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A Revision of the Genus *Thraulodes* (Ephemeroptera: Leptophlebiidae)

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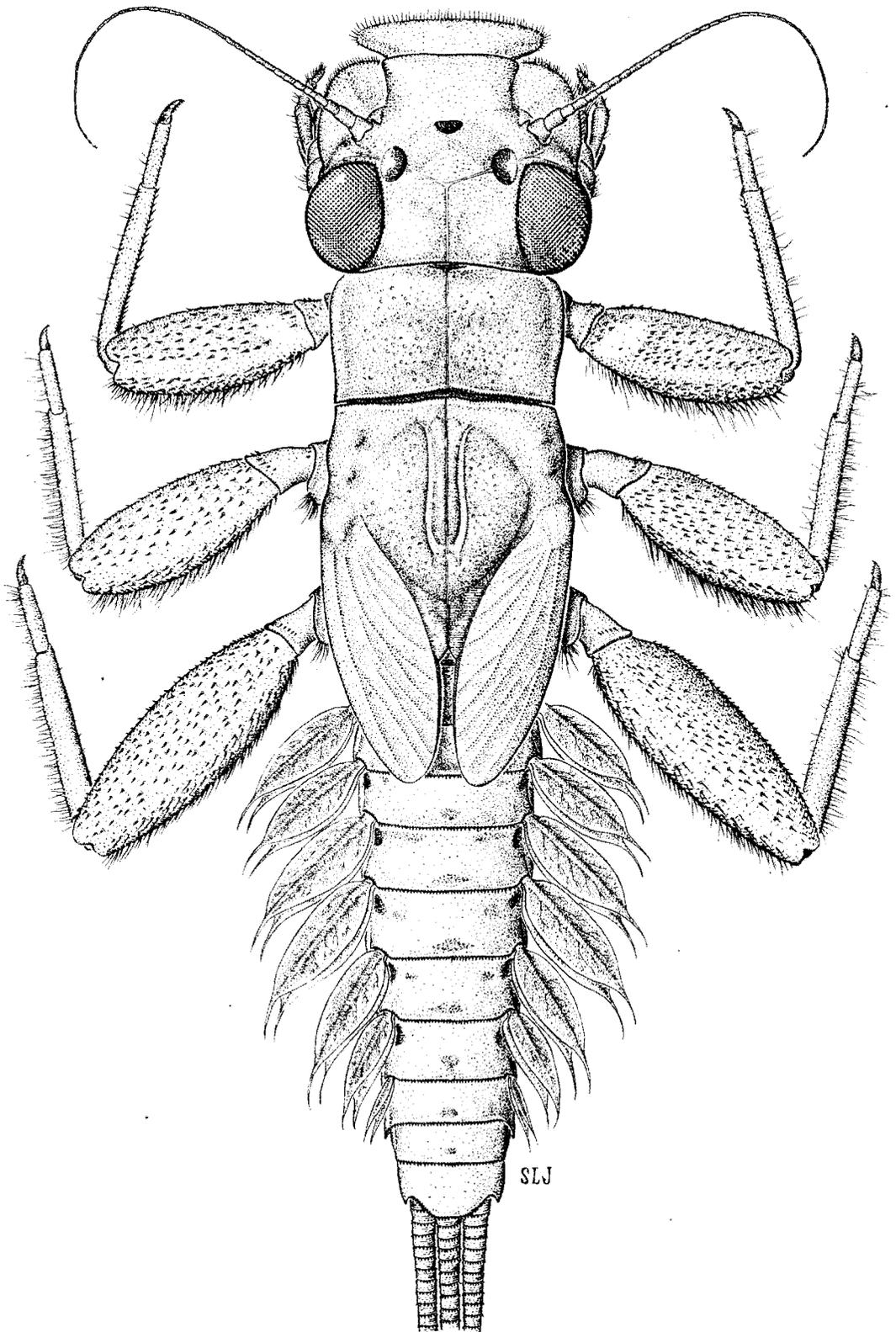


FIG. 1.—*Thraulodes* sp. nymph, Lago Caranageira, Cachimbo, Brazil: 27°11'S, 51°46'W. Drawing by S. L. Jensen.

A Revision of the Genus *Thraulodes* (Ephemeroptera: Leptophlebiidae)¹

JAY R TRAVER AND GEORGE F. EDMUNDS, JR.²

ABSTRACT

The genus *Thraulodes* Ulmer is known only from the New World. Diagnostic features of imagos and nymphs and characters of the ova are discussed in some detail. Of the 30 species which have been placed heretofore in *Thraulodes*, 23 are recognized as valid members of the genus. Eleven new species are described: *T. ephippiatus*, *T. gonzalesi*, *T. itatiajanus*, *T. lunatus*, *T. osiris*, *T. packeri*, *T. papilionis*, *T. regulus*, *T. schlingeri*, *T.*

spangleri, and *T. zonalis*. A key to male imagos and synopses of characters of previously known species are presented. Included are figures of the male genitalia of all species given in the key, abdominal patterns of 9 species and wings of 6 species. Females are too inadequately known and nymphs of too few species have been associated with imagos to make keys of either of these groups practicable.

INTRODUCTION

The known geographical range of the genus *Thraulodes* Ulmer is from Arizona south through Mexico, Central America, and South America into Argentina. Other South American countries from which this genus is known are Colombia, Venezuela, Ecuador, British Guiana, central Peru, southeastern Brazil, Uruguay, and a recent record from southern Chile. Present records indicate that this genus is confined to the New World and is principally Neotropical. It has not yet been reported from the West Indies, although allied genera of the family Leptophlebiidae are known from these islands. To date 30 species have been placed in *Thraulodes*; 23 of these we recognize as belonging to this genus.

Navas described 4 species: *Thraulodes humeralis* from Mexico (1935); *T. irretitus* from Costa Rica (1924); and *T. subfasciatus* (1934), and *T. limbatus* (1936) from Brazil. Genitalia of none of Navas' 4 species are known. We are of the opinion that *subfasciatus* and *limbatus* are more likely to belong to the genus *Ulmeritus* Traver than to *Thraulodes*, hence these two are not considered further in this paper. Not enough description is given of Navas' species from Mexico and Costa Rica to place them with certainty in relation to others of the genus, at least until the genitalia may be figured. In a previous paper by Traver (1946), *T. plicatus* Needham and Murphy (1924) was placed in synonymy with *T. telegraphicus* Needham and Murphy (1924); attention was called to an error in the work of Needham et al. (1935) in which the wings of *T. speciosus* Traver were mislabeled as *Habrophlebia vibrans* Needham, owing to an interchange of numbers (*T. speciosus* is actually Fig. 143, not Fig. 145 as labeled). We have now placed *T. pedregoso* Traver in synonymy with *T. lepidus* Eaton. *T. flavopedes* Spieth (1943) from Surinam was transferred by Traver (1946) first to *Atalophlebioides* Phillips and later to the subgenus *Pseudulmeritus* Traver of the genus *Ulmeritus* when

this subgenus was established by Traver (1959). Of doubtful generic status are the 2 species *vitripennis* Blanchard (1851) from Chile, described in *Ephemera* L.; and *nervosa* Eaton (1892) from Guatemala, described in *Choroterpes* Eaton. On the basis of the fork of MP in the hind wing, Ulmer (1921) placed *vitripennis* in *Thraulodes*; this species is known only from a poorly preserved sub-imago lacking the abdomen, and very inadequately described. At least 7 Neotropical genera are now known in which MP of the hind wing is forked, hence that character alone is insufficient for generic placement; further, up to this time no species positively identifiable as *Thraulodes* has been reported from Chile (we now have a nymphal record from southern Chile). *Choroterpes nervosa* is known from a single female imago, the venation of which is atypical for that genus, having a very large number of cross veins in both wings; Eaton's figure indicates that MP of the hind wing is not forked. Ulmer (1920) placed this species tentatively in *Thraulodes*; it seems to us that it comes closer to *Traverella* Edmunds. We are therefore excluding *vitripennis* and *nervosa* from consideration in *Thraulodes*.

The Ephemeroptera collections at the University of Utah and the personal collections of Jay R Traver contain most of the specimens of *Thraulodes* and other comparative *Leptophlebiidae* used in this study. The principal sources of material used in the Utah collections are the following: W. L. Peters from Peru, Panama, and Jamaica; G. F. Edmunds, Jr., from Chile; purchases from F. Plaumann from Brazil; J. S. Packer from Honduras; G. G. Musser from Costa Rica; and J. Schunke from Peru. Also deposited at Utah are the important collections of J. Illies from Peru and Chile, D.-J. Fittkau from Peru and Brazil, and H. Sioli and W. Sattler from Brazil. Numerous other interested persons have either sold or given smaller collections to the University. The Jay R Traver collection has been acquired from numerous interested persons, but an important collection from Mexico, Costa Rica, and Guatemala was the gift of L. Berner.

Collections where specimens are deposited are indicated by the following abbreviations: personal collection of Jay R Traver (JRT), University of Utah

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(UU), and California Academy of Sciences (CAS). The accounts of previously described species are synopses only.

GENERIC CHARACTERS

Genus *Thraulodes* Ulmer

Thraulodes Ulmer 1919, 33; Ulmer 1921, 263, 1 Fig. *Thraululus laetus* Eaton designated as type of genus. Traver 1935, 551; Traver 1944, 11 (nymph). Demoulin 1955, 16 (nymph).

Type-species: *Thraulodes laetus* (Eaton).

Imago

Generic characters.—Turbinate eyes of male quite large; may appear circular or somewhat oval in outline from dorsal aspect; in the latter instance, long axis of eye transverse, turbinate overlapping lower portions of eye laterally. Turbinate eyes set on rather short stout stalks, usually contiguous apically. Eyes of female smaller, separated by at least 3 diameters of eye. Pronotum well developed, somewhat wider than long, slightly excavated at midline apically. Fore legs of male slightly more than $\frac{3}{4}$ length of fore wings. Claws dissimilar on all tarsi of both sexes. Tarsus I of male shorter than tibia, which in turn is longer than femur; tarsal segments in descending order of length: 2, 3, 4, 5, 1. Third leg of male is always shorter than first, although femur III exceeds femur I in length. Segment 5 of tarsus longest in legs II and III of male, and in all legs of female. Tibia III of male may be slightly shorter, equal to, or slightly longer than femur. Fore leg of female about 0.5 times length of fore wing, which is relatively longer than in male. In female, leg III exceeds leg I in length. Basal costal cross veins in fore wing present or absent. Veins between R_{2+3} and R_{4+5} end free in membrane, forming no triangles. No sag in stem of MA of fore wing, although fork of vein may be slightly asymmetrical. MP_2 frequently ends free in membrane, supported by cross veins, usually just apical of level of fork of Rs and basal of fork of MA; in a few species MP_2 runs directly into MP_1 . First long intercalary behind CuA most commonly runs into CuA but may be connected to it by cross veins; second intercalary associated in similar manner with first. In apical $\frac{1}{3}$ of fore wing, from R_1 as far back as MP_2 , cross veins may be so numerous that majority of cells formed by them almost or fully as wide as long (Fig. 23). In other species, these cells are distinctly longer than wide and cross veins less numerous (Figs. 21, 22). In still others, squarish cells and elongated cells about equal in number (Fig. 20). Costal angulation present on hind wing, seldom really acute; Sc continues a short distance beyond this angulation. Only 3 strong cross veins in hind wings: Sc in its basal $\frac{3}{4}$, R_1 in basal $\frac{1}{3}$ or thereabouts, and strong arched cross vein or veins from costal angulation which meet each of these longitudinals. If 2 such arched cross veins present, as in many species, the more basal is the stronger. MA joins R_1 basal of intersection of latter vein with the strong

arched cross vein. MP of hind wing forked, origin of fork variable in terms of length of fork to length of stem. Region of radial sector only moderately developed. Forceps of male 3-segmented, basal segment longest. Margin of forceps (styliger) plate lying dorsal of forceps and ventrad of penes may appear as a gently curving arc, or may be prolonged into a large domeshaped structure, or a much smaller median conelike area. Each penis lobe bears a slender spearlike process arising dorsally from distal margin, the points of the spears directed inward and toward one another. In most species, subanal plate of female slightly excavated apically on its mid-margin. Terminal filaments of male approximately 3 times body length; of female, about twice as long as body. In both sexes, terminal filament very slightly longer than cerci.

