Anal valves slightly convex, the margins thin and strongly elevated.

Males with the gonopods erect, the apex of each bent sharply laterad to form a long, nearly horizontal, and subuncinate arm; from the posterior side, near the apex of the gonopod, a trifurcate process extends caudolaterad. Located behind the base of each gonopod is an oblique oval structure with the inner or upper end developed into a long and very slender cylindrical process reaching the lateral arm of the gonopod. Base of the gonopods outwardly protected by several thin, erect, shieldlike plates.

Males with a comb of fine hairs on the under side of the last joint of legs 1 and 2. Other legs in front of the gonopods, and some succeeding legs, with a velutinous pad on the lower distal half of the last joint. Females with a comb of hairs on legs 1 and 2, as in the males, and sometimes a comb on leg 3 also, but there are no velutinous pads on the succeeding legs. Coxae of all legs of both sexes normal, lacking produced lobes, although baglike structures may at times be extruded from the coxae of some anterior legs.

FIGURE 16.—Species of *Colactis* and *Spirostrephon*.

- a, b. Colactis saxetana*: *a*, Lateral view of gonopod; *b*, outline of poriferous carina from near middle of body.
c, d. C. baboquivari: *c*, Lateral view of gonopod; *d*, outline of poriferous carina from near middle of body.
e, f. C. quadrata: *e*, Lateral view of gonopod; *f*, outline of poriferous carina from near middle of body.
g-i. C. protenta: *g*, Lateral view of gonopod; *h*, posterior view of gonopods; *i*, outline of poriferous carina from near middle of body.
j, k. C. sideralis: *j*, Lateral view of gonopod; *k*, outline of poriferous carina from near middle of body.
l, m. Spirostrephon lactarium: *l*, Last joint of sixth leg of male; *m*, posterior view of gonopods.
n. S. texensis: Posterior view of gonopods.

SPIROSTREPHON LACTARIUM (Say)

FIGURE 16, *l, m*

- Julus lactarius* SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 2, p. 104, 1821.
Spirostrephon lactarium BRANDT, Recueil de mémoires relatif à l'ordre des insectes myriapodes, p. 90, 1840.
Platops lineata NEWPORT, Ann. Mag. Nat. Hist., vol. 13, p. 267, 1844.
Lysiopetalum lineata GERVAIS, Myriapodes; in Walckenaer and Gervais, Histoire naturelle des insectes, Aptères, vol. 4, p. 133, 1847.
Cambala lactarius GERVAIS, *ibid.*, p. 134.
Reasia spinosa SAGER, Proc. Acad. Nat. Sci. Philadelphia, vol. 8, p. 109, 1856.
Lysiopetalum lactarium PACKARD, Proc. Amer. Philos. Soc., vol. 21, p. 183, 1883; and others.
Lysiopetalum eudasum McNEILL, Proc. U. S. Nat. Mus., vol. 10, p. 330, 1887.
Callipus lactarius BOLLMAN, Proc. U. S. Nat. Mus., vol. 11, p. 405, 1888; and others.

Description.—Length 30 to 39 mm; width 1.8 to 2.3 mm; number of segments 55 to 59.

Eyes composed of about 60 ocelli usually in 11 rows, counting downward; sense organ about the size of an ocellus, located just in front of the sixth and seventh rows of ocelli.

Antennae long, reaching to the posterior border of segment 6, at least.

First segment nearly semicircular, with 20 longitudinal crests of uniform height, those near the middle extending across the basal two-fifths of the segment.

Transition to the full number of dorsal crests occurs on segment 12.

On the anterior half of the body the primary and secondary crests are approximate in height, but on the posterior half they are differentiated. Sides of the crests and the intervals between them unevenly granulate; apex of the crests smooth and moderately shining.

Lateral carinae rather prominent; pore borne in the thickened outer margin in an elliptic impressed area, which is open in front and reaches to the posterior third or fourth of the margin, except on the posterior segments where it nearly reaches the hind angle; on the segments near the middle of the body the pore is about one-third of the way back in the impression.

Below the lateral carinae are two prominent crests, which are larger and more elevated than any of the dorsal crests; smaller crests are present lower on the sides.

Anterior subsegments with impressed longitudinal flutings on the back quarter, the flutings separated by fine beaded lines; anterior three-quarters crossed by fine, low, shining, raised lines extending back and slightly downward from the front margin; surface between the lines distinctly reticulated.

Male gonopods as shown in figure 16, *m*.

Males with a comb of fine hairs on the under side of the last joint of legs 1 and 2. Last joint of the other legs in front of the gonopods with a velutinous pad on the under side near the claw (fig. 16, *l*); smaller pads, gradually diminishing in size, are found on the last joint of several of the legs following the gonopods. Coxae of the seventh legs normal.

Females with a comb of hairs on the first two pairs of legs, as in the male, and sometimes with a similar comb on the third legs also; other legs normal.

Remarks.—This species has a very wide distribution, having been reported from nearly all the Eastern, Southeastern, and East Central States and also from Minnesota, Arkansas, Texas, and Louisiana; and specimens from many localities in Florida have been examined. Because of the striking external similarity of this species with *S. texensis*, making dissection of the males necessary in classifying, it seems probable that the specimens reported as *lactarium* from the more western of the above States were incorrectly identified and may have been *texensis* or another species.

SPIROSTREPHON TEXENSIS, new species

FIGURE 16, *n*

Diagnosis.—The external features of this species are very similar to those of the eastern *lactarium*, but the male gonopods show striking differences; the curved outer arm ends in a sharp point, instead of being broadly rounded; the upper division of the subapical structure is short and simple, and not bifid near the tip; and the lower division is in two parts instead of one as in *lactarium*.

Description.—Body 25 to 32 mm long and 1.5 to 2 mm broad; composed of 56 to 61 segments.

The eyes usually of 10 series of ocelli, counting downward, disposed as follows: 1, 2, 3, 4, 5, 6, 7, 8, 8, 7, a total of 51 ocelli. Several specimens had 51 ocelli in 10 series, and none exceeded this arrangement. The sense organ is in front of the sixth and seventh rows of ocelli.

The impressed poriferous area of the lateral carinae is narrower than in *lactarium*, and the pore is slightly farther forward in it, being located at the anterior fourth or fifth.

Male gonopods as shown in figure 16, *n*.

Males with ventral comb of hairs beneath the outer joint of the first two pairs of legs; the other legs in front of the gonopods and 8 or 10 pairs thereafter with a velutinous pad beneath the last joint near the tip. Females with comb of hairs on the first two and sometimes on the first three pairs of legs as in *lactarium*.

Type.—Male, U.S.N.M. no. 1237.

Remarks.—The type locality is Pierce, Wharton County, Tex., where a single male was collected in December 1905 by Dr. O. F. Cook. Many other specimens were collected the same year at Wharton, Tex., on the bank of the Colorado River. In 1927 additional specimens were collected by Dr. Cook in Smith, Dallas, and Tarrant Counties, Tex.

DIACTIS, new genus

Type.—*Diactis soleata*, a new species from southern California.

Diagnosis.—From *Tynomna* this genus is distinguished by the extremely divergent inner primary crests of segments 2, 3, and 4; the more numerous ocelli; and, in the males, by the lobed coxae of the seventh legs and of the anterior legs on the segments near the middle of the body.

Description.—Body moderately slender, 12 to 15 times as long as broad, slightly flattened, composed of 48 to 54 segments.

Eyes triangular, composed of 35 to 48 ocelli in 6 to 9 rows; sense organ distinctly larger than an ocellus, its diameter nearly equal to the distance between the eye and the base of the antenna.

Antennae subclavate; joint 2 longest; joints 3 and 5 subequal, longer than joint 4, which is longer than joint 6; joint 7 more than half as long as joint 6.

First segment with 18 low longitudinal crests posteriorly, the median crests not extending forward beyond the basal fourth of the segment; lateral crests but slightly longer; in front of the crests 10 setae are arranged in a transverse triarcuate series extending forward and inward from near the hind angle on each side; counting from the angle the fourth seta on each side is set far behind the third seta but not quite so far behind the fifth seta, which is very close to the middle of the segment.

Segments 2, 3, and 4 with the inner pair of primary crests four to eight times as widely separated behind as in front; the two secondary crests between them small and parallel, but the other secondary crests are larger and oblique, as are the primary crests; behind segment 4 the inner primary crests are nearly parallel.

Transition to the full number of dorsal crests occurs on segment 8 or 9.

Primary crests thin and of uniform height at the apex, which is smooth; crests usually more strongly developed on the caudal segments. Secondary crests usually reaching the posterior margin of the segments, diminishing in size and becoming inconspicuous on the last segments. Sides of both primary and secondary crests and the intervals between them definitely and uniformly netted. The setae

at the back end of the primary crests a third to half as long as the crests, except on the caudal segments where they may exceed the crests in length.