Discussion.—The femora in both sexes often strikingly marked, displaying 1 or more dark transverse bands, 1 of these apical or pre-apical; a second band, if present, is postbasal in position. In certain species the dark apical band is sharply marked off from the basic ground color of the segment by a narrow dark line on its proximal edge, occasionally preceded by a yellow streak. However, femur I may be almost wholly dark, so no distinctive banding is evident. These transverse femoral bands, single or double, may be the principal clues to identifying the females with the male imagos. However, this dark femoral banding is not confined to the genus *Thraulodes*, as rather similar femoral markings occur in certain other Neotropical Leptophlebiidae (e.g., *Atalophlebia* Eaton, *Choroterpes*, *Ulmeritus*, *Neohagenulus* Traver, and some species of *Traverella*).

A comparison of the relative lengths of segments in the fore leg of the male imago in 15 Neotropical genera of this family shows that tarsus I is shorter than tibia I in 7 of these (*Thraulodes*, *Hagenulopsis* Ulmer, *Hermanella* Needham and Murphy, *Homothraululus* Demoulin, *Neohagenulus*, *Traverella*, and *Ulmeritus*); subequal to the tibia in *Borinquena* Traver, *Choroterpes*, and *Hagenulus* Eaton; longer than the tibia in *Atalophlebia*, *Atalonella* Needham and Murphy, *Miroculis* Edmunds, *Deleatidium* Eaton, and *Massartella* Lestage. In all of these genera, tibia I exceeds femur I in length; tarsal segments in descending rank are essentially as in *Thraulodes*. In only 4 of these, *Atalophlebia*, *Deleatidium*, *Atalonella* and *Choroterpes*, leg I of the male is as long as, or very slightly longer than, the fore wing; in *Miroculis*, it is nearly as long.

In species of *Thraulodes* in which cross veins of the fore wings are distinctly darker than the longitudinals, basal costals are generally present; if cross veins other than the humeral are pale, basal costals are either absent or so faint as to be barely visible. In the stigmatic costal area, some cross veins may be anastomosed, but this is not of common occurrence. Thickened and/or margined cross veins are present in some species in which these veins are dark; this

situation occurs mainly along the costal border and in the disk of the wing (Fig. 21). Occasionally faint clouds may be present at or near the bullae or at the fork of MA. Dorsum and pleura of the thorax may show distinctive markings in some species of this genus.

The color patterns of the abdominal terga, and to a lesser extent of the sterna, are frequently distinctive. This fact, in combination with the thoracic and femoral markings and the characteristic long-short-short-long effect presented by markings of the caudal filaments, make the *Thraulodes* male imago an unusually handsome mayfly. These tergal markings we have endeavored to categorize as follows (see Fig. 29, 32): (1) posterior margins of some or all terga may be prominently dark, sometimes for the entire width, again only the mid-dorsal area is so darkened; (2) an oblique lateral streak extends from the posterior margin, arising a short distance above the pleural fold, forward to the anterolateral angle; sometimes this streak is part of a darkened triangle occupying part of the posterolateral area, or again it is a narrower or even a zigzag line; (3) midway spots are of frequent occurrence, located about halfway between the middorsal line and the pleural fold. These may be small or larger dots, distinct spots, or even short transverse dashes. In some previously described species, one of us (Trayer) unfortunately failed to discriminate between submedian and midway spots, leading to some confusion; (4) dots, spots, or blotches on each side of and rather close to the mid-dorsal line are the true submedian spots. A pair of such submedians may sometimes be united at the midline, thus forming 1 type of dorsal markings; (5) dorsolateral markings: these are large blotches or spots, part of each median or submedian in position, the other part lateral; (6) dorsal markings of a somewhat different appearance than listed under (4) extend across the middorsal line from 1 side to the other; these are often saddleshaped; (7) isolated spots are variable in position in different species. One or more may lie dorsad of and parallel to the pleural fold; others may occupy an area occupied by the oblique lateral streak in other species. In fact, any dot or spot not included under the preceding headings constitutes an isolated spot; (8) submedian dashes are short streaks or lines arising from the anterior margin and extending obliquely for a greater or shorter distance on each side of the midline; (9) stigmatic dots are situated on or in the pleural fold; usually single, but occasionally 2 occur, 1 posterior to the other. Ventrally, the ganglionic areas may be colored or darkened, sometimes blackish. In a few species, a row of dots (usually a curved row) is seen on each side of a sternum, 1 dot being either near the antero- or the posterolateral angle, 1 at an edge of the ganglionic patch, 1 or 2 others between these. A dash or line interrupted at each intersegmental area may be present, near or paralleling the pleural fold. Anterior or more often posterior margins of the sterna may be narrowly darkened.

Probably the most characteristic features of the male imago are the genitalia. Forceps consist of a long, frequently slender basal segment which is often distinctly curved, the location of this curvature, in terms of the length of the segment, varying in different species, hence often having specific value. Each of the apical segments, generally but 2, are much shorter than the basal. The forceps plate surrounds the base of the forceps. On its middorsal margin it is generally drawn out into a point, a cone, or a wider obtuse formation; this area, designated the dorsal projection (Fig. 31) may be useful in species differentiation. However, it would appear that in some species the rather narrow cone at the midline is not so heavily chitinized as the remainder of the dorsal plate, seeming in some instances to be attached as a sort of saclike structure to the dorsal surface of the plate's margin. Delicate lines, apparently for attachment, may be seen extending down from 1 or both sides of this cone onto the dorsal plate. Such a thin-walled saclike cone, being less stable than the dorsal margin of the plate, might often be deflated or retracted and hence not appear as a definitive structure. We believe that this phenomenon may account for the fact that such a cone may be evident on the genitalia of some males but apparently absent from others of the same species. It does not follow that all cones in this position are saclike; indeed, some seem to form an unmodifiable chitinized portion of the dorsal plate. The forceps plate may be rounded on its apicolateral margin or sometimes strongly angulate in this area.

The penes differ in appearance according to the aspect from which they are viewed, as well as to the medium in which they are mounted. Lateral margins (in part), spears, recurved folds on the ventral surfaces, and part but not all of the distal margin appear well chitinized (see Fig. 30). However, about midway along the distal margin is a thinner membranous area; slight pressure at this point, or the effect of some mounting media, permits the outer and inner distal tips to become more widely separated than usual because of this weakened area. At its base, each penis lobe appears to enter into and become part of a large ovate chitinized structure, the basal lobe; in a few species this lobe is much reduced in size. Within each basal lobe is a mass of sperms enclosed in a thin sac, presumably the enlarged portion of the ejaculatory duct (cf. Hsu 1935, Pl. 10). The narrow portion of this duct can be traced apicad from the basal lobe as far as the base of the spear; the inner margin of the duct often lies beneath the recurved fold (Fig. 30).

Features of the penes to be noted (Fig. 30) are: (1) apico-lateral area, which may be short and rounded, or considerably prolonged laterally, in which case it often forms an ear; (2) the spears, a very characteristic feature of this genus, may be very long and slender, or rather short and stout, at least in part varying in appearance according to the position when viewed by the observer; some may be straight, others quite strongly curved; these spears arise from the

dorsal side of the distal margin, their points projecting toward one another and toward the mid-axis of the body; (3) a rather membranous structure present on the lateral margin, which may or may not be continuous with or seem to arise from the apicolateral area; this feature, of variable length in different species, we designate the lateral pouch; (4) the recurved folds extend parallel to the inner margin on the ventral surface. Each may be of about equal width throughout, or the outer margin may be produced into an angulate structure, the tip of which may reach or extend beyond the outer margin of the penis. A recurved fold bearing such an angulate feature we term a lapel; (5) lateral spines of variable length, usually rather small, arise from or near the base of the apicolateral area, their points directed laterad or basad. Such spines, as in *T. trijunctus* Banks (Fig. 34), arise from the apical angle of the lateral pouch. Apparent lateral spines in *T. valens* Eaton (Fig. 64) may be merely the more heavily chitinized apical portion of the lateral margin; the thinner more basal portion, in dried specimens, may not be readily discernible.

All drawings of genitalia other than those of the 9 species redrawn from various authors were made with the aid of a camera lucida; all parts of each drawing are at the same magnification.

Even though the penes may differ in appearance under such circumstances as just indicated, such features as lapels, recurved folds, and spears, being sclerotized, would seem likely to be constant. It is possible to place certain species in groups based upon structural features of the penes and occasionally on other genitalic characters, as indicated later.

There appear to be 2 forms of penes, each of which occurs with little or no modification in several species of this genus. One of these we refer to as the *trijunctus* form; to this group belong *T. trijunctus*, *T. centralis* Traver, *T. packeri* n.sp., and *T. osiris*, n.sp., and perhaps also *T. bomplandi* (Esben Petersen), *T. lepidus*, and *T. valens*. Features of this form are: lateral pouch present; inner apical margin not greatly distended; lapels present; apicolateral area may or may not form an earlike process. Here as in the next form the spears are long processes. The second group we term the *speciosus* form; here belong *T. speciosus*, *T. arizonicus* McDunnough, *T. gonzalesi*, n.sp., *T. schlingerii*, n.sp., and perhaps *T. lunatus*, n.sp. The *speciosus* form has the following features: no true lateral pouch, although an extension basad from the earlike area more or less parallels the lateral margin; inner apical margin greatly distended; apicolateral area does form ears; recurved fold does not form lapels. Modifications of each of these forms may be seen in several other species. Resemblances certainly occur between *T. valens* and *T. lepidus*, and between *T. laetus* (Eaton) and *T. traveriae* Thew; perhaps also *T. zonalis* n.sp., and *T. regulus*, n.sp., have much in common. Yet the penes of most of the remaining species, while certainly showing some of the afore-

mentioned features, do not fall easily into allied couplets or larger groups; some indeed appear to be wholly species distinctive. Except in a few instances, such as in *T. lepidus* and *T. valens*, we have been unable to correlate the penis forms with such features as forceps and forceps base, abdominal color patterns, femoral bands, or the presence or absence of darkened cross veins. We have been unable to distinguish useful subgroupings within the genus *Thraulodes* in terms of correlations of observable structures or distinctive patterns of abdominal and femoral markings.

The cerci and middle terminal filament are often conspicuously marked with black bands of variable widths at the apices of the segments, or entire segments may be darkened. In some areas every segment may have an equally wide band apically; more often 1 segment with a wide band alternates with a narrow-banded one, or again 2 or more with narrow bands may be present between a couple of wide-banded segments. This arrangement, which varies in different species, has been the basis of such specific names as *telegraphicus* and *trijunctus*. The posterior margin of the head of the female imago from eyes to midline is slightly emarginate. Thorax often paler than in male but may have similar markings. Venation essentially the same as in the male, although the wings are generally longer and the hind wing may vary slightly in shape; cross veins in the fore wing may be somewhat more numerous than in the male. The legs, although often paler than in the male, have the same pattern of femoral markings, so that this feature is important in trying to relate the 2 sexes. The same basic color pattern may be present as on the abdomen of the male, particularly on the terga, but it is often obscured or partially eliminated by the presence of much brownish, orange, or reddish-gray overlay. Such striking features as dark posterior margins, oblique lateral streaks, and midway spots are evident in most cases, although they are sometimes less distinct than in the male. Much but not all the color of the abdomen is due to the presence of eggs, but even a spent female may have color bands, at least on the basal and middle terga.

Nymph

Generic characters.—Body somewhat flattened, especially head, thorax, and femora, in this respect resembling heptagenine nymphs. Head appears squarish in dorsal aspect, about as wide as long, generally slightly wider than thorax; mandibles form part of dorsal surface of head, tips of maxillary palps are usually visible from above. Labrum somewhat wider than clypeus; its apical margin may be slightly emarginate but never with a deep V-shaped median cleft nor with pronounced median denticles. Mandibles bear a row of hairs along outer margin from near middle of this margin to base of outer incisors; never with tuft of long hairs at midregion. Distal segment of maxillary palp rather short and stout, bearing long hairs. Below level of crown of galea is a row of large pectinate spines, more prominent than those forming crown.

Distal segment of labial palp very short, rather conical, its base narrower than distal margin of preceding segment. Pronotum wide and long, well developed. Femora quite broad, bearing short stout spines dorsally and long hairs interspersed with spines on posterior margins. Tibiae and tarsi slender; outer margins fringed with hairs, among which spines of various lengths are usually present. Claws bear several well developed teeth and a few smaller teeth toward base. Abdomen flattened ventrally, slightly convex dorsally. Very delicate spinules present along posterior margins of terga. Posterolateral spines present on abdominal segments 2-9; short and inconspicuous on 2-3 or 2-4, becoming progressively longer from 4 or 5-9, the latter generally being slightly the longest, although but a trifle longer than 8, which in turn barely exceeds 7 in length. Spine on 9 tends to be appressed against body ventrally. Gills present on segments 1-7, largest on 3 and 4, smallest on 7; bilamellate, similar in shape on all segments; variable in width on different species. Subanal plate of female shallowly excavated apically. In male nymphs, only tips of forceps seen externally; dissection shows long basal segment to be strongly folded on itself in a U-shaped fashion, opening of U toward midline. In all other Neotropical genera of this family that we have studied, forceps relatively much longer and not folded on themselves as in *Thraulodes*. Each penis lobe bears a slender elongate projection. Caudal cerci and terminal filament well developed, the latter slightly longer than cerci.

Discussion.—Clypeus usually very slightly wider at apex than at base. Median ocellus somewhat smaller than laterals. A dark arched band extends between the eyes, encompassing the ocelli. However, similar bands may occur in other genera of this family. Antennae are slender, twice or more the length of the head. Posterior margin of head may be slightly rounded in late-instar males but is almost straight in females. Labrum somewhat wider than clypeus but never as broad as in *Hermanella* and *Traverella*. Its relation to width of head is seen in Fig. 1. In some species it is quite sharply angulate laterally; distance lengthwise apicad. of this angulation equal to approximately 3 units as opposed to 2 units of length below angulation (Fig. 75); a labrum of this type is figured by Demoulin (1955). A second type of labrum, apparently more common than the aforementioned, is figured by Traver (1944)—in the latter type, lateral margins are less sharply angulate and rather rounded; length apicad. of widest point is approximately equal to length below this point (Fig. 74). These 2 principal types are connected by a series of intermediate forms. In either type, or in the connecting forms, the apical margin may be shallowly and rather widely emarginate, with or without 3-5 shallow, wide, rounded crenulations in this area, but never with a deep V- or U-shaped indentation at midcenter, or with upright, pointed denticles. Labrum of the first type may appear almost or entirely straight across the apical margin. In different species, the labrum

varies from about 1.5-3.0 times as wide as long. Those of the first type described usually appear wider than other types (by actual measurement this is not always so). In none of the other Neotropical genera of this family have we found exactly the same type of labrum.

The outer margin of the mandible curves very gently from base of outer incisor to about the middle, this curve becoming more pronounced from midpoint to base. In some species a slight hump is present at or near the midpoint (Fig. 76) but is never as prominent as in some allied genera, and there is never a sharp angulation of this outer margin such as occurs in *Hermanella* and *Traverella*. The most distinctive feature is a series of hairs from midmargin to base of outer incisor; short and single ranked at midpoint, becoming progressively longer until a thick field of long hairs is formed at and preceding the incisor base, where these hairs are often double ranked (Fig. 71, 72, 79). Occasionally there may be a few single isolated hairs basad of the midregion (Fig. 76), but these do not form a continuous series. There is never a tuft of longer hairs at the midregion. This series of hairs, from short at midarea to long and thickly set preceding the incisor base, is so distinctive of this genus that we believe it to be of major importance in distinguishing *Thraulodes* nymphs from those of all other genera, with the possible exception of *Ulmeritus* and several unnamed allies of that genus, all of which differ markedly from *Thraulodes* in the gills and the labrum. The *Ulmeritus*-like nymph figured by Demoulin (1955), as the probable nymph of *Homothraululus*, differs in the presence of a regular series of hairs extending from midregion of outer margin to extreme base of mandible. In *Ulmeritus* and allied genera from British Guiana, Barro Colorado Island (Panama), and from Colombia, several very long isolated hairs occur at the midmargin; few or none are found basad of this area; and a closely set group of long hairs occurs up to or extending onto base of outer incisor, where they are 4- to 5-ranked. In *Ulmeritus*, a series of long hairs intervenes between the long isolated midhairs and the dense meshwork of hairs at incisor base; such is not true of the other allies noted. Two other genera which might be confused with *Thraulodes* in spite of the striking differences in the labrum are the Chilean *Deleatidium* and *Massartellopsis* Demoulin. In each of these genera, a tuft of long hairs is present at the midregion of the outer margin, from which a row of much shorter hairs extends forward but does not reach the base of the outer incisor. There is likewise a difference in relative lengths of the mandible in some species of *Thraulodes*. In what we designate as the long type (Fig. 76), length of mandible below (basad of) anterior articular process on inner margin is about 3 times its length above this process. This long type seems to occur most frequently with, but is not restricted to, those specimens having a slight hump near middle of outer margin. In other specimens, the entire mandible appears short and chunky (Fig. 72).

Intermediate forms connect these 2 types. Both outer and inner incisors are 3-denticulate at apex of the left mandible, while the right mandible has but 2 denticles on the inner incisor. Margins of incisors on both mandibles are frequently serrate or crenulate. Prosthecae on both mandibles are well developed and are essentially similar on each.

The galeal-lacinal region of the maxilla (Fig. 78) is short and stout, about as long as wide, and with the customary dense crown of long hairs mingled with long pectinate spines. The slightly undulating row of large pectinate spines below the level of the crown on the ventral surface varies in number of spines from about 14 to 26 or more, a feature that may be of specific value. The single larger spine at the inner apical margin appears to be inserted at a lower level than the others and may not belong in this series. Maxillary palpi 3-segmented, with basal segment wider at apex than base of second and slightly shorter than second. On second segment, a series of long hairs on the outer margin and several to many on inner margin are present; apical segment conical, commonly 0.5 to 0.6 times the length of second; near but not at the apex it bears a paint-brushlike tuft of long hairs, 1 to several spines on inner margin, and several long hairs on outer margin; ventral surface densely clothed with finer hairs which form a thick feltwork and are often long enough to extend well beyond the margins of the segment. In 1935 Traver wrote: "The outer apical margin of the second joint prolonged into a slender process which lies appressed against the side of the short third joint." Recent studies of many more nymphs than were available at that time indicate that there is indeed a narrow clear area at base of the third segment on the outer side, which is sometimes visible as an independent entity even in instances in which the new segment is forming inside the old one. Although this area does not seem to us now to be an extension of the second segment, we merely report its presence without interpretation. When this clear area is visible (perhaps owing to the position of the palp), the main part of the third segment appears narrower at its base than is the apex of the preceding segment. We have not seen any specimens of *Thraulodes* in which the maxillary palpi might be described as "forceps-like at the apex," as indicated by Burks (1953), nor do we so interpret this structure on the Peruvian nymphs described by Needham and Murphy (1924) and correctly referred to *Thraulodes* as we now recognize that genus.

Hypopharynx (Fig. 73) rather broad. Median lobe of lingua stout, broad, and separated apically by a rather broad V-shaped cleft; lateral lobes moderately slender, upturned, and not appreciably narrowed at the incurved tips, each with only a few short hairs at apex. Superlinguae have bluntly rounded apices and a fringe of long spines along apical margin. Glossae of labium (Fig. 82) straight on inner margins, well rounded on outer; rather long spines are present along apical margin; a curved row of short

spines occurs on dorsal surface and close-set hairs on ventral surface. Paraglossae large and wider than long; a feltwork of thickly set hairs or slender spines occurs along apical area and on inner dorsal portion adjoining glossae; the usual marginal spines, very numerous and quite long, are present. Labial palp (Fig. 83) is 3-segmented; its basal segment shorter than second, a distinctly humped area occurs along outer margin; both margins rather sparsely clothed with rather long spines. Second segment wider at apex than at base; marginal spines very few in number and rather short except near apex, where many longer ones occur. Distal segment short, conical, but slightly rounded at tip; commonly $\frac{1}{2}$ to $\frac{1}{4}$ as long as second segment; a few short spines near inner margin, a few longer ones on outer side. Other allied genera may also have a short distal segment narrower at base than apex of second, so this feature alone is not distinctive of *Thraulodes*, but taken in conjunction with several other characters, principally those of the mandibles and labrum, is useful in identifying this genus.

Thorax somewhat flattened, most noticeable ventrally. Pronotum shallowly excavated on both anterior and posterior margins, lateral margins rounded; widest $\frac{1}{3}$ - $\frac{1}{4}$ the distance backward from the anterolateral angle, narrowest at anterior margin which is somewhat narrower than posterior border. Anterolateral angle rounded, posterolateral angle quite sharply acute. These features are shown in Fig. 1, except for part of the anterior margin which is there partially concealed beneath the head. Likewise shown in the same figure is the U-shaped mark on the mesonotal scutum, 1 arm of the U on each side of the mid-dorsal line, the 2 arms uniting near the posterior portion of the scutum. In *Thraulodes* this U-figure, which may be whitish or yellowish, is usually more prominent than in other related genera, but is not distinct in all specimens.