Poriferous carinae projecting scarcely more than the primary crests of the dorsum; the thin-rimmed pore area elliptic and occupying the entire margin, except on a few of the first pore-bearing segments. Below the poriferous carinae are two primary crests decidedly more prominent than those of the dorsum.

Posterior margin of the anterior subsegments with a transverse series of large, shallow, slightly oblong channels, separated by fine raised lines with beaded tops; bottoms of the channels minutely netted. In front of the channels the surface is rather coarsely and distinctly reticulated, with a few smooth raised lines extending through the netting longitudinally.

Last segment narrowly rounded-truncate behind, with six setae arising from the surface, in addition to the papillate hairs in the apical margin.

Anal valves slightly inflated, the margins thin and moderately raised.

Male gonopods consisting of two slender erect pieces variously modified, in front of which at the base there are two very large bulbous structures, more strongly chitinized on the inner side; behind the base of the erect gonopods are two large, thin, very convex shieldlike plates connected by a Y-shaped yoke, the lower part of which is produced downward and forward between the two plates; above the yoke the plates are joined by thin membranous tissue.

Female organs long and slender when extruded; the outer joint subcylindric, distinctly clavate, with the outer side rather narrowly raised and widest a short distance behind the acutely rounded apex, which extends well beyond the thicker inner portion of the joint; basal part of the joint almost completely glabrous, the apical half with many long bristles, which are less numerous on the raised outer structure except at its tip.

Males with the last joint of legs 1 and 2 with a comb of fine hairs on the under side and with the ensuing pregenital legs and some of the postgenital ones with a velutinous pad of very short hairs on the under side of the last joint; coxae of the seventh legs produced into erect, subconic lobes; first pair of legs of the segments near the middle of the body with coxae produced forward at the apex into distinct lobes, with a small dense cluster of long hairs below each lobe.

Females with a comb of hairs beneath the outer joint of only the first two pairs of legs.

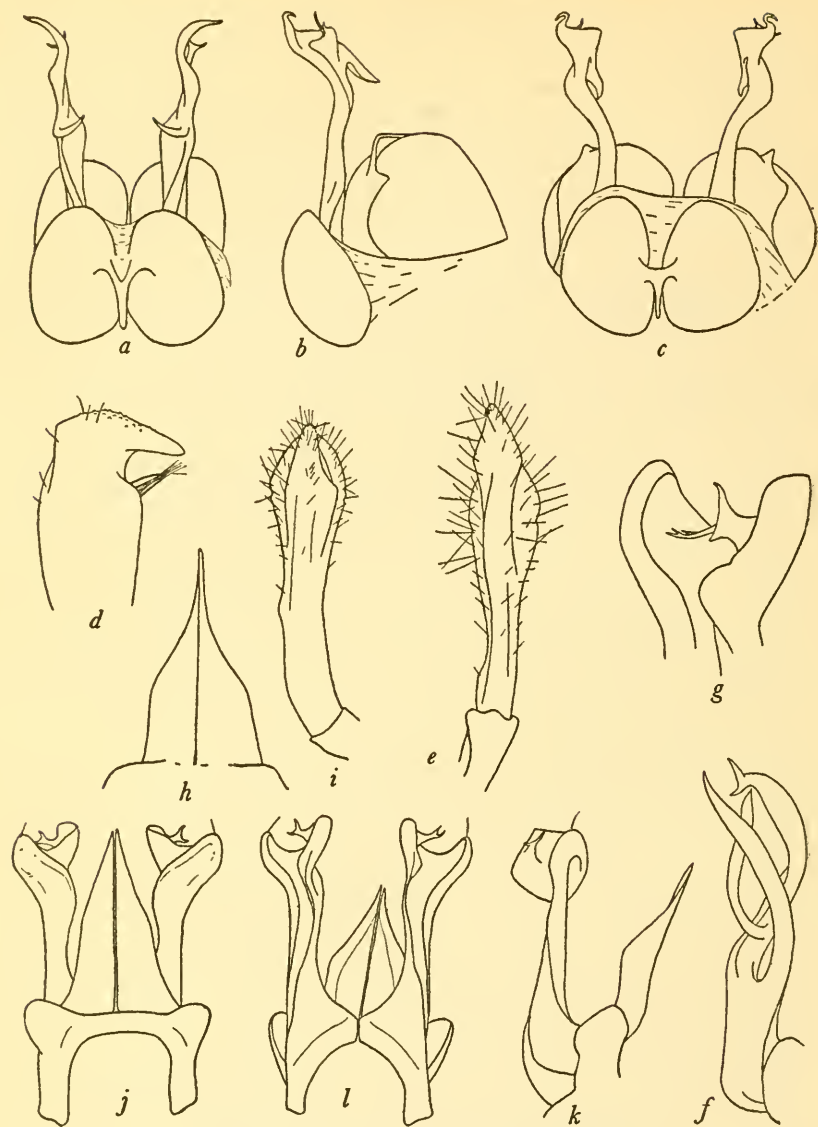


FIGURE 17.—Species of *Diactis* and *Tynomma*.

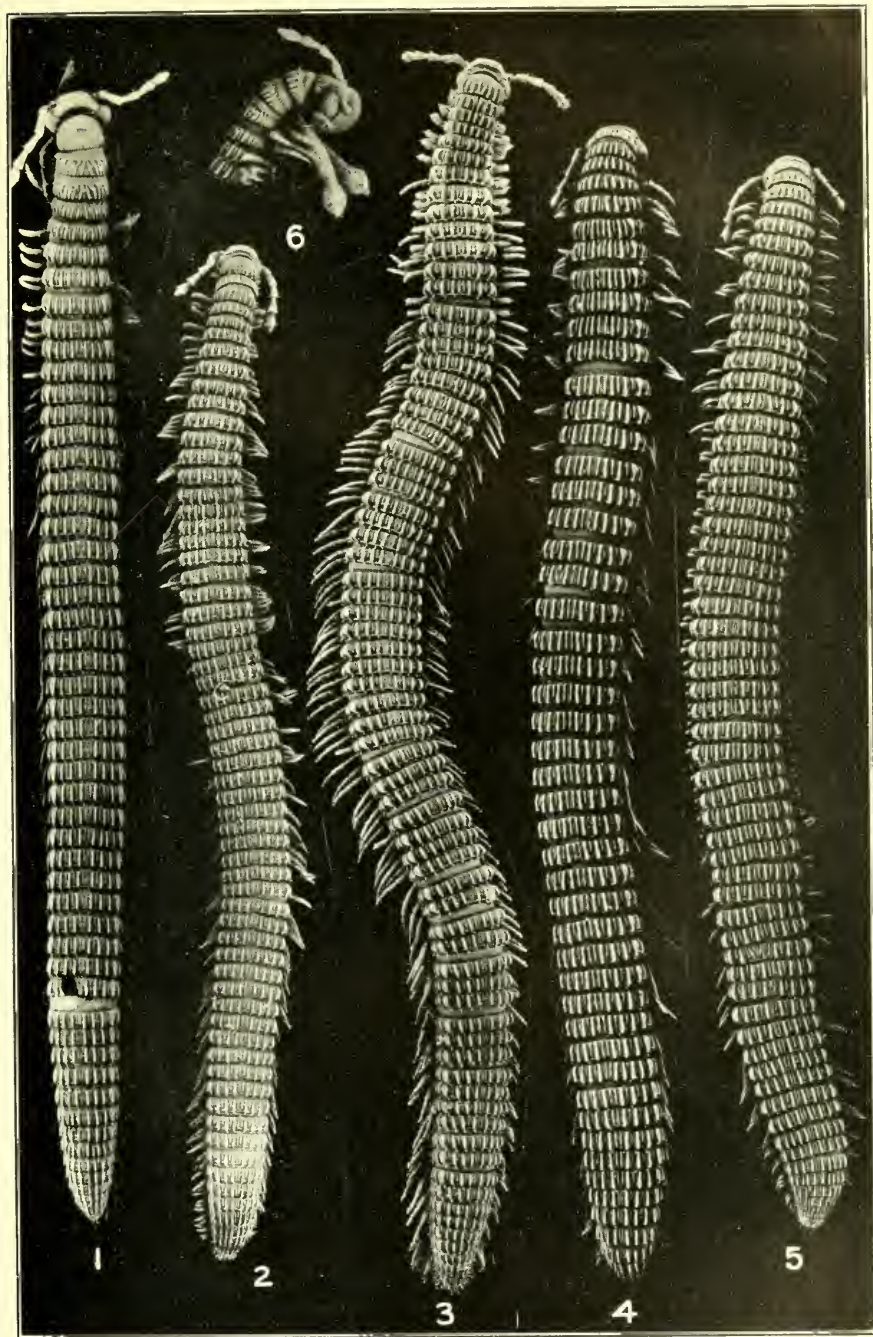
a. *Diactis triangula*: Posterior view of gonopods.

b-c. *D. solcata*: b, Lateral view of gonopod; c, posterior view of gonopods; d, inner face of coxal joint of anterior pair of legs of segment 24 of male; e, lateral view of last joint of female organ.