First leg shortest, third longest. A fringe of rather long slender hairs is present on posterolateral margin of all coxae (Fig. 1). On the trochanters, 2 or more groups of short grooved spines occur on the dorsal surface; 1 row arranged longitudinally on side adjacent to base of femur; another, either transverse or slightly oblique, somewhat parallel to posterior margin; still a third group may be present on some but not all species of nymphs on or near the dorsal margin. Numbers of spines in each group vary in number in different species: e.g. in specimens from Oak Creek Canyon in Arizona, 8-10 on different trochanters in the longitudinal row, 2-8 in transverse row, 2 or 3 on dorsal margin; in *T. lunatus*, 5 in longitudinal row, 2-4 in transverse row; in *T. zonalis* 5-7 longitudinally, 1 only in transverse position. Femora relatively broad for their length. Posterior margin bears a fringe of long hairs closely set; intermingled with these are spines of 2 or 3 different lengths, especially noticeable on femur III. Longest of these spines, which may be $\frac{1}{2}$ to $\frac{3}{4}$ the length

of the hairs, are broadest at base, narrowest just preceding the tip, which latter is generally paler, slightly widened and flattened, giving the apex of the spine a spoonlike or spatulate appearance. Such spatulate spines, while apparently present on all *Thraulodes* nymphs, are not confined to this genus. Some occur also on the femora of nymphs of *Atalophlebia*, *Homothraulidus*, *Traverella* and *Hermanella* of the Leptophlebiidae, and on *Stenonema* Traver of the Heptageniidae. Adjacent to the hind margin are 2 or 3 rows of rather long acute-tipped spines, irregularly arranged. The anterior margin bears several to many shorter spines. On the dorsal surface are many rather short more or less flattened spines, usually blunt-tipped and stubby; some may resemble light bulbs, being wider toward the tip than at the base; a groove extends mid-dorsally on each; variable in number, these are arranged in irregularly parallel rows, but leaving certain areas spineless. Such areas include a relatively large space near the base of femur I, occasionally present also on the other femora; on all femora a longitudinal streak roughly parallel to the position of the main trachea; and a small region near the apex adjacent to the hind margin. Tibiae slightly shorter than femora. Outer margin of tibia bears a fringe of long hairs, often not continuous to the tip, very weakly developed on tibia I. Among these long hairs on tibia III, 1 to several spatulate spines may occur; on the dorsal surface of this segment is a row of short spines adjacent to the outer margin, often similar to those on the dorsal surface of the femur. On the inner margin of all tibiae, several to many rather short acute spines are present, intermingled with a fringe of short hairs on tibia III. At the apex of tibia III, on the ventral surface, a row of rather long grooved spines, acute-tipped, is present on all *Thraulodes* nymphs we have studied. Occasionally these apicals are pinnate, bearing delicate spinelets along each margin; again, if spinelets are present, they are so weak as to be very difficult of detection. Similarly grooved, sometimes pinnate spines occur in single or double rows on the ventral surface of tibia III, frequently not reaching the basal area. Much more readily detectable pinnates in these areas are found on at least 6 other Neotropical genera: *Atalophlebia*, *Ulmeritus*, *Homothraulidus*, *Hagonulopsis*, *Choroterpes*, and *Massartella*. Similar pinnates occur also on some New Zealand and Philippine Island Leptophlebiidae and on the Nearctic leptophlebiid genera *Leptophlebia* Westwood, and *Habrophlebia* Eaton, being exceptionally strong and very numerous in *Leptophlebia*. One or 2 long strong spines are commonly present laterally at or near the apex of tibia III in *Thraulodes*. The presence of these grooved spines ventrally at the apex of tibia III and not on the other tibiae may prove to be a character of the family Leptophlebiidae, inasmuch as such occur, whether pinnate or not, on all other Neotropical and Nearctic genera of this family which we have examined, not only those just named.

Claws denticulate, bearing a variable number of

large teeth and several smaller ones nearer the base. Larger teeth range in number from 5-8, 7 being a fairly common number. Usually that tooth next to the tip of the claw is slightly the longest but is never equal in size to the tip and is but a little longer than the next 2 or 3 following it. On late-instar nymphs it is possible to make out the slight hump on the costal margin of the hind wing bud.

Most of the features just indicated, dealing with structures of the head, legs, and thorax, as well as features of the abdomen, are shown in Fig. 1. Details of mouthparts are illustrated as just indicated.

There seems to be no great difference in the size and/or length of gills on segments 1-4 in most specimens. When gills on 1, 3, 5, and 7 are mounted separately from the body of the nymph, gill 1 often seems a little shorter and smaller than gill 3; yet when these gills are studied while still on the body it is difficult to be certain that this is the case. Demoulin's figure of the Brazilian nymph he studied shows that gill 1 was a little smaller than gill 3; it shows also the decrease in size from 5 to 7 on the gill series. Statements regarding the gills by Traver (1935): "widest on segments one and two," by Traver (1944): "basal and middle gills largest . . . following gills progressively shorter;" and by Burks (1953): "diminishing in size from abdominal segments one to seven," may each be true of certain species of *Thraulodes*. Yet in most of those we have studied, the diminution in size begins after gill 4 and is very gradual and indeed very slight up to gill 7, while gills 3 and 4 seem usually somewhat the largest.

A considerable amount of variation exists in different species of *Thraulodes* nymphs as to both size and shape of gill and length of tip beyond the main body. One type is that shown in Fig. 1 and by Demoulin (1955): tip short to moderate in length; body of gill relatively wide, a few to many lateral branches from main tracheal stem, although in some specimens no lateral branches are apparent. A second type, in marked contrast to the aforementioned, has both upper and lower members of each pair of gills very slender, no lateral branches, tip very short; such a gill is figured by Traver (1944). Several intermediate types may be found if a long series of nymphs is studied (Fig. 77, 80, 81, 83). Gills from 16 specimens were drawn with a camera lucida from slide mounts and measurements were made of the width vs. length of body of gill, and length of tip beyond main gill body vs. length of gill to base of tip. Specimens selected for these measurements are from Arizona, Costa Rica, Brazil, and Chile: these were selected for widest vs. narrowest gills; presence or absence of lateral tracheal branches; and long vs. short tips. While this is admittedly a very small number on which to base any generalization regarding the genus as a whole, we believe that representatives of the principal modifications of gill types are included in this group. Those in which width is about $\frac{2}{3}$ of length are classed as wide; width about $\frac{1}{3}$ of length

as moderate; width $\frac{1}{4}$ of length as moderately narrow; and $\frac{1}{6}$ - $\frac{1}{7}$ as narrow. For length of tip vs. length of gill body, tips about $\frac{1}{2}$ of body are long; $\frac{1}{3}$ of body, moderate; $\frac{1}{4}$ or less, short. This terminology will be employed in descriptions of different species of this genus.

Ova from black-winged, fully mature nymphs agree with those from adults in the few instances in which both nymphs and adults of the same species were available.

Ova

Ova were studied from adults preserved in alcohol, as no fresh material was available. Three different methods were employed: (1) temporary mounts in alcohol; (2) ova in alcoholic or water mounts crushed slightly by pressure and rotation of cover slip, allowed to dry, then mounted in Hoyer's medium or in CMC-S, a TURTOX stain-mountant; (3) ova mounted directly in CMC-S. Outline sketches of entire ova could be made under moderately high power with the aid of a camera lucida using either method (1) or (3); details of chorionic structure were obtainable by the use of methods (2) and (3) using higher magnifications. A relatively permanent mount could be made with method (2) or (3) by ringing the cover slip after the slide had dried. Method (2) was of value because the chorion was thus separated from the contents of the ovum, avoiding the possibility of confusing underlying structures with those of the surface, but in Hoyer's the crushed ova were so pale as to make study difficult. In a few species only did details of the chorion show by the use of method (1). Method (3) alone was satisfactory in some instances, but more often it was desirable to supplement it with (2); thus methods (2) and (3) served as checks against one another. This was doubly valuable when the dried slides of method (2) were mounted in CMC-S rather than in Hoyer's.

Ova of most species of *Thraulodes* studied are somewhat ellipsoidal, a few being barrelshaped or even oval in lateral aspect; viewed from the ends some are hexagonal or pentagonal in outline. Coiled threads within and part of the surface plaques seem to be a constant feature in all species of this genus we have studied. Methods (2) and (3) caused the release of some to many of these threads, which stood out like coiled watch-springs; in 1 species at least, the threads are long, less tightly coiled filaments appearing to end in very small knoblike structures. Lengths of ova varied in different species from 1.4 to 1.6 times the widths, 1.5 being of most frequent occurrence.

Three principal types of chorionic structures occur among the specimens studied. In the first type, the surface of the chorion is divided into hexagonal or pentagonal blocks, set close to one another but not in direct contact; within each block is a circular plaque containing a coiled thread. Outlines of these blocks may be well defined and clearly evident; to this

category belong *T. packeri* (Fig. 61); 3 undetermined species of nymphs from Brazil (Puirras River, Bocaina; and Forte Brook, Nova Teutonia); 1 undetermined nymph from Chile (Chorrilla Tres Puentes, Magallanes); and another from Costa Rica (Cartago). In others the outlines of the blocks are faint and indistinct. Here belong certain nymphs from Brazil (Nova Teutonia); undetermined nymphs from Mexico (Metlac and Tenndido River), and 1 ♀ from Metlac. In the second type the surface is almost completely occupied by irregularly oval or circular plaques rather closely packed; within each plaque can be seen a series of concentric rings representing the coiled threads; it is this type from which the long filaments issue on stimulation. The only species of this type which we have observed is *T. paysandensis* Traver (Fig. 68). In neither of the aforementioned types are additional smaller plaques present in spaces between the large ones. However, in the third type, irregularly circular, pentagonal, or oval plaques are more widely separated, leaving considerable space between them. In the first division of this type a series of small but clearly delineated rounded plaques surround each large plaque, arranged singly like beads in a necklace, generally in contact with the surface of the larger plaque; these small plaques vary in number from 8 to 11, may not form a complete ring, and their proximity causes the larger plaques to appear slightly angulate in outline. To this division belong *T. traverac* (Fig. 69), *T. gonzalesi*, nymphs tentatively assigned to *T. arizonicus* and *T. lunatus*, and several undetermined species of adults from Uruguay and Argentina. Allied to the aforementioned are ova of the second division, in which even smaller and more numerous but still discrete plaques occur between the large plaques, again seeming to surround the large plaques but not in contact with them. To this group belong *T. schlinger* (Fig. 54), *T. spangleri*, n.sp., and specimens of *T. daidaleus* Thew, from Uruguay (Treinta y Tres). Ova of *T. speciosus* and an undetermined species from Mexico (East Morelia) are very similar to those of the second division, but have in addition several small plaques between those surrounding the large plaques; in the Mexican ova the large plaques are quite numerous and quite close together (Fig. 70). In a third division the large plaques seem to be surrounded by a faint halo of very minute rods or granules, with an occasional small round plaque outside the halo; here belong *T. trijunctus*, an undetermined species from Colombia (Caquesa), and nymphs of *T. zonalis*. Still a fourth division is represented by *T. telegraphicus* (Fig. 60) and an undetermined species from Colombia (Villavicencia); here the halo is absent, but small round plaques between the large plaques may occur as in *T. trijunctus*. The average number of large plaques visible on the surface of the ova varies considerably, as can be seen by the figures just listed, but seems relatively constant within a certain range in any given species.

It is unfortunate that we have been limited in the availability of unspent females of determined species

of *Thraulodes*, having representatives of only 7 species known to be associated with named males, plus 2 others believed to be correctly associated; hence the tentative remarks that follow are based on rather meager data. From such information as we have, it would appear that the ova will be of but limited value in determining relationships within the genus but may well serve to separate sibling species therein. Smith (1935), in his study of the North American representatives of the large genus *Ephemerella* Walsh, observed but 3 types of chorionic patterns in that genus, which has since been subdivided into 8 subgenera by Edmunds (1959). Ova of Smith's second group are of those species now included in the subgenus *Euryophella* Tiensuu; in his third group was the single species *E. maculata*, now included with many others in the subgenus *Ephemerella*; while his first group included species now placed in 6 different subgenera. In *Thraulodes* we note that *T. gonzalesi*, *T. speciosus*, *T. schlingeri*, *T. arizonicus*, and *T. lunatus* have rather similar penes. Ova from females of *T. gonzalesi* and from nymphs believed to be *T. arizonicus* and *T. lunatus* fall into the first division of type 3 of the ova, as just listed; ova of *T. schlingeri* are of the second division of this type, those of *T. speciosus* a modification of the second division. However, *T. traverae*, with ova of the first division, has penes which do not accord well with those of the other species mentioned. *T. packeri* and *T. trijunctus* have rather similar penes, but the ova of these species differ markedly. The distinctly different types of ova serve as a means of separation of *T. packeri* from *T. spangleri*, species which have much in common as to venational characters and abdominal markings. Until we know more of variations of chorionic patterns to be expected in other Neotropical genera of the family Leptophlebiidae, we cannot be certain whether the ova of *Thraulodes* will serve as a positive means of distinguishing members of this genus from those of other allied genera.

SYSTEMATICS

The following key to male imagos of the genus *Thraulodes* may serve to distinguish the 31 species treated herein when used in conjunction with the genitalic figures, and those of the abdominal patterns given for some of the species. Longer series of adults will be necessary before a completely reliable key can be made. Omitted from the key are *T. colombiac* (Walker), which is known only from a female subimago, and *T. humeralis* and *T. irretitus*, both of which are inadequately described and lack genitalic figures. As the types of several species available to us for study are much faded from long immersion in alcohol, and as there are several others the types of which we have not seen, the original descriptions have been utilized in such cases as a basis for the key; we realize that our interpretations of some parts of these descriptions may be in error. We have not seen specimens of the following species included in the key: *T. bomplandi*, *T. hilaris* (Eaton), *T. mexicanus* (Eaton), *T.*

valens, and *T. venezuelana* Ulmer. Additional notes on all the previously described species are included under the synopses immediately following the key.

KEY TO MALE IMAGOS OF *THRAULODES*

1. Abdominal sterna mainly blackish brown, paler only on anterior margins of 4-6; terga 2-3 and 7-10 brown, 4-6 pale with dark oblique lateral streaks; genitalia similar to Fig. 44 *brunneus* Koss
 Not as above; abdominal sterna, if mainly dark, are concolorous with terga 2-10 or 3-10; tergal markings and genitalia variable 2
2. Dorsum of abdomen brownish, no essential difference between terga 2-6 or 3-6, and 7-10; sterna variable in color 3
 Dorsum and venter of abdominal segments 2-5 or 3-5 pale whitish or yellowish, 7-10 or 8-10 darker; tergum 6 variable in color 7
3. Abdominal sterna paler than terga; tergal markings variable 4
 Abdominal sterna and terga concolorous, terga with dark posterior margins and midway spots 5
4. Abdominal terga light raw umber brown, paler laterally; tergal markings consist of dark oblique lateral streaks and dark posterior margins; cross veins of fore wings dark, basal costal cross veins present; all segments of caudal filaments darker at joinings; genitalia as in Fig. 64 (after Kimmins) *valens* (Eaton)
 Abdominal terga with dark transverse bands, darkest on 1-4, 5 slightly paler; posterior margins pale, no oblique lateral streaks; cross veins of fore wings pale, no basal costal cross veins; only the basal segments of caudal filaments darker at joinings, all others pale; genitalia as in Fig. 42 *regulus*, n. sp.
5. Oblique lateral streaks present; cross veins of fore wings dark, basal costal cross veins present; genitalia as in Fig. 38 *bilaroides* Traver
 No such oblique lateral streaks; cross veins variable 6
6. Large dorsolateral purplish spot each side of tergum 7; apical portions of costal and subcostal spaces of fore wing brown-tinged; all femora twice-banded; cross veins of fore wings dark, a few weak basal costal cross veins present; genitalia as in Fig. 28 (after Ulmer) *venezuelana* Ulmer
 No such dorsolateral spot in tergum 7; costal and subcostal spaces in fore wing not brown-tinged; only femur III twice-banded; cross veins pale except those in stigmatic area of fore wing, no basal costal cross veins; wing as in Fig. 25; genitalia as in Fig. 41 *zonalis* n. sp.
7. Tergum 6 concolorous with 7, 7-8, or 7-10; midway spots present, may be very faint 8
 Tergum 6 concolorous with preceding terga 2-5 or 3-5; midway spots variable 9
8. Turbinate eyes of moderate size, circular; abdominal terga 6 and 7 with large orange brown blotches, leaving much of lateral areas pale; 2-5 white, posterior margins black, prominent black midway spots; cross veins of fore wings orange, costal angulation of hind wing well apicad of mid-length (Fig. 22); abdominal pattern as in Fig. 12 and 13; genitalia as in Fig. 37 *ephippiatus*, n. sp.

- Turbinate eyes very large, transversely oval; abdominal terga 6 and 7 quite bright red, pale lateral areas more limited; dorsum of terga 2-5 distinctly tinged with pale reddish to olive brown; midway spots appear as transverse dashes; cross veins of both wings pale; costal angulation of hind wing basad of mid-length; genitalia as in Fig. 45. *schlingeri*, n. sp.
9. Curved row of small dark dots, usually 3 on each side, on abdominal sterna; midway and isolated spots and dorsal markings present on terga; segments 2-6 transparent whitish or yellowish. 10
Ventral markings, if present, not as above; tergal markings variable 12
10. Abdominal segments 2-6 whitish; terga 2-7 with U-shaped dark reddish brown markings each side of midline and more or less parallel to it, may be joined posteriorly; small midway spots; 2 smaller dark dots parallel to pleural fold, dark dash along pleural fold; femur III twice-banded; genitalia as in Fig. 65 (after Esben Petersen) *bomplandi* (Esben Petersen)
Tergal markings not as above; femur III once-banded 11
11. Abdominal segments 2-6 pale yellowish; midway spots on terga 2-4, replaced on 5 and 6 by a row of small dots near anterior margin, extending to dorsum; dark dot below midways on 3-6; dark red dorsal triangle on tergum 7, rose colored triangles on 8-10, posterior angles chalky white; wing as in Fig. 24; genitalia as in Fig. 43. *itatiajanus*, n. sp.
Abdominal segments 2-6 whitish; posterolateral median black spot, midway black spot, and a smaller one laterad of it, on each of terga 2-6; terga 7-10 reddish with black median streak and lateral spot; genitalia as in Fig. 26 (after Thew) *davidaleus* Thew
12. Abdominal segments 2-6 white; tergal markings consist only of fuscous posterior margins (by original description, see note under synopses); cross veins of both wings pale, no basal costal cross veins in fore wings; genitalia as in Fig. 62 (after Demoulin) *mexicanus* (Eaton)
Tergal markings more extensive, not as above; cross veins variable 13
13. Markings on abdominal terga consist of oblique lateral streaks on 2-6 or 3-6, and dark posterior margins; stigmatic dots may also be present; cross veins of fore wings darkened, basal costal cross veins present. 14
Markings on abdominal terga 2-6 or 3-6 not confined to the above; may include midway spots, isolated spots, dorsal or dorsolateral blotches or spots, some of which form distinctive patterns; basal costal cross veins of fore wing present or absent; cross veins variable in color 18
14. Subcostal space of fore wing distinctly and deeply tinged with amber-yellow or orange; abdominal pattern as in Fig. 18 and 19 (as *pedregoso*); genitalia as in Fig. 27 (after Kimmins) *lepidus* (Eaton)
Subcostal space of fore wing not as above; wing membrane may be faintly yellow-tinged, but this color not deeper in aforementioned space . . . 15
15. Basal segment of forceps slender, strongly angu- late; dorsal projection of forceps base oblong-obtuse; lapels present on penes 16
Basal segment of forceps stouter, not strongly angulate; dorsal projection of forceps base a low cone; no lapels on penes. 17
16. Angulation of basal segment of forceps at mid-length of that segment; dorsal projection of forceps base large, extends beyond middle of basal segment of forceps; apicolateral angles of penes not prolonged into ears; hind femora twice banded; genitalia as in Fig. 67 (after Kimmins) *bilaris* (Eaton)
Angulation of basal segment of forceps at $\frac{1}{3}$ from base; dorsal projection of forceps base shorter; apicolateral angles of penes prolonged into ears; hind femora once-banded; genitalia as in Fig. 53. *spangleri*, n. sp.
17. Abdominal terga 1-2 and 7-10 reddish brown, 4-6 yellowish; many cross veins in fore wing margined, especially in basal costal and subcostal spaces and in 2 rows across base of disk; genitalia as in Fig. 44. *speciosus* Traver
Abdominal terga 2-6 hyaline, whitish or very pale yellowish, 7 and 9-10 reddish brown, 8 rather creamy; no cross veins in fore wing margined, although a few along the costal margin and in disk are heavier than others (see synopses); genitalia as in Fig. 51. *arizonicus* McDunnough
18. Dorsal and/or dorsolateral dark markings present on some or all of abdominal terga 2-6; if dorsolateral, these generally coalesce or are joined to submedian dashes on at least some terga to form dorsal spots. 19
Without such dorsal and/or dorsolateral spots; if small triangular spots occur near each side of midline, these do not coalesce on any tergum to form dorsal spots. 26
19. Midway spots present, generally as distinct and separate entities; if seeming to be part of dorsolateral spots, are of a different color. 20
Midway spots absent, or if faintly indicated as part of dorsolateral markings are of same color 24
20. Oblique lateral streaks present on abdominal terga 21
No such oblique lateral streaks on abdominal terga 22
21. Cross veins in fore wings dark; femur III twice-banded; wings as in Fig. 21; abdominal pattern as in Fig. 8, 9; genitalia as in Fig. 31 *packeri*, n. sp.
Cross veins in fore wings pale; femur III unmarked; abdominal pattern as in Fig. 14, 15; genitalia as in Fig. 49. *prolongatus* Traver
22. Only other markings on abdominal terga 2-6 are purplish brown median triangles; cross veins in fore wings dark; fore wing 14 mm; genitalia as in Fig. 56. *furficulus* Traver
Isolated spots also present on abdominal terga 2-6; cross veins in fore wings pale; fore wing about 8 mm. 23
23. Wide reddish brown bands dorsally at posterior margins of terga 2-6; reddish median triangle on anterior margins of 5-6; curved dark mark above pleural fold; abdominal pattern as in Fig. 4, 5; genitalia as in Fig. 46. *paysandensis* Traver
Submedian dark brown spots joined narrowly on dorsum at posterior margins on at least some of abdominal terga 2-6; no such triangles anteriorly, no such curved dark line above pleural