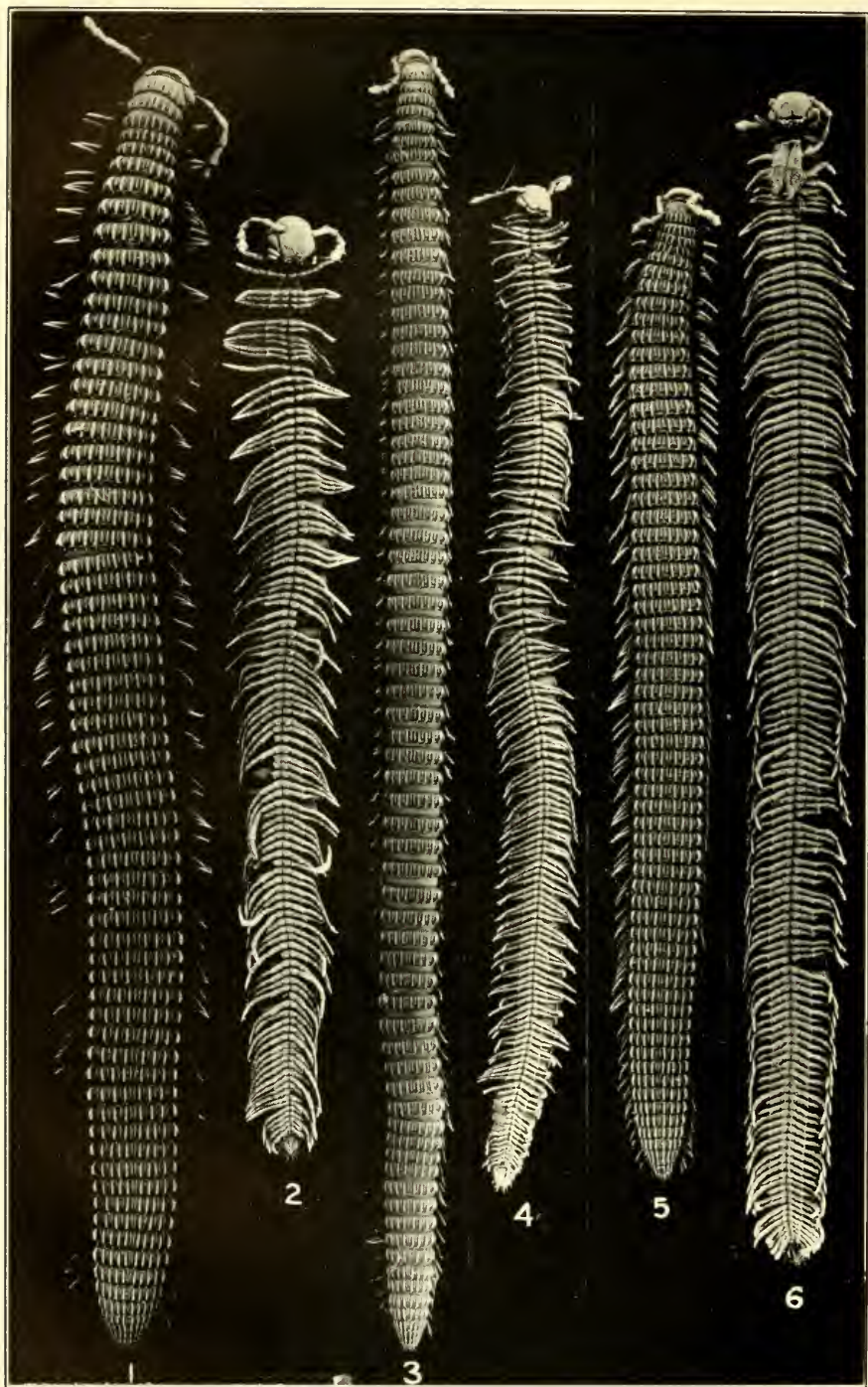
f. *D. frondifera*: Erect arm of gonopod in anterior-mesial view.

g-i. *Tynomma consanguineum*: g, Posterior view of apex of posterior gonopod; h, anterior view of anterior gonopod; i, lateral view of last joint of female organ.

j-l. *T. scoccinum*: j, Anterior view of gonopods; k, lateral view of gonopod; l, posterior view of gonopods.



1, *Diactis solcata*, female, $\times 6$; 2, *Colactis saxatana*, male, $\times 3$; 3, *C. protenta*, female, $\times 4\frac{1}{2}$; 4, *C. baboquivari*, male, $\times 7$; 5, *C. quadrata*, female, $\times 5$; 6, *Tynomma sedecimum*, lateral view of head, anterior segments, and female organs, $\times 8$.



1, *Colactis sideralis*, dorsal view of female, $\times 5$; 2, *C. sideralis*, ventral view of male, $\times 5$; 3, *Heptium carinellum*, dorsal view of female, $\times 4\frac{3}{4}$; 4, *H. carinellum*, ventral view of male, $\times 4\frac{3}{4}$; 5, *H. scamillatum*, dorsal view of male, $\times 5$; 6, *H. scamillatum*, ventral view of female, $\times 5$.

DIACTIS SOLEATA, new species

FIGURE 17, *b-c*; PLATE 3, FIGURE 1

Body moderately slender, somewhat depressed; 19 to 27 mm long and 1.3 to 2 mm wide; number of segments 48 to 54 (pl. 3, fig. 1).

Eyes composed of 42 to 48 ocelli in 8 or 9 rows, counting downward from the top of the head; sense organ large, opposite the anterior ends of rows 6 and 7, or 7 and 8, and invading the triangular outline of the eye.

First segment with 18 low crests not exceeding the basal fifth at the middle of the hind margin; lateral crests scarcely longer than those at middle; inner primary crests oblique, the anterior ends almost meeting but the posterior ends widely separated; no secondary crests between the median primary crests.

Segments 2 to 4 with the inner pair of primary crests very strongly divergent on each segment, the posterior ends of the crests six to eight times as widely separated as the anterior ends. Median pair of secondary crests present on segment 2 and succeeding segments.

Transition to the full number of crests occurs on segment 8.

Primary crests more prominent on the last segments than on those in front. Secondary crests occasionally not reaching the posterior margin of the segments; the inner pair more apt to be shortened than any others. On the posterior segments the secondary crests are much fainter than on the middle segments. Setae at the posterior ends of the primary crests are longer than in any other American member of the family; nearly half as long as the crests, while on the caudal segments the setae are as long as or longer than the crests. Apex of the crests smooth and continuous; the sides of the crests and the intervals between crests marked with fine reticulations visible under strong magnification.

Poriferous carinae projecting little more than the primary dorsal crests but with the lateral margin thickened and with the impressed pore area occupying the entire margin on all but a few of the anterior segments. Pores located in front of the middle of the impression. Below the pore carinae are two primary crests, which are higher than the carinae or any of the dorsal crests.

Last segment narrowly rounded-truncate at apex, the surface without crests but with six setiferous tubercles.

Males with the gonopods erect (fig. 17, *b, c*); the lower half of each very slender; the upper half more expanded, ending in a small S-shaped hook directed forward and outward, below the hook and in front of it is a short 2-pronged arm with the prongs widely spreading; from the lower anterior part of the apical expansion a large, rather long, slightly curved and concave lobe is directed down-

ward and forward. Base of the gonopods covered behind by two thin, strongly chitinized, convex, kidney-shaped pieces joined on the inner side at the middle by a yokelike structure, above which the margins are connected by membranous tissue. In front of the base of each gonopod is a very large globular structure with the inner half chitinized, and the outer part more delicate and resembling an inflated bladder.

Apical joint of the female organs shown in figure 17, *e*.

Males with the outer joint of the first two pairs of legs bearing a ventral comb of fine hairs. Under side of the last joint of all the legs from the third pair to within 10 or 12 pairs of the posterior end of the body occupied by a velutinous pad of uniform short hairs. Seventh legs with the coxa prominently produced into an erect subconic lobe. The anterior pair of legs of each midbody segment has the coxal joints produced forward at the apex into a rather long, slender, shoelike lobe, below which a small dense cluster of long hairs projects obliquely upward nearly to the end of the lobe (fig. 17, *d*).

Females with comb of hairs on legs 1 and 2, similar to the males, but the other legs are without special modifications.

Type.—Male, U.S.N.M. no. 1238.

Remarks.—Two mature males and mature females collected beside the Temescal Canyon Road, near Corona, Calif., November 29, 1927, by Dr. O. F. Cook.

DIACTIS TRIANGULA, new species

FIGURE 17, *a*

Diagnosis.—The outstanding differences between this species and *soleata* are the less divergent primary crests of segments 2, 3, and 4; the transition to the full number of dorsal crests occurring on segment 9 instead of on segment 8; and the shorter setae on the primary crests near the middle of the body.

Description.—Body 18 mm long and 1 mm wide; very little depressed in the male; female not known; number of segments 49.

Eyes composed of 39 ocelli in 9 rows; sense organ much larger than an ocellus, occupying most of the space between the end of the seventh row of ocelli and the base of the antenna but not encroaching on the triangular outline of the eye.

First segment with 18 crests, those on the sides a little longer than the ones at middle, which extend across the basal fourth of the segment; inner pair of crests parallel.

Segments 2, 3, and 4 with the inner pair of primary crests rapidly diverging from in front, the posterior ends about four times more widely separated than the anterior ends; other outer crests

paralleling the inner crests. Secondary crests on either side of the impressed median line of segment 2 obsolete but appearing on the posterior half of segment 3 and conspicuous on the segments thereafter.

Transition to the full number of dorsal crests occurs on segment 9.

Primary crests more prominent on the posterior half of the body than in front, while the secondary crests become less conspicuous behind the middle and are almost entirely obliterated on the last few segments. Secondary crests adjacent to the median furrow smaller than the other secondary crests. Setae at the back ends of the primary crests shorter than in *soleata* except on the last segments, where they also equal or exceed the length of the crests. Surface between and on the sides of the crests marked with extremely fine reticulations forming lengthwise cells; the crests rather thin, the apex moderately shining.

Poriferous carinae but little more projecting than the primary crests of the dorsum, the narrowly elliptic impressed area occupying the entire margin except on several of the anterior segments where it does not quite reach the posterior corner; rim surrounding the impression thin; pore located in front of the middle of the impression. Below the lateral carinae are two primary crests higher than the carinae or any of the dorsal crests.

Last segment narrowly rounded-truncate behind; surface smooth except for six setiferous tubercles as in *soleata*.

Male genitalia simple (fig. 17, *a*), consisting of two slender erect pieces, each of which has a small uncinat process about halfway up on the outer-posterior side extending inward and slightly upward; on the anterior side about halfway between the uncinat process and the apex of the gonopod there is a small arm, divided at the tip into two prongs; apex of the gonopod erect, slender, acute. Anterior basal pieces elongate, instead of globular, as in *soleata*, highly chitinized on the inner side and in front of the erect gonopod, but inflated and bladderlike on the outer side. Posterior basal pieces much as in *soleata*.

Males with a comb of fine hairs on the under side of the last joint of legs 1 and 2; last joint of the other legs in front of the genitalia with a velutinous pad beneath, near the claw; a number of legs following the genitalia with similar pads which decrease and vanish before reaching the middle of the body. Seventh legs with coxal lobes similar in shape to those of *soleata*, but they are smaller. Anterior pair of legs on each of the midbody segments with rather long, slender, forwardly produced lobes on the coxae as in *soleata*.

Type.—Male, U.S.N.M. no. 1239.

Remarks.—A single male was collected at Cottonwood Creek, 46 miles east of San Diego, Calif., on the road to El Centro, January 22, 1921, by Dr. O. F. Cook.

DIACTIS FRONDIFERA, new species

FIGURE 17, *f*

Diagnosis.—The smaller size of the body, fewer crests on the first segment, and the slender branches of the gonopods readily distinguish this species.

Description.—Body 13 to 16 mm long, 1 to 1.2 mm wide, 44 to 51 segments.

Eyes composed of 35 to 40 ocelli in 6 or 7 rows, counting downward from the top of the head; sense organ in front of rows 4 and 5, or 5 and 6, in contact with the triangular eye cluster.

First segment with only 12 crests, occupying the posterior third of the dorsal surface.

Segments 2, 3, and 4 with the median pair of primary crests notably divergent, and without an intervening pair of secondary crests, the median pair of secondary crests first apparent on segment 5.

Transition to the full number of dorsal crests occurs on segment 8.

Primary crests rather strongly developed to within 4 or 5 segments before the end of the body, their tops smooth and shining; setae inserted at the posterior ends of the crests of moderate length; sides of crests and the surface between finely reticulate. Secondary crests very thin, rather weakly elevated on the anterior segments, very faint or entirely obsolete on the segments behind the middle of the body. Poriferous keels and lateral crests as in *soleata*.

Last segment smooth but for the six setiferous tubercles.

Gonopods with the erect portion (fig. 17, *f*) with three slender branches, two subapproximate at apex, the other shorter; inner branch longest, slightly curved, tapering gradually to a simple point; outer branch more strongly curved, terminating in two divergent prongs; middle branch simple, inserted near the base of the outer branch, projecting into the curve below its 2-pronged termination.

Velutinous pads present on the under side of the last joint of the male legs to well beyond the middle of the body.

Anterior pair of legs on segments near the middle of the body with distinct coxal lobes, directed forward.

Type.—Male, U.S.N.M. no. 1240.

Remarks.—A male and female collected at Torrey Pines, near La Jolla, Calif., November 1, 1925, by "Hardy." Several other females subsequently collected in the same locality by Dr. O. F. Cook.

TYNOMMA, new genus

Type.—*Tynomma sedecimum*, a new species from California.

Diagnosis.—This genus is related to *Spirostrephon* and *Diactis* but has genitalia dissimilar to both. The smaller size; smaller eye cluster; and the greater differentiation of the primary and secondary crest of the anterior segments also distinguish it from *Spirostrephon*, while externally it differs from *Diactis* by the smaller eye cluster; the nearly parallel inner primary crests of segments 2, 3, and 4; and the normal coxae of the seventh male legs and all legs near the middle of the body.

Description.—Body rather slender, 14 to 15 times as long as broad, moderately depressed in both sexes; segments 46 to 53 in number.

Eye cluster relatively small, containing 22 to 39 ocelli in 6 to 8 rows, as counted downward from the top of the head; sense organ moderately large and occupying more than half of the distance between the eye and the base of the antenna.

Antennae resembling those of *Diactis* in shape and proportions.

First segment of the usual shape, with 16 to 18 distinct crests, the inner ones of two sizes like the crests of segment 2, except that between the inner pair of primary crests there are no secondary ones; lateral crests large and resembling the inner primary crests, except that they are longer and cross the posterior two-fifths of the segment. In front of the crests is a triarcuate series of 10 setae, the fourth seta on each side, counting inward, set far behind the third and fifth setae.

Segments 2, 3, and 4 with the inner pair of primary crests almost parallel, not strongly divergent as in *Diactis* but more oblique than in *Spirostrephon*.

Transition to the full number of dorsal crests occurs on segment 11 or 12.

Primary crests thin and with the apex smooth; the sides of all primary and secondary crests and the surface between them uniformly reticulated.

Secondary crests reaching the posterior margin of the segments, the crests less conspicuous on the caudal segments.

Poriferous carinae not much more prominent than the primary crests of the dorsum; lateral margin of the carinae completely occupied by the rather broad poriferous impression, except on several of the first poriferous segments where it does not extend to the posterior corner. Below the carinae are two primary crests, which are larger and more conspicuous than the dorsal crests.

Last segment narrowly rounded-truncate behind and with six setiferous tubercles in addition to the apical papillae.

Male genitalia in two distinct parts; the anterior part of two erect, thin, convex, subtriangular pieces, in contact mesially from the broad base to the acute tips; posterior gonopods erect, subcylindric, but each with a channel extending inward and upward from the outer side of the base to the apex; the apex strongly expanded and with an outwardly produced, bifurcate arm arising from the concave face of the inner lobe; under high magnification the lower branch of the bifurcate arm is seen to be equipped with several tiny appressed barbs. The large anterior and posterior pieces at the base of the gonopods in *Diactis* have no recognizable counterparts in this genus.

The ovipositors of the female, when extruded, are seen to consist of two long, indistinctly jointed appendages, with the last joint especially long and very strong clavate, thickest near the apex; the distal half of the joint with a broad, longitudinal section along the outer side gradually raised distad, the end rapidly constricted to a narrowly rounded apex which scarcely exceeds the inner, swollen portion of the joint; basal half of the joint glabrous, the apical half with moderately long, erect bristles, which are less numerous on the lateral elevation except at its tip.

Males with a comb of hairs on the under side of the last joint of legs 1 and 2; a velutinous pad occupying the under side of the last joint of legs 3 to 7, and usually several pairs following the gonopods, where the pads gradually decrease in size. Coxae of the seventh legs and of the legs near the middle of the body without special lobes such as are present on these legs in *Diactis*.

Females with a comb of hairs on the first two pairs of legs as in the male but without velutinous pads on any of the ensuing legs.

TYNOMMA SEDECIMUM, new species

FIGURES 17, *j-l*; PLATE 3, FIGURE 6

Description.—Body 15 to 18 mm long and 1 to 1.2 mm wide; with 46 to 52 segments.

Eye cluster very small, composed of only 22 to 28 ocelli in 6 or 7 rows; sense organ considerably larger than an ocellus and located in front of rows 4 and 5, or rows 5 and 6 of the cluster.