- fold; abdominal pattern as in Fig. 2, 3 (from nearly mature subimago); genitalia as in Fig. 66
 *traveræ* Thew
24. Lunate lateral patches on abdominal terga 2-6, joined dorsally on 2-3; several cross veins in fore wing orange, some are thickened, basal costal cross veins present; abdominal pattern as in Fig. 6, 7; genitalia as in Fig. 35..... *lunatus*, n. sp.
 Tergal markings not as above; cross veins in fore wing pale, no basal costal cross veins..... 25
25. Very pale gray butterfly-shaped blotches on abdominal terga 3-6; faintly indicated on 2 and 7, joined posteriorly on 6-7; very narrow dark line each side of pale mid-line; abdominal pattern as in Fig. 16, 17; genitalia as in Fig. 55
 *papilionis*, n. sp.
 Very dark gray dorsolateral blotches on abdominal terga 3-6; very dark oblique submedian dashes, to which lateral blotches are joined posteriorly on 6-7; posterior margins of terga 2-7 pale; wings as in Fig. 23; abdominal pattern as in Fig. 10, 11; genitalia as in Fig. 39
 *gonzalesi*, n. sp.
26. Isolated spots present in addition to midway spots and stigmatic dots, on abdominal terga..... 27
 Only midway spots and stigmatic dots on abdominal terga..... 28
27. Femora twice-banded; "series of small triangular spots on each side of dorsum" (Eaton) of abdominal terga 2-6; posterior margin of tergum 8 and triangular spot from it to base of 7, yellow; genitalia as in Fig. 63 (after Eaton) *laetus* (Eaton)
 Femora once-banded; abdominal tergum 6 with submedian brown spots on anterior margin; posterior margin of 6 and anterior margins of terga 7-8 narrowly purplish brown; genitalia as in Fig. 33..... *ulmeri* Edmunds
28. Fore wing 10 mm long; all femora once-banded; abdominal terga 7-10 "rich chestnut brown bordered laterally with whitish" (Needham and Murphy 1924); cross veins of fore wings yellowish; genitalia as in Fig. 40.....
 *telegraphicus* Needham and Murphy
 Fore wing not over 8 mm long; femoral bands, cross veins of fore wing, and abdominal terga 7-10 variable..... 29
29. Femur I twice-banded; abdominal tergum 7 "dark brown in middle, pale each end and at the side, eighth with median dark line and basal band, ninth rather darker with median stripe" (Banks 1918-19); cross veins of fore wings pale brown; venation as in Fig. 20; genitalia as in Fig. 34
 *trijunctus* (Banks)
 Femora once-banded; abdominal terga 7-10 not as above; cross veins of fore wings pale yellowish or whitish; abdominal segments 2-6 shaded with pale reddish brown..... 30
30. Abdominal segments 2-6 yellowish; reddish to yellowish brown shading on terga most distinct on 6, forming lateral patches in sterna; ganglionic areas of sterna not darkened; cross veins in fore wings in 7-8 irregular rows apicad of bulla; stigmatic dots on abdominal segments very small; recurved folds on penes form lapels; genitalia as in Fig. 50..... *centralis* Trayer
 Abdominal segments 2-6 whitish; reddish shading

on abdominal terga 2-6 not more distinct on 6 than on others; sterna not as above, 7th ganglion darkened; cross veins in fore wings in 4-5 rows; stigmatic dots large, prominent; no lapel formed on penes; genitalia as in Fig. 36..... *osiris* n. sp.

Thraulodes arizonicus McDunnough
 (Fig. 51)

Thraulodes arizonicus McDunnough 1942, 117.

Femora once-banded; basal costal cross veins present, dark; abdominal segments 2-6 whitish, terga with dark posterior margins and oblique streaks; genitalia of *speciosus* type.

Male imago.—Fore wing 7.5 mm. Head pale creamy. Dorsum of thorax light reddish brown with creamy markings; thoracic sternum creamy white except large reddish brown patch on mesosternum. Fore femur blackish brown, reddish brown at each end; other femora yellowish, reddish brown pre-apical bands, darker on proximal edges; tibiae and tarsi yellowish, black apical band on tibia I, claws and distal tarsal segments dusky. Humeral cross vein in fore wing black, brown cloud on side away from base; veins faintly brown, cross veins deeper brown than longitudinal, rather sparse; some in basal costal space and in following 2 spaces and a few in wing disk thickened but none are margined. Abdominal segments 2-6 transparent whitish to yellowish; posterior margins narrowly dark brown; dark brown oblique lateral streaks on 2-5, fainter on 6; tiny stigmatic dots present. Terga 7 and 9 reddish brown, 7 with yellowish posterolateral triangle; 8 slightly creamy, brown line near anterior margin; 10 creamy apically and laterally. Sterna 7-9 creamy, brownish shading on 9. Ganglionic areas darkened. Caudal filaments whitish at base, becoming dark gray apically, paler gray between base and tip; dark apical margins of segments near base alternately narrow and wide, elsewhere all margins darkened. Genitalia very similar to *T. speciosus*; see Fig. 51.

Nymph.—Nymphs which may be of this species were taken at Oak Creek Canyon, Sedona, Coconino Co., Arizona, 23-VI-51 (UU). Male nymph: body 9 mm. Turbinate eyes bright red-brown; head reddish brown; scape of antenna pale red-brown, pedicel pale, filament amber-tinged. Basal 1/2 of labrum yellowish. Pronotum red-brown, black penciling laterally; mesonotum light red-brown, V-shaped yellow submedian lines, narrow black penciling anterolaterally, antero-median lobe yellow; a few black lines on pleura above leg bases. Coxa and trochanter red-brown. Femur I with 2 yellowish bands, 1 each side of brown transverse one; blackish midspot just beyond base; quite bright red-brown band beyond middle, tip dark brown. Tibia I red-brown; narrow black band near tip; tarsus red-brown. Femur II lacks black postbasal spot, basal pale area narrower; tibia and tarsus pale yellowish to reddish brown; leg III missing. Venter of thorax pale except 2 brown longitudinal streaks on posterior half of mesosternum. Terga 1-4 yellowish; 5 red-tinged except yellow triangle at mid-posterior

margin; 6 and 7 largely dark red-brown; 8 red-brown except yellow in midarea; 9 widely yellow medially, lateral areas red-brown; 10 dark red-brown, anterior margin yellow. Terga 2-5 with grayish oblique lateral streaks, rather diffuse; 5-9 with very narrow black posterior margins. Sterna yellow; ganglia on 7 blackish, on 6 faintly gray; small brown spot medially at joining of 8 and 9; some gray shading laterally on 2-8, on 2 each side of midline. Gills dark gray in middle, margins widely pale; numerous tracheal branches; moderate in width, narrowed in apical $\frac{1}{3}$; tip short. Caudal filaments dark red-brown. Female nymph: head, thorax, and legs as in male, but paler. Terga of abdomen quite bright red-brown with yellowish tinge; 9 pale in midarea; 9 and 10 narrowly black on posterior margins. Oblique lateral streaks barely indicated. Labrum widest just basad of middle; midapical margin slightly emarginate, with 3 low crenulations; paler along lateral margins. No hump on outer margin of mandible; 12-15 low spines below crown of maxilla. Tibia III with a spine each side at apex; 5 pinnate spines on ventral-apical margin; single row of such spines on ventral surface. Tarsus II with 6 lateral spines on 1 margin, 1 on other margin among the row of long hairs.

Female imago.—Unknown.

Type-locality.—Oak Creek Canyon, near Flagstaff, Ariz.

Type.—No. 5322 in Canadian National Museum, Ottawa.

Material.—McDunnough described this species from 7 ♂ imagos. We have examined 2 of the paratype ♂ from this collection, and added to or modified the original description from our study of these.

Discussion.—This species is close to *T. speciosus*, but differs in the following characters: no cross veins in fore wing margined; basal costals only a trifle thicker than stigmatics; abdominal terga 2 and 3 pale, segments 2-6 not so pronounced yellow; tergum 8 slightly creamy; distal tarsal segment and claws dusky but not as dark; fewer black pencilings on mesothorax.

Thraulodes bomplandi (Esben Petersen)

(Fig. 65)

Thraulodes bomplandi Esben Petersen 1912, 336, 2 fig.

Thraulodes bomplandi Ulmer 1919, 34; Ulmer 1920, 116; Needham and Murphy 1924, 41; Ulmer 1943, 24, 2 fig.; Traver 1959, 1 fig. (misidentified, see *daidaleus*).

Femora twice-banded; a few weak basal costals; abdominal segments whitish; dorsal, submedian, mid-way and isolated spots on terga present, row of small dark dots on sterna; genitalia as in Fig. 65, redrawn after Esben Petersen.

Male imago.—Fore wing 8 mm. Thorax light brown, pronotum blackish medially and laterally. Femur III yellowish white, reddish median and apical bands, tibia yellowish white; all other legs missing. Wings hyaline; longitudinal veins of fore wing yellowish white, cross veins paler, the latter more numerous (per Ulmer 1943) than in Esben Petersen's figure; a few weak basal costals present, several veins in each of next 3 spaces near base; costal and subcostal spaces yellow-tinged. Humeral cross vein and wing base adjoining it on both wings dark reddish brown by original description (blackish violet, per Ulmer 1943). Abdominal segments 2-6 whitish, transparent. Terga marked in reddish brown as follows: U-shaped figure on dorsum; midway spots; 2 other small dots laterad of midways parallel to pleural fold; stigmatic dots; longitudinal streak parallel to pleural fold (see Fig. 47, Ulmer 1943). Segments 7-10 yellowish red, 7 and 8 paler. Sterna each with 2 small dark dots each side of midline, larger dot in postero-lateral angle. Caudal filaments missing. Genitalia as in Fig. 65.

Female imago and nymph.—Unknown.

Type-locality.—Misiones, Bompland, Argentina.

Location of type.—Esben Petersen Collection.

Material.—Species described by Esben Petersen from a single male imago.

Discussion.—Only 2 other species in this genus having similar ventral markings are known—*T. daidaleus* and *T. itatiajanus*. The former more closely resembles *T. bomplandi* in genitalic features, but both *T. daidaleus* and *T. itatiajanus* differ from *T. bomplandi* in tergal markings.

Thraulodes brunneus Koss

Thraulodes brunneus Koss, 1966, 91, 7 fig.

Femora once-banded; cross veins dark, basal costal cross veins present; terga with dark posterior margins; extensive dark oblique lateral streaks on terga 4-6; abdominal sterna almost completely dark; genitalia of the *speciosus* type.

Male imago.—Body 8.5 mm; fore wing 9 mm. Head pale. Pronotum with black anterior and lateral margins and midstripe. Meso- and metanota pale yellowish brown; tip of mesoscutellum dark brown. Propleuron almost wholly black; black markings encircling coxae II, above coxae III, and between coxae II and III. Prosternum purplish; meso- and metasterna pale yellowish brown. Legs I and III missing; femora of leg II once-banded. Cross veins of fore wing dark; basal costal cross veins present; venation much as in *T. speciosus*. Abdominal terga 2-3 dark, tergum 2 with 3 pale spots on anterior margin, 2 such pale spots on tergum 3; terga 4-6 pale with extensive dark oblique lateral streaks; posterior margins of all terga narrowly darkened. Terga 7-10 much as in *T. speciosus*, no creamy margins on 7 and 8. Abdominal sterna almost completely blackish brown, paler only on anterior margins of sterna 4-6. Caudal filaments missing. Genitalia very similar to those of *T. speciosus* (Fig. 44).

Female and nymph.—Unknown.

Type-locality.—Near Silver City, New Mexico.

Location of type.—In collection of the University of Utah.

Material.—*T. brunneus* was described from a single male imago.

Discussion.—This species is allied to both *T. arizonicus* and *T. speciosus* but differs from both by the very dark abdominal sterna and the more extensive dark oblique lateral streaks on terga 4–6. Frons of head pale, as in *T. arizonicus*. Venation much as in *T. speciosus*.

Thraulodes centralis Traver

(Fig. 50)

Thraulodes centralis Traver 1946, 432, 3 fig.

Femora once-banded; no basal costals; abdominal segments 2–6 whitish or yellowish, heavily shaded with yellowish to reddish brown; midway spots present; genitalia of the *trijunctus* type.