First segment with only 16 crests; excepting the uniformly large lateral crests the others alternate in size like the crests on the second segment, although there are no secondary crests between the inner pair of primary crests; median crests extending across the basal two-fifths of the segment, the two outer crests on each side nearly twice as long as the median crests.

Segments 2, 3, and 4 with the inner pair of primary crests almost parallel, very slightly spread apart behind.

Transition to the full number of dorsal crests occurs on segment 11.

On the caudal segments the primary crests are more conspicuous and the secondary crests less so than on the segments farther forward; near the middle of the body the setae at the posterior ends of the primary crests are about a third as long as the crests but on a few of the last segments the setae are as long or a little longer than the crests.

Male and female organs as described for the genus and as illustrated in figure 17, *j-l*, and plate 3, figure 6.

Males with a velutinous pad on the under side of the last joint of the five pairs of legs preceding the gonopods and on several pairs following them.

Type.—Male, U.S.N.M. no. 1241.

Remarks.—Many specimens of both sexes were collected by Dr. O. F. Cook, W. H. Jenkins, and H. G. McKeever, between Vallejo and Cordelia, Calif. (type locality), January 4, 1928, and at Cordelia and Davenport, Calif., in February 1929.

TYNOMMA CONSANGUINEUM, new species

FIGURE 17, *g-i*

Diagnosis.—This species is very closely related to *T. sedecimum* but differs in having larger eyes, two more crests on segment 1, and the transition to the full number of dorsal crests occurring one segment farther back.

Description.—Body of the largest specimen 18 mm long and 1.3 mm broad; number of segments 45 to 53.

Eye cluster distinctly larger than in *sedecimum*, composed of 35 to 39 ocelli in 8 rows; sense organ in front of the fifth row of ocelli.

First segment with 18 crests; no secondary crests between the median pair of primary crests; the two outer crests on each side longer than any of the other crests.

Transition to the full number of dorsal crests occurs on segment 12.

Male gonopods very similar to those of *sedecimum*, but the distal half of the erect anterior piece on each side is abruptly attenuated above the middle and the tip much slenderer (fig. 17, *h*). Posterior gonopod with a slender 3-pointed branch from the bifurcate arm, which is in the expanded apex (fig. 17, *g*).

Outer joint of the female organs shown in figure 17, *i*.

Type.—Male, U.S.N.M. no. 1242.

Remarks.—Three males and two females collected in the Santa Cruz Mountains, between Santa Cruz and Holy City, Calif., January 2, 1928, by H. G. McKeever.

TYNOMMA MUTANS (Chamberlin)

Lysiopetalum mutans CHAMBERLIN, Ann. Ent. Soc. Amer., vol. 3, p. 233, 1910.

This species was described from female specimens collected at Stanford, Calif., but no characters of definite generic value are given in the description. The size and shape of the eye, as shown by Chamberlin's drawing, and the locality where the animals were collected indicate that the species may belong to *Tynomma* rather than to the more southern *Diactis*, which has larger eyes. While the female organs, or ovipositors, of *mutans* do not closely resemble those of other species of *Tynomma*, they show still less similarity to those of *Diactis*. *Spirostrephon* is excluded on account of its much larger size and more eastern distribution.

COLACTIS, new genus

Type.—*Colactis saxetana*, a new species from Arizona.

Diagnosis.—This genus, and its close relative *Heptium*, may be distinguished readily from the other American genera of this family by the presence of only 10 crests on the first segment; no secondary crests on segments 2, 3, and 4; abbreviated secondary crests on the other segments; and 8-jointed legs on all but a few of the anterior segments. In *Colactis* the seventh legs of the males are no smaller than the other legs, but in *Heptium* the seventh legs of the males are greatly reduced in size; and the full number of dorsal crests begins on segment 18 or 19, instead of on segment 16 or 17, as in *Colactis*.

Description.—Body of variable size and proportions; 10 to 20 times as long as broad; usually distinctly depressed, although cylindrical in one species; number of segments 49 to 89.

Eyes triangular to quadrate, composed of 30 to 52 ocelli in 6 to 9 rows; sense organ of about the size of an ocellus.

Antennae moderately long and slender; joint 2 longest; joints 3 and 5 subequal and each slightly longer than joint 4; joint 6 a little shorter than joint 4 and not over a third longer than the conic seventh joint.

First segment nearly semicircular; posterior portion with only 10 crests, in front of which are 10 setae arranged in a more or less triareuate series.

Segments 2, 3, and 4 usually with only primary crests, but rudiments of secondary crests occasionally may be found on segment 4.

Transition to the full number of dorsal crests occurs on segment 16 or 17.

Primary crests completely crossing the posterior subsegments, somewhat thickened, the sides below the apex with one or two rows of tiny circular pits.

Secondary crests lower and thinner than the primary crests and extending from the front margin of the subsegment two-thirds or three-fourths of the way to the posterior margin, although in some species there is a tendency for some of the crests to extend to the back margin; sides of the crests below the apex usually pitted as well as reticulated; surface between both classes of crests finely reticulated.

Poriferous carinae strongly projecting, rectangular to broadly rounded in outline; pore borne near the middle of the impressed area which occupies only part of the lateral margin of all except the hindmost segments, the rim surrounding the impression is more or less thickened or inflated and with small circular pits on the sides.

Last segment broadly truncated behind; surface with 10 to 12 short setae.

Male gonopods simple, composed of two erect pieces which usually are expanded near the tip and with a 2- or 3-pronged arm at or near the apex; outer side of gonopods at base with a quadrate or subtriangular plate on each side above which there is a somewhat fingerlike process directed upward and forward, with long hairs at the apex.

Males with a comb of fine hairs on the under side of the last joint of legs 1, 2, and 3; similar combs on legs 1 and 2 of the females. The males of three species have a velutinous pad on the under side of the last joint of the legs beginning with the fourth pair, and sometimes extending back as far as the twenty-seventh pair.

First three pairs of male legs distinctly 7-jointed, the other legs more or less conspicuously 8-jointed, although in the species with pad-bearing anterior legs the eighth joint may not be distinguished until further back. Females with the first two pairs of legs 7-jointed, the ensuing legs usually plainly 8-jointed.

The species of this genus are separated in the following key:

KEY TO THE SPECIES OF COLACTIS²

- | | |
|---|-------------|
| 1. Body almost cylindrical, not conspicuously flattened; short, not over 22 mm long..... | baboquivari |
| Body noticeably flattened and over 22 mm long in specimens of average normal size..... | 2 |
| 2. Body stout, 10 to 13 times as long as broad; males without a velutinous pad on under side of last joint of any of legs..... | quadrata |
| Body slenderer, 14 to 20 times as long as broad; males with a velutinous pad on under side of last joint of fourth to seventh legs, at least..... | 3 |

² A species to which Prof. R. V. Chamberlin gave the name *Spirostrephon utorum* has tentatively been assigned to this genus, but the original description offers no character by which the species can be definitely separated from the species in the present key.

- | | |
|--|------------------|
| 3. Body 40 to 50 mm long; with 70 to 89 segments; poriferous carinae very broadly and evenly rounded in outline, hind angles indistinct..... | protenta |
| Body less than 40 mm long; number of segments less than 70; poriferous carinae not so decidedly rounded, hind angles distinct..... | 4 |
| 4. Gonopods with apex of each erect piece not at all expanded, when viewed from side..... | tiburona |
| Gonopods with apex of each erect piece conspicuously expanded, when viewed from side..... | 5 |
| 5. Gonopods with margin of expanded apex very distinctly and irregularly serrate; poriferous carinae decidedly irregular in outline..... | saxetana |
| Gonopods with margin of expanded apex continuous, not serrate; poriferous carinae without large irregularities..... | sideralis |

COLACTIS SAXETANA, new species

FIGURE 16, *a, b*; PLATE 3, FIGURE 2

Description.—Body slender, 21 to 33 mm long and 1.3 to 1.8 mm broad, composed of 56 to 68 segments; dorsum slightly depressed, the females more so than the males; males not appreciably more constricted behind segment 1 than the females (pl. 3, fig. 2).

Eye cluster quadrate, with 35 to 50 ocelli in 6 to 9 rows; sense organ opposite the third row of ocelli.

Segment 1 with 10 crests, the median pair of crests parallel and crossing the posterior half of the segment; anterior part of the segment, in front of the crests, faintly and sparsely tuberculate and with 10 setae arranged in a triarcuate row.

Transition to the full number of dorsal crests occurs on segment 16.

Primary crests of the dorsum prominent and only moderately thickened, highest at the posterior margin of the segment; apex uneven, subdentate when viewed from the side, and with a series of quite large, round pits on either side immediately below it. Secondary crests usually distinct but considerably lower than the primary crests and reaching across the anterior two-thirds or three-fourths of the subsegment; behind the secondary crests the surface between the primary crests gradually descends to a slightly lower level. Sides of the secondary crests, the lower sides of the primary crests, and the surface between both classes of crests roughly and irregularly reticulated, appearing almost scabrous.

Lateral carinae prominently projecting; in outline the margin is roughly rounded to well behind the middle, from where it parallels the side of the body to the right-angled posterior corner (fig. 16, *b*). Pore located in a relatively small, broadly oval area occupying the median half of the edge of the carinae of all but a few of the anterior and posterior segments; rim surrounding the poriferous impression decidedly thickened, the apex of uneven height and with a row of pits

below it on the outer side. Below the lateral carinae there are two very prominent primary crests, which are higher and more conspicuous than any on the dorsum.

Anterior subsegments with the channels on the posterior part rather shallow, noticeably longer than broad, and separated by low but distinct beaded lines; reticulations in front of the channels coarse and prominent, the longitudinal lines through the netting strongly raised.

Last segment with 10 setae in addition to the two apical papillate hairs.

Anal valves with the raised margins rather thin and strongly elevated; disk of each valve only a little inflated.

Gonopods (fig. 16, *a*) with the large expanded apical portion of each erect piece directed somewhat forward, the entire apical half with large, very uneven serrations along the margin; from the outer side of the gonopods, opposite the base of the expansion, an anteriorly directed 3-pronged arm arises; of the two apical prongs the longer points upward and the shorter points downward; below the lower prong is a still smaller prong also pointing downward.

Males with a comb of fine hairs on the under side of the last joint of the first three pairs of legs; ensuing four pairs of legs with a velutinous pad of hairs occupying the distal half of the under side of the last joint, and on five or six pairs of legs following the genitalia decreasingly smaller pads are present.

Type.—Male, U.S.N.M. no. 1243.

Remarks.—A number of specimens were collected from beneath rocks on the north slope of Picacho Mountain, between Tucson and Casa Grande, Ariz., February 7, 1926, by H. F. Loomis. Several other female specimens appearing to belong to this species have been collected at different times on a small mountain in the San Tan Range, near Sacaton, Ariz.

COLACTIS BABOQUIVARI, new species

FIGURE 16, *c, d*; PLATE 3, FIGURE 4

Diagnosis.—The short, stout, and cylindric body distinguishes this species. The gonopods indicate relationship with *saxetana*, but this is not so strongly borne out by the other characters.

Description.—Body short and stout, 18 to 22 mm long and 1.5 to 1.8 mm broad; cylindric, neither sex flattened; males slenderer and very slightly more attenuated behind the head than the females; segments 50 to 55 (pl. 3, fig. 4).

Eyes triangular, the 32 to 45 ocelli in 6 or 7 rows; sense organ small, not larger than an ocellus, located in front of the fourth and fifth rows of ocelli.

First segment shorter in proportion to its width than in the other species; median crests extending less than halfway to the front margin, the four inner crests closer together than the others; inner pair of crests parallel; surface smoother in front of the crests than between them.

Transition to the full number of dorsal crests occurs on segment 16.

Primary crests prominent and with a few scattered pits on the sides below the apex in an irregular row; apex somewhat thickened and of uniform height. Secondary crests conspicuous; on some of the anterior segments the median pair and occasionally some of the other crests extend to the hind margin; on the middle and posterior segments the median pair of crests extend farther caudad than any of the others, sometimes reaching the hind margin, the other crests crossing three-fifths or four-fifths of the segment; behind the secondary crests the surface of the dorsum is not lowered as in some of the other species, especially *protenta*. Surface between both classes of crests scaberulous, with indications of scattered pits.

Lateral carinae less prominent than in the other species; rectangular in outline, the front angle broadly rounded, the hind angle nearly square, sometimes a little produced backward; lateral margin continuous, scarcely rounded, paralleling the side of the body (fig. 16, *d*). Poriferous impression longer than in the other species, occupying the margin except for a short distance in front of the hind angle on all but a few anterior segments, on the foremost of which only the anterior half of the margin is occupied; rim around the impression of uniform height, not thickened, and with a few inconspicuous pits in an indefinite row on the side. Below the lateral carinae are two primary crests scarcely more prominent than the dorsal crests and no thicker.

Anterior subsegments with the posterior channels longer than broad, the intervening lines moderately high and distinctly beaded; reticulations in front of the channels distinct, the lines through them fine but somewhat more prominent than in *saxetana*.

Last segment with 10 setae on the dorsal surface.

Anal valves with the margins slightly raised and thickened, the disk of each valve not locally inflated but slightly and evenly convex throughout.

Male gonopods (fig. 16, *e*) with the expanded apical portion of each erect piece small, the tip directed forward; branched arm short and stout, arising from near the base and inside the slightly rolled expansion; arm with three apical prongs, the uppermost of which is long, pointed, and erect; the middle prong shorter, directed forward and divided at tip into 6 or 7 very small, rather short,

radiating spinules; lower prong very short, located on the under side of the arm and perpendicular to it.

Males without velutinous pads on the under side of the last joint of any legs.

Type.—Male, U.S.N.M. no. 1244.

Remarks.—Numerous specimens collected in Baboquivari Canyon of the Baboquivari Mountains, Pima County, Ariz., November 21, 1923, by H. F. Loomis.

COLACTIS SIDERALIS, new species

FIGURE 16, *j*, *k*; PLATE 4, FIGURES 1, 2

Diagnosis.—This species resembles *saxetana* more closely in the number of segments and the size and proportions of the body but differs in the greater number of ocelli, the shape of the lateral carinae and male gonopods, and in the greater number of male legs with a pad beneath the last joint. In these latter characters it shows some similarity with the considerably larger, more segmented *protenta*.

Description.—Body moderately slender, the males more so than the females and less flattened; 26 to 36 mm long and 1.8 to 2.5 mm broad; segments 55 to 68 in number (pl. 4, figs. 1, 2).

Eye cluster triangular-quadrate, with a few more ocelli than in the other species, from 48 to 56 ocelli arranged in 8 or 9 rows; sense organ in front of rows 3, 4, and 5 of the ocelli.

Segment 1 with 10 crests, the inner pair reaching the middle of the segment but not beyond, the anterior ends slightly more separated than the posterior ends; the four inner crests closer together than the outer ones; the 10 anterior setae in a strongly triarcuate series.

Transition to the full number of dorsal crests occurs on segment 16.

Primary crests of the dorsum prominent, thickened, with the apex nearly even and continuous, when viewed from the side, and with a crowded series of quite large, round pits immediately below the top on each side, and usually with a more irregular series containing fewer pits just below the top row. Secondary crests low and slender, the sides scaberulose or coarsely reticulated, as is the surface between all ridges, but lacking distinct pits. Inner pair of secondary crests reaching nearly to the posterior margin, the other secondary crests not extending onto the posterior fourth of the segment.

Lateral carinae prominent, in outline somewhat intermediate between those of *baboquivari* and *protenta*, being less broadly rounded and with a more distinct hind angle than in the latter, and more broadly rounded and with a less acute hind angle than in the former, and there are no large irregularities of the margin, as in *saxetana* and *quadrata* (fig. 16, *k*). Pore located in an elliptical impressed area occupying nearly all the lateral margin of the carinae on the

posterior half of the body, the rim around the impression very strongly swollen and with numerous scattered pits. The two primary crests below the lateral carinae distinctly more conspicuous than those on the dorsum and with the apex slightly more irregular in outline, faintly subdentate.

Anterior subsegments with the posterior channels subquadrate, very slightly longer than broad, and separated by distinct beaded lines; bottom of the channels appreciably more finely reticulated than the surface of the segment in front of them.

Last segment rather broadly rounded behind, subtruncate, with 12 dorsal setae in addition to the two apical papillate hairs.

Anal valves with the margins thinly raised, the disk of each valve strongly convex.

Gnathopods somewhat resembling those of *protenta* but the expanded apical portion of each erect piece is more oblique and is broadly rounded distally; the outer arm on each erect piece is shorter and more slender, and the apposed prongs at the end are smaller (fig. 16, *j*).

Males and females with a comb of hairs beneath the outer joint of the anterior legs, as in the other species, but the males have the velutinous pads on 6 to 20 pairs of legs behind the genitalia, in addition to the four pairs immediately in front of them.

Type.—Male, U.S.N.M. no. 1245.

Remarks.—Numerous specimens collected in the Estrella Mountains, Maricopa County, the type locality, and in the Table Top Mountains, Pinal County, Ariz., February 13, 1929, by R. H. Peebles and H. F. Loomis. Many specimens also were collected in the Kofa Mountains, Yuma County, Ariz., March 31, 1930, by R. H. Peebles and H. F. Loomis, extending the range for this species over a greater area than that of any other member of the family in the Southwest.

COLACTIS PROTENTA, new species

FIGURE 16, *g-i*; PLATE 3, FIGURE 3

Diagnosis.—Not only is this the largest species of *Colactis*, but it is also the largest member of the family in North America, some specimens exceeding by 10 mm the largest *Spirostrephon*. Specific characters not shown by other members of the genus are the bowed inner pair of crests of the first segment, the rounded lateral carinae, and the transition to the full number of dorsal crests on segment 17, instead of on segment 16.