Male imago.—Fore wing 7–8 mm. Thorax blackish red-brown, mesonotal scutellum paler. All legs missing from imagos, those of subimago yellowish orange. Fore femur with small dark spot near middle, black spot pre-apically, both margins narrowly black; dusky pre-apical band in tibia, tarsus unmarked. Femora II and III lack the median dark spot, apical band present; tibiae and tarsi unmarked. Wing membrane very faintly yellow-tinged; longitudinal veins of fore wing very pale amber; cross veins moderately numerous, indistinct; no basal costals; humeral cross vein purplish black; 7 or 8 stigmatic veins, simple, aslant; stigmatic area opaque whitish. Costal angulation of hind wing rather acute. Segments 1 and 8–10 dark reddish brown, 7 paler; 2–6 originally whitish on holotype, yellowish on 1 paratype, pale red-brown on other paratype; midway spots pale grayish, present on terga 2–5; small stigmatic dots on 2–6; dorsum of terga and most of sterna rather heavily shaded with bands of yellowish to reddish brown, most evident on tergum 6; mid-dorsal and midventral lines pale; anterolateral angles of sterna pale; sterna 7–9 dark red-brown. The dark paratype would key to the group containing *hilaroides*, etc., but the genitalia place it in this species; its abdomen contains a dark mass, not a parasite. Caudal filaments white; near base, white segments alternate with black ones, elsewhere wide black segment, then 3 pale ones, first of these narrowly black at joining. Genitalia as in Fig. 50.

Female imago and nymph.—Unknown.

Type-locality.—Rio Pedregoso, Costa Rica.

Location of type.—Private collection of J. R. Traver.

Material.—Species described from 3 ♂ imagos and 1 subimago ♂.

Discussion.—The nearest ally of *T. centralis* appears to be *T. osiris*, but it differs in the following characters: the shading on abdominal segments is more yellowish than reddish brown and most distinct on tergum 6; cross veins in the fore wing are more

numerous, forming 7–8 irregular rows apical of the bullae; and the ganglionic areas are not appreciably darkened. The abdomen is rather yellowish than whitish as in *T. osiris*; the stigmatic dots are quite small, but large and prominent in *T. osiris*.

Thraulodes colombiae (Walker)

Ephemera colombiae Walker 1853, 537.

Palingenia colombiae Hagen 1861, 304.

Leptophlebia colombiae Eaton 1871, 84.

Adenophlebia colombiae Eaton 1881, 194.

Thraulodes colombiae Eaton 1884, 110.

Thraulodes colombiae Ulmer 1919, 34; Ulmer 1920, 116; Kimmins 1960, 302.

Femora not banded; 1 or 2 very faint basal costals; some cross veins dark; costal angulation of hind wing far apical of midlength; abdominal terga reddish yellow, dark posterior margins and broad oblique lateral streaks.

Female subimago.—Fore wing 15 mm. Dorsum of thorax very pale yellowish brown. Fore femur yellowish to reddish brown, "almost light clove-brown" (Eaton); tibia pitch-brown, tarsus more yellowish than tibia; other legs "dull, subluteous or dark testaceous" (Eaton). Longitudinal veins of fore wing light yellowish brown, as are the cross veins "in advance of the radius, and most of those posterior to it in the proximal half of the disc" (Eaton); remaining cross veins in the disk black. One or 2 very faint basal costals; about 18 curved oblique stigmatic cross veins, a few of these forked near the costa. Costal angulation of hind wing distinctly apical of middle of wing, about $\frac{2}{3}$ of distance from base to apex. Abdominal terga light reddish yellow; 1–8 with black posterior margins; broad oblique black lateral streaks on terga 2–7. Caudal filaments "intense warm sepia-brown" (Eaton); joinings dark, likewise dark "in the midst of the joints" (Eaton).

Male and nymph.—Unknown.

Type-locality.—Colombia.

Location of type.—British Museum (Nat. Hist).

Material.—Species described from a single female subimago.

Discussion.—This species is distinctive by reason of the position of the costal angulation of the hind wing, a feature almost unique among the known members of this genus, occurring in only 1 other species, *T. ephippiatus*. From what is known of the females of those species in which the males have dark posterior margins and oblique lateral streaks on the terga, we may deduce that the male of *T. colombiae*, when discovered, will be similarly marked and will have a similar hind wing. The absence of femoral banding is also most unusual for this genus. No other species in the genus *Thraulodes* has been placed in as many different genera as has this one. Only *T. furficulus* and *T. venezuelana* approach it in size, but the venation and abdominal markings of both those species distinguish them from *T. colombiae*.

Thraulodes daidaleus Thew

(Fig. 26)

Thraulodes daidaleus Thew 1960, 119, 1 fig.*Thraulodes bomplandi* Traver 1959, 1 fig. (misidentified)
(nec Esben Petersen 1912).

Femora twice-banded; no basal costals; abdominal segments 2-6 white, terga with dorsal, midway, and isolated spots, row of small dark dots on sterna.

Male imago.—Fore wing 6.6 mm. Dorsum of thorax light brown; pronotum paler, blackish medially and laterally; mesonotal area preceding scutellum white; brown pleural markings. All femora and tibiae yellowish white, femora with brownish median and apical bands; tibiae with brown pre-apical bands, apices white; tarsi pale brown, joinings white. Wings hyaline; longitudinal veins of fore wing pale yellowish, cross veins pale; stigmatic area opaque whitish; no basal costals; brownish shading around humeral cross vein in both fore and hind wings. Abdominal segments 2-6 white, transparent; each tergum with "large postero-median black spot" (Thew), large black midway spots, laterad of which is a small black spot, another faint dark spot at anterolateral margin; mid-dorsal area tinged with reddish brown. Tergum 1 white, anterior margin pale brown, black median and midway spots present. Segments 7-10 reddish brown, midway black spots, mid-dorsal line black. Black stigmatic dots on all segments. Sterna 2-7 whitish "with two small black dots each side of median line and a large black dot in each postero-lateral corner" (Thew), the latter on 8 also. Caudal filaments white, "every fourth segment dark brown" (Thew). Genitalia as in Fig. 26 (redrawn after Thew).

Female imago.—Fore wing 7.5 mm. As in male, but terga 1-6 and base of 7 brownish, 8 and apical half of 7 whitish, 9-10 "pinkish brown" (Thew).

Nymph.—Nymphs described here were taken in the Arifanha River, Nova Teutonia, Brazil, in or near the same area as the imagos of this species (27°11'S, 52°23'W). We tentatively assign these nymphs to *T. daidaleus* on the basis of dorsal and ventral abdominal markings similar to those of the adult; the femora are likewise double banded; chorionic pattern of ova quite similar. Body of mature male nymph 7 mm; of female, 8 mm. Head pale reddish brown, dusky shading around bases of antennae and on clypeus; scape and pedicel of antennae pale reddish brown, filament yellowish. Pronotum yellowish, faintly washed with pale red-brown; midline, median area of anterior margin, and lateral margins, pale. Mesonotum reddish brown, dark in specimens with dark wing pads, much paler in others; submedian U-shaped mark pale; black pencilings on mesopleura and on bases of wing pads. Thoracic sternum yellowish, faintly red-tinged, no dark markings. Legs yellowish. Femora with incomplete brownish pre-apical bands, dark spot ventrally in area of probable postbasal band; narrow black line near anterior margin in apical area. Tibiae narrowly brownish at base, narrow pre-apical

black band; tarsi pale at base, elsewhere pale smoky brown. Claws with 3 large and 3-4 smaller denticles. Abdominal terga 2-6 of male nymph yellowish, 5-6 faintly tinged with pale reddish brown; 7-10 quite bright reddish brown; terga 2-10 of female nymph pale reddish brown. Blackish markings very much as in imago, as follows: midline on 6-7 in posterior ½, faintly indicated also on 8-9; spot at midline near posterior margin on 2-5; midway spots 2-5, faintly indicated on 6-8; smaller spot laterad of midways, faint smoky spot nearer anterior margin. On some nymphs which appear similar in other respects, the dark midlines on terga 5-6 or 5-7 are replaced by dark spots as in preceding terga. Curved row of dark dots on abdominal sterna as in imago, very distinct on some, indistinct on others; black transverse dashes at posterolateral angles. Gills rather narrow, width ½ of length, tuning-fork shaped; main tracheal trunk blackish, pale gray area each side; tip about ⅓ of length of body of gill; no lateral branches evident. Caudal filaments pale reddish brown at base, yellow beyond; joinings in basal ⅔ of filaments blackish brown; wide at all joinings near base; beyond this, every second and farther out every fourth joining wider. Labrum quite broad, barely emarginate on apical margin; lateral angle low, 3 units of length above angulation to 2 units below. Mandible curved on outer margin, with distinct hump in this area. About 18 pectinate spines in an irregular row below crown of maxilla. Tibia III with a long spine at each outer apical angle; 4 apicoventral spines, not apparently pinnate; similar spines in 2 irregular rows along apical half of ventral surface. These nymphs were taken by F. Plaumann, as were the imagos.

Type-locality.—Nova Teutonia, Santa Catarina, Brazil.

Location of type.—Illinois State Natural History Survey Collection.

Material.—Thew described this species from 11 ♂ imagos, 3 ♀ imagos, 3 ♂ and 3 ♀ subimagos. We have studied the holotype.

Discussion.—Specimens from Treinta y Tres, Uruguay, placed by Traver (1959) as an aberrant form of *T. bomplandi*, are almost certainly *T. daidaleus*. In this collection by Dr. C. S. Carbonell and colleagues are 3 ♂ and 2 ♀ imagos, 2 ♂ and 3 ♀ subimagos. The genitalia agree quite well with Thew's figure but possess a lateral pouch on each side not indicated by Thew; also, the curvature of the basal segment of the forceps is somewhat nearer the base and more acute.

By reason of the series of dark dots on the abdominal sterna, this species seems allied to *T. bomplandi* and *T. itatiajanus*; it differs from those 2 species in details of genitalia and in abdominal markings.

Thraulodes ephippiatus Traver and Edmunds,
new species

(Fig. 12, 13, 22, 37)

Femora twice-banded; basal costals present; costal

angulation of hind wing well apicad of midlength; abdominal segments 2-5 whitish, 6 concolorous with 7; genitalia distinctive.

Male imago.—Body 8.5 mm; fore wing 10 mm. Head yellowish white; black line below antennae and between ocelli. Scape of antenna pale, pedicel blackish brown, filament pale brown. Turbinate eyes pale dull orange. Pronotum yellow with much orange shading; small black spot on lateral margin. Mesonotum dark brown; pale spot anteriorly each side of dark midstripe, black oblique line each side of pale spot. Scutellum pale, black-tipped; pale area precedes it and borders it along lateral ridge. Grayish black area around wing bases. Metanotum blackish with ruddy tinge, especially on midposterior margin. Pronotal pleura pale; meso- and metanotal pleura reddish brown, black markings above legs. Prosternum pale; meso- and metasterna bright red-brown except for pale strips between leg bases. Legs bright yellow. All femora twice-banded, pre-apical band the wider, both bands blackish; black longitudinal streak on each margin bounding pre-apical band; narrowly black at base. On fore tibia, a greenish spot about $\frac{1}{3}$ distance from base (possibly an abnormality); no other markings on tibiae. Claws on all legs, and distal segment of tarsus I, orange-tinged. All cross veins in fore wing strongly orange-tinged, most are narrowly margined with same color; 2 wide zigzag areas, 1 just basad of bullae, the other apicad of this, devoid of cross veins; 8-9 very distinct basal costals; 8-10 slanting simple stigmatic veins. Humeral cross vein and dark tinge basad of it along R_1 and Sc, black; costal angulation of hind wing well apicad of midlength; humeral vein black, Sc and R_1 faintly orange-tinged. Venation as shown in Fig. 22.