Description.—Body moderately slender, 40 to 50 mm long and 2 to 2.5 mm broad; strongly depressed, especially the females, which are not so conspicuously constricted behind the first segment as the males; segments 70 to 89 (pl. 3, fig. 3).

Eye cluster subquadrate, 42 to 52 ocelli in 6 to 9 rows; sense organ in front of the ends of the third and fourth rows of ocelli.

First segment with the inner crests extending across the posterior two-thirds, the median pair not parallel but each crest bowed out, especially in front; surface between all crests and in front of them indistinctly roughened; with 10 setae in a faintly triarcuate series in front of the crests.

Transition to the full number of dorsal crests occurs on segment 17.

Primary crests strongly thickened and of moderate height, ending in rounded-obtuse angles above the posterior margin of the segments; sides of the crests below the apex with numerous small pits arranged in two rows, the uppermost forming a nearly straight line, the lower row quite irregular; apex of the crests narrow and of nearly uniform height, only very faintly subdentate when viewed from the side. Secondary crests distinct although not greatly elevated, rather thick and reaching across the anterior three-fourths of the segment, while on the remaining fourth of the segment the surface between the primary crests descends quite abruptly to a distinctly lower level; sides of the secondary crests with an inconspicuous row of pits near the apex on either side. Surface between all the crests indefinitely reticulated but distinctly roughened and slightly shining.

Lateral carinae strongly produced, relatively more prominent than in any of the other members of the genus, very broadly and evenly rounded in outline from front to back and without distinct front or back angles (fig. 16, *i*). Pore slightly in front of the middle of the relatively short and broadly oval impressed area in the lateral margin; rim around the impressed area very greatly thickened and with two more or less uniform rows of pits on the sides. The two primary crests below the poriferous carinae are heavier and higher than those on the dorsum.

Anterior subsegments with the posterior channels especially deep and short, about as broad as long and separated by prominent beaded lines; surface in front of the channels finely reticulated, the longitudinal lines through the reticulations not especially evident and only slightly raised.

Posterior subsegments shorter in proportion to their width than in any other species.

Last segment with 12 dorsal setae in addition to the two papillate hairs in the thickened apical margin.

Anal valves with the margins moderately raised and decidedly thickened; disk of each valve definitely inflated.

Gonopods, viewed from the side, with the erect piece on each side enlarged at apex into an upward pointing leaflike expansion; from behind the base of the expansion, on the outer side, a long arm curves

up and forward and is divided at the end into two apposed, pointed prongs, the lower of which is shorter and slendered (fig. 16, *g*, *h*).

Males with a comb of fine hairs beneath the last joint of the first three pairs of legs; the under side of the last joint of the ensuing legs, sometimes as far back as the sixteenth pair, with a low, velutinous pad on the distal half except on the last few pairs of these legs where the pads decrease in size and vanish. Females with a comb of hairs beneath the outer joint of the first two pairs of legs as in the other species.

Type.—Male, U.S.N.M. no. 1246.

Remarks.—Numerous specimens collected 15 miles north of Ensenada, Lower California, on the Tiajuana Road, May 3, 1923, by H. G. McKeever. Additional specimens were found in the same locality on January 7, 1925, by H. G. McKeever and Dr. O. F. Cook.

COLACTIS TIBURONA (Chamberlin)

Lysipetalum tiburonom CHAMBERLIN, Proc. California Acad. Sci., ser. 4, vol. 12, p. 402, 1923.

It is evident that this species belongs in *Colactis* or *Heptium*, as the first segment was described as having only 10 crests; secondary crests of the poriferous segments not reaching the posterior margin of the segments; and the gonopods, as illustrated, might allow it to be assigned to either genus. As the seventh legs of the male were not described as being reduced in size the species is referred to *Colactis*, which has the seventh legs of normal size. The point of transition to the full number of dorsal crests was not stated.

COLACTIS QUADRATA, new species

FIGURE 16, *c*, *f*; PLATE 3, FIGURE 5

Diagnosis.—Closer relationship with *C. tiburona* (Chamberlin) than with any other species is indicated by the shape of the eye cluster, the size and proportions of the body, and the form of the gonopods, although these lack the slender, erect, serrate structures figured by Chamberlin for *tiburona*.

Description.—Body stout, noticeably depressed in both sexes, 17 to 34 mm long and 1.6 to 2.7 mm broad, composed of 49 to 61 segments (pl. 3, fig. 5).

Eye cluster distinctly quadrangular, composed of about 51 ocelli in 7 or 8 rows, counting downward from the top of the head, the ocelli distributed as follows: 5, 7, 8, 8, 8, 8, 7, or 3, 5, 7, 7, 7, 8, 7, 7; sense organ in front of rows 2 and 3, or 3 and 4, of the cluster.

First segment with the inner crests crossing the posterior two-fifths, the four inner crests decidedly closer together than the other

crests; setae in a subtriarcuate series, the six inner setae nearly in a straight line.

Transition to the full number of dorsal crests occurs on segment 16.

Primary crests high, moderately thickened, the apex smooth, continuous in lateral view, a single row of small, circular pits on each side below the apex below which the sides are reticulated.

Secondary crests lower and slenderer than the primary crests, the sides with similar punctations and reticulations; crests usually crossing only the anterior three-quarters of the subsegment, but the inner pair frequently extending to the posterior margin; surface behind the crests descending gradually to a somewhat lower level between the primary crests.

Surface between both types of crests roughly and finely reticulate as on the sides of the crests; the middle of each interval usually with a row of very tiny granules not reaching either margin of the subsegment; between the median line and the secondary crest each side is a row of similar granules which extends completely across the segment.

Poriferous carinae rather strongly projecting, the anterior angle broadly rounded, the posterior angle slightly more acute than a right angle; on the caudal segments the outline of the lateral margin of the carinae is smooth and continuous, as the poriferous impression reaches the length of the margin to the posterior corner, but on the other segments, in front, the impression occupies only part of the margin and its posterior limit is indicated by a distinct recession of the margin following it (fig. 16, *f*). Poriferous area broad and surrounded by a strongly thickened rim with pits on both sides, the apex smooth; pore located near the center of the impression. The two primary crests below the lateral carinae are somewhat heavier and more prominent than the dorsal crests.

Anterior subsegments with the posterior channels longer than broad, separated by distinct, beaded lines; bottoms of the channels very finely reticulated; in front of the channels the reticulations are very much coarser than in them, and there are prominent raised lines extending lengthwise through the netting.

Last segment broadly truncate behind; with 12 short setae on the dorsal surface and two short papillate hairs in the apical margin.

Anal valves scarcely inflated, the margins thin and only moderately raised.

Male gonopods with the erect piece on each side not expanded at the tip as in the other species with the exception of *tiburona*, but it is abruptly bent forward and ends in two prongs, one of which is directed upward, the other downward; behind the upper prong is a smaller erect subapical pointed projection; below the bend near the

extremity of the piece the surface is expanded forward mesially; basal structures of the gonopods resembling those of *protenta*, to a certain extent (fig. 16, *e*).

Males with a ventral comb of hairs on the first three pairs of legs, as in the other species, but none of the ensuing legs have ventral pads. Females with ventral combs on the first two pairs of legs.

Type.—Male, U.S.N.M. no. 1247.

Remarks.—Two males and three females were collected beneath rocks at the base of the cliffs in Cave Creek Canyon, Chiricahua Mountains, Cochise County, Ariz., May 25, 1928, by R. H. Peebles and H. F. Loomis.

COLACTIS UTORUM (Chamberlin)

Spirostrephon utorum CHAMBERLIN, Pan-Pac. Ent., vol. 2, no. 2, pp. 61-62, 1925.

In the original description of this species the remarks pertaining to the dorsal crests apply to nearly all the western members of the family that have been seen. Also some of the newly described species are light in color, so that this character is of incidental importance. The shape of the poriferous keels is the only character that may be of generic value and would indicate relationship with *Colactis* or *Heptium*, as does the number of segments. On the basis of the distribution of these genera it is probable that the species belongs in the genus *Colactis*, and no doubt it is different from any of the species described in this paper, although no characters are given that may be used to distinguish it.

HEPTIUM, new genus

Type.—*Heptium carinellum*, a new species from southern California.

Description.—This genus is closely related to *Colactis*, but differences are mentioned in the following paragraphs.

Transition to the full number of dorsal crests occurs on segment 18 or 19, instead of segment 16 or 17, as in *Colactis*.

The outer basal portion of the male gonopods consists of a single large piece instead of two or three distinct pieces, which, when taken together, do not closely resemble the outline of the structure in *Heptium*, although a relationship is evident.

Males with seventh legs greatly reduced in size, not extending beyond the end of the fourth joint of the normal sixth pair of legs; basal joint with a long, slender, erect spine developed from the inner anterior angle and extending nearly as high as the apex of the gonopods; joint 2 very short; joint 3 much longer, equaling or exceeding in length the combined remaining joints. One male of

FIGURE 18.—Species of *Heptium*

a-e. Heptium scamillatum : *a*, Lateral view of gonopod ; *b*, lateral view of apex of gonopod ; *c*, outline of poriferous carina from near middle of body ; *d*, segments 17 and 18, showing transition to full number of dorsal crests ; *e*, anterior view of seventh legs of male (outer joints of one leg not drawn).

f-j. H. carinellum : *f*, Outline of poriferous carina near middle of body ; *g*, lateral view of gonopod ; *h*, anterior view of eighth leg of male, showing the eight distinct joints ; *i*, anterior view of reduced seventh legs of male, showing difference in size and structure of coxal spines and the full number of eight joints of the leg ; *j*, anterior view of one of reduced seventh legs of male showing greatly produced coxal spine and a total of only seven distinct leg joints.

k. Diagrammatic sketch of segments 4, 5, and 6 of the American species of Lysiopetalidae, showing the dorsal primary crests and the transition of the setae from their anterior to their posterior ends.

(*e, h, i, and j* are drawn to same scale.)

carinellum with the seventh legs 8-jointed, but the other males in both species have these legs 7-jointed.

Males with a comb of fine hairs beneath the last joint of the first three pairs of legs; none of the ensuing legs with velutinous pads such as are found in some species of *Colactis*. Females with combs of hairs beneath the first two pairs of legs.

Males with the first three pairs of legs 7-jointed and also occasionally the seventh pair, the other legs distinctly 8-jointed. Females with only the first two pairs of legs 7-jointed, the other legs 8-jointed.

HEPTIUM CARINELLUM, new species

FIGURES 18, *f-j*; PLATE 4, FIGURES 3, 4

Body long and very slender, loose jointed, the anterior subsegments greatly exposed in all specimens, dorsum distinctly depressed in both sexes; length 25 to 38 mm, width 1.4 to 1.7 mm; number of segments 61 to 70 (pl. 4, figs. 3, 4).

Eye cluster definitely triangular, with 29 to 46 ocelli usually in 6 rows but sometimes in 7 rows; sense organ the size of an ocellus and close to the third and fourth rows of ocelli.

First segment with 10 prominent crests, the inner ones extending almost halfway to the front margin; the third and fourth crests, counting outward from the center of the dorsum, longer than the others; surface in front of the crests not tuberculate; setae in a triarcuate series.

Second segment with the dorsal crests quite thick and strongly elevated, but on the ensuing segments the crests gradually decrease in size and height, and behind the front third of the body they are lower and slenderer than in any of the other American species examined. The secondary crests, although obsolete on the first five segments, are more conspicuous on the segments immediately following than farther back, and are scarcely visible on the last few segments.

Transition to the full number of dorsal crests occurs on segment 19.

Primary crests with the apex almost a straight line when viewed from the side; on each side immediately below the apex is a single series of small, closely placed, circular pits; the lower sides of the primary crests, all the secondary crests, and the rest of the dorsal surface rather coarsely and irregularly reticulated. Behind the secondary crests the surface of the segments faintly descends to a slightly lower level.

Poriferous carinae prominent; in outline slightly irregular, with a broadly rounded anterior corner and an abrupt, nearly right-angled posterior corner (fig. 18, *f*). On the midbody segments the

pore area is short and broadly elliptic and occupies only about the middle half of the outer margin, the rim above and below the impression strongly inflated and with pits similar to those of the primary crests; pore near the center of the impression. Below the poriferous carinae are two primary crests distinctly higher than those of the dorsum and with three to six very tiny denticles along the apex.

Anterior subsegments with the posterior channels notably longer than broad and separated by strongly raised, beaded lines; reticulations in front of the channels rather coarse, the longitudinal lines through them low and fine.

Last segment with 12 setae in addition to the two papillate hairs.

Anal valves evenly convex, the margins moderately thick and elevated. Preanal scale with a broad, shallow, transverse impression near the middle, the lateral tablike processes large and conspicuous.

Each gonopod with the upright piece expanded at the apex on both sides of the pronged arm; the upper, inner expansion with three or four large serrations distally; the lower, lateral expansion extending outward and curving somewhat forward, partially concealing the base of the arm; the outer basal structure with a long and slender fingerlike process adjacent to the upright piece (fig. 18, *g*).

Males with a comb of hairs beneath the outer joint of the first three pairs of legs; these legs and usually the seventh pair 7-jointed (fig. 18, *j*), the other legs 8-jointed (fig. 18, *h*); in one male the seventh legs are definitely 8-jointed (fig. 18, *i*).

Males with the seventh legs greatly reduced in size, their tips sometimes only slightly exceeding the end of the second joint of the adjacent normal legs, but occasionally they reach opposite the end of the fourth joint of these legs; coxa with a long slender spine arising from the inner anterior corner and curving up and back to near the apex of the gonopods; in one specimen one of these spines is shortened and truncated and has a long erect seta continuing from the apex; joint 2 very short; joint 3 long, usually longer than the remaining joints combined, the outer joints being reduced in size and length.

Type.—Male, U.S.N.M. no. 1248.

Remarks.—Numerous specimens collected 2 miles east of "Indian Head", on the Indio-El Centro Road, southern California, February 2, 1929, by Dr. O. F. Cook and W. H. Jenkins. A female appearing to belong to this species was found beneath a stone in Monsen Canyon, Eagle Mountains, near Shavers Well, Riverside County, Calif., April 6, 1930, by H. F. Loomis.

HEPTIUM SCAMILLATUM, new species

FIGURE 18, *a-c*; PLATE 4, FIGURES 5, 6

Diagnosis.—This is a stouter species than *carinellum*. The tuberculate anterior half of segment 1, the very abrupt descent of the surface to a lower level behind the secondary crests, and the transition to the full number of dorsal crests on segment 18 are other characteristics of this species.

Description.—Body not especially slender, distinctly depressed in both sexes; rather close jointed, the anterior subsegments little exposed; length 27 to 34 mm, width 1.8 to 2 mm; number of segments 64 to 69 (pl. 4, figs. 5, 6).

Eye cluster triangular, with 41 to 55 ocelli in 7 or 8 rows; sense organ in front of the fourth and fifth rows of ocelli.

First segment with the inner crests reaching nearly halfway to the anterior margin, the two outer crests on each side longer than the others. Surface in front of the crests finely but distinctly and irregularly tuberculate. Setae arranged in the usual triarcuate series.

Dorsal crests thicker and higher than in *carinellum*, and decreasing in size more slowly toward the back end of the body. Transition to the full number of dorsal crests occurs on segment 18 (fig. 18, *d*).

Primary crests with a distinct, finely dentate apex, directly beneath which on each side is an irregular row of small, almost contiguous, circular pits; the lower sides of the primary crests and the remainder of the subsegment, including the secondary crests, coarsely and very unevenly reticulated. Secondary crests prominent from segment 6 to near the end of the body; entirely lacking or greatly reduced in size on the first five segments; apex of crests irregular in outline. Behind the secondary crests the surface between the primary crests descends very abruptly to a much lower level, which continues to the back margin, giving the segments a distinctly scalloped appearance behind.

Poriferous carinae prominent; outer margin strongly and irregularly serrate; the anterior corner broadly rounded and the posterior corner acute and somewhat produced backward (fig. 18, *e*); rim surrounding the pore area decidedly thickened. On the midbody segments the pore is located a little behind the center of the rather broadly elliptic impression which occupies considerably more of the margin than in *carinellum*. The two primary crests below the poriferous carinae higher than those of the dorsum and with 6 to 10 conspicuous teeth or serrations along the apex.

Anterior subsegments not so greatly exposed as in *carinellum*, and with the posterior channels a little deeper.

Last segment with 14 setae in addition to the two papillate hairs. Preanal scale shorter and less acute than in *carinellum*.

Each gonopod with the inner, apical expansion of the erect piece having only two or three serrations; lower lateral expansion less developed and not curving forward and partially hiding the base of the pronged arm as in *carinellum*; middle structure of the pronged arm ending in 8 to 10 tiny, obliquely radiating spines or points; outer basal structure of the gonopod with a short and stout fingerlike process adjacent to the erect piece (fig. 18, *a, b*).

Seventh legs of the two males more normal in appearance than in *carinellum* but also reduced in size and with the last joint not reaching beyond the end of the fourth joint of the adjacent legs; spine of the coxa shorter than in *carinellum* and not curving forward toward the tips of the gonopods; joint 3 as long as the four remaining outer joints combined (fig. 18, *e*).

Type.—Male, U.S.N.M. no. 1249.

Remarks.—Two males and two females collected between Perris and Elsinore, Calif., February 3, 1929, by Dr. O. F. Cook and W. H. Jenkins.