Abdominal tergum 1 reddish black, paler anteriorly and at midline; 2-5 translucent whitish, posterior margins narrowly purplish black, widest at midline; large black midway spots. Terga 6 and 7 mostly pale orange brown dorsally, in shape of large saddleshaped patches, darker brown laterally; on 6 a midway spot within this dark area; anterior margins and lateral triangular areas of these patches pale yellowish, posterior margins narrowly purplish black. Terga 7-10 yellowish brown, orange-tinged; 8 paler than 9-10; posterior margins narrowly purplish brown; on 10, oblique dark lines above bases of filaments, anteriorly dark at midline and submedian lines each side. Stigmatic dots present on 3-7, smallest on 7. Black longitudinal streak above pleural fold on 7. Basal and middle sterna distinctly orange-tinged medially; apical sterna concolorous with terga; on sterna 7 and 8, bright reddish brown longitudinal streaks parallel pleural fold. Abdominal pattern as shown in Fig. 12, 13. Caudal filaments missing. Genitalia most unusual, very distinctive (Fig. 37); penes are slender upright tubular structures; forceps base strongly angulate laterally, rather wide conic dorsal projection.

Holotype.—Male imago. Mexico; Ocosingo, Chiapas; 25-VI-50; C. and M. Goodnight and L. J.

Stannard, collectors. Specimen in collection of University of Utah.

Female and nymph.—Unknown.

Discussion.—This seems to be the only species of *Thraulodes* other than *T. colombiae* in which the costal angulation of the hind wing is so far apicad of the mid-length of that wing. By reason of the twice-banded femora and the absence of oblique lateral streaks, it appears most unlikely that *T. ephippiatus* can be the unknown male of *T. colombiae*.

Thraulodes furficulus Traver

(Fig. 56)

Thraulodes furficulus Traver 1946, 435, 3 fig.; Thew 1960, 122.

Femora twice-banded; basal costals present, cross veins dark; abdominal segments 2-6 yellow, dorsal and midway spots present; genitalia distinctive.

Male imago.—Fore wing 14 mm. Thorax reddish brown; mesonotal scutellum yellowish; oblique black pleural streaks. Legs yellow. Fore femur piceous, base and narrow median band yellow; apex of tibia black; distal tarsal segments missing. Femora II and III with wide black pre-apical and narrower brown postbasal bands; tibiae, distal tarsal segments, and blunt claw blackish. Wing membrane very faintly amber-tinged on costal margin; longitudinal veins deep amber, cross veins rather sparse, brownish black; basal costals and those in next 2 spaces narrowly dark-margined, widest margins at bullae; in apical $\frac{1}{3}$ of subcostal and radial spaces, also in 2 rows across disc, veins somewhat thickened but not margined; about 9 stigmatic veins, simple, strongly slant. Humeral cross vein and bases of Sc and R in both wings purplish black; faint cloud around humeral; extreme wing bases red-tinged. Hind wing quite long for its width; costal angulation basad of midlength; cross veins pale. Basal abdominal segment dark reddish brown; 2-6 yellow, transparent; 7-10 bright reddish brown. Purplish brown markings on terga 2-6 as follows: median triangles near posterior margins; midway spots; often a spot above pleural fold; posterior margins of 6-9 narrowly dark. Ganglionic areas of basal sterna orange brown, lateral dark dashes each side; on 7 blackish. Caudal filaments brownish at base, joinings of segments pale; remainder with alternate dusky and whitish segments; then a wide black segment followed by 3 shorter pale ones, joinings dusky. Genitalia as in Fig. 56.

Female imago and nymph.—Unknown.

Type-locality.—Georgetown, British Guiana.

Location of type.—Cornell University Collection.

Material.—Species described from 2 ♂ imagos, 1 of these in private collection of J. R. Traver.

Discussion.—The genitalia, while bearing some resemblance to the *trijunctus* type, seem distinctive. Blunt lateral projections are present on the penes.

Thraulodes gonzalesi Traver and Edmunds,
new species

(Fig. 10, 11, 23, 39, 72, 78, 81)

Femora once-banded; no basal costals; terga 2-6 pale yellowish white, 3-6 with grayish brown domeshaped patches; genitalia of *speciosus* type.

Male imago.—Body 6.5 mm; fore wing 6.5 mm. Head dark reddish brown; scape and pedicel of antenna dark reddish brown, filament paler brown. Turbinate eyes large, orange, almost circular, contiguous apically. Pronotum dark reddish brown, a few faint blackish lateral markings. Mesonotum bright reddish brown, margins of sclerites narrowly paler, middorsal area slightly duller red-brown, midline distinctly but narrowly pale; scutellum margined with dull blackish brown; pleura pale reddish brown, dark brown areas present anterior to wing roots. Metanotum reddish brown, posterior margin narrowly yellow, forming small yellow triangles at midline; lateral areas yellow-shaded. Sternum light reddish brown; midareae somewhat paler brown. Fore femur reddish brown, apical $\frac{1}{3}$ darker, with dark brown band on proximal edge; narrow black longitudinal streak along posterior margin; tibia paler red-brown, very slightly darker at extreme apex; tarsus still paler, claw and distal segment shaded with light smoky brown. Leg II missing. Leg III yellowish; femur reddish at extreme apex, not dark on proximal edge; base of tibia and distal segment of tarsus faintly red-tinged, claw brownish. Wings hyaline whitish. Longitudinal veins yellowish, main ones very pale reddish near bases; cross veins pale; quite numerous in apical $\frac{1}{3}$ of wing; humeral cross vein in fore wing and extreme bases of both fore and hind wings faintly red-shaded, humeral dark next to subcosta; stigmatic area opaque whitish, 8-10 very indistinct cross veins, several anastomosed. Costal angulation of hind wing basad of midlength. Venation as in Fig. 23.

Abdominal tergum 1 dark reddish brown, anterior margin black. Terga 2-6 and basal $\frac{1}{2}$ of 7 translucent pale yellowish white; remainder of 7 semi-opaque, deeper yellow; 8-10 opaque reddish brown. Terga 3-6 distinctly marked dorsolaterally with large grayish brown somewhat domeshaped patches; middorsal area pale, bordered by oblique submedian streaks, these relatively short on 2-4, longer and with thickened anterior ends on 5-8, thickened ends contiguous medially on 6-8, so that pale midline is interrupted. Posterolaterally a wedge-shaped gray patch parallels the pale posterior margin, usually connected by a longitudinal streak to the dorsolateral patch. Sternum 1, and to a lesser extent 2, shaded with reddish brown; 3-5 yellowish with faint orange tinge, especially along ganglionic areas. Pleural fold appears margined with pale orange or deep yellow. Apical sterna reddish brown, slightly deeper color over ganglia on 7 and 8. Abdominal markings as in Fig. 10, 11. Caudal filaments missing from specimen; free in vial is a portion of one filament, pale brown, paler between segments. Genitalia as in Fig. 39.

Female imago.—Body 6.5 mm; fore wing 7 mm. In general, similar to male. Cross veins in apical $\frac{1}{3}$ of fore wing not quite as numerous as in male. Dark dorsolateral patches appear straight rather than convex on anterior margins; wedgeshaped lateral patches joined more broadly to dorsolaterals; thorax somewhat paler red-brown. Abdominal terga orange-brown, due to presence of ova. Subanal plate large, domeshaped, extending beyond tip of tergum 10; only slightly excavated apically. Caudal filaments pale reddish brown at extreme base, pale yellowish white beyond; 4 to 5 basal segments dark at joinings, next beyond these also narrowly dark; all other joinings wholly pale.

Nymph.—Nymphs having a similar distinctive abdominal pattern, taken at the same time and place as the females, are associated with the adults of this species, even though this relationship has not been confirmed by rearing. Entire body of nymph bright yellow. Thoracic notum generally unmarked except for blackened tracheae, or occasional brown longitudinal streaks. Legs unmarked. Abdominal terga with grayish black markings similar to those of adults. Gills slender, tuning-fork shaped; no lateral branches from main trachea (Fig. 81). Lateral angles of labrum about halfway from base to apical margin; apical margin very slightly emarginate; very low indistinct crenulations. Mandible relatively short, markedly curved, but no hump on outer margin (Fig. 72). About 20 pectinate spines in oblique row below crown of maxilla (Fig. 78). On claw, 4-5 large denticles, several smaller ones toward base. At apex of tibia III, usually 1 long spine at each outer corner; 5 long, grooved, distinctly pinnate spines along apicoventral margin; 2-3 irregular rows of similar spines on ventral surface, preceding apex; 4-6 short, blunt, grooved spines ventrally on tarsus, numerous long slender hairs on margin.

Holotype.—Male imago. Texas; Gonzales, 12-V-58; O. S. Flint, Jr. and H. Evans, collectors. In private collection of J. R. Traver.

Allotype.—Female imago. Mexico: Tamaulipas Prov., Rio Guayalejo, 22-XII-39; L. Berner, collector (JRT).

Paratypes.—One male imago, same data as holotype; 1 ♀ imago, same data as allotype (JRT).

Discussion.—Although the genitalia of this species are very similar to those of *T. speciosus* and *T. arizonicus*, the distinctive abdominal pattern at once differentiates *T. gonzalesi* from all others known in this genus.

Thraulodes hilaris (Eaton)

(Fig. 67)

Thraulodes hilaris Eaton 1892, 9.

Thraulodes hilaris Ulmer 1919, 34; Ulmer 1920, 116; Kimmins 1934, 345, 2 fig.; Ulmer 1943, 22; Kimmins 1960, 302.

Femora twice-banded; basal costals present, cross veins dark; abdominal segments 1-7 white, dark posterior margins and oblique lateral streaks on terga.

Male imago.—Fore wing 7 mm. Thorax pitch-black; shaded posteriorly with yellowish. Fore femur blackish brown, paler at extreme base, black longitudinal streak from base to beyond middle; tibia yellowish brown, apex whitish, base and pre-apical band blackish; tarsus yellowish white. Other femora dark reddish to purplish brown, whitish at base and with narrow whitish median band; tibiae and tarsi yellowish. Longitudinal veins amber; cross veins blackish, arranged in about 7 rows across wing, some are very narrowly dark-margined; basal costals present; about 14 stigmatic cross veins, some of these anastomosed; humeral cross vein black, brownish shading along edge away from base; dark cloud "at near end" (Eaton) of MP, smoky streaks at forks of MA and Rs. Abdominal segments 1-7 white; posterior margins of terga narrowly blackish, dark oblique lateral streaks present; segments 8-10 opaque. Caudal filaments whitish; near base, all segments black at joinings; beyond base, alternate joinings darker; still farther out, every fourth joining darkened. Genitalia as in Fig. 67 (redrawn after Kimmins).

Female imago.—Fore wing 8 mm. Thorax "light raw umber, varied posteriorly with bistre-brown" (Eaton). Basal band on femora blackish but obscure. Venation less distinct than in male. Abdomen eaten out by museum pests.

Nymph.—Unknown.

Type-locality.—San Juan, Vera Paz, Guatemala.

Location of type.—British Museum (Nat. Hist.), Godwin and Salvin Collection.

Material.—Eaton described this species from 1 imago of each sex. Ulmer rather doubtfully reports as this species 2 other specimens from Costa Rica, in the Stettiner Museum.

Discussion.—In the structure of the dorsal projection of the forceps base, this species resembles *T. valens*, *T. lepidus*, and *T. hilaroides*, most closely the last named. It differs from all 3 of those species in the very marked curvature of the forceps limbs and in details of the penes, and from *T. valens* and *T. hilaroides* in the whitish instead of brownish color of abdominal terga 2-6.

Thraulodes hilaroides Traver

(Fig. 38)

Thraulodes hilaroides Traver 1946, 433, 3 fig.

Legs missing; basal costals present; cross veins dark; abdominal segments dark reddish brown, terga with black posterior margins; oblique lateral streaks and midway spots on terga 2-6.

Male imago.—Fore wing 8 mm. Dorsum of thorax very dark reddish brown, slightly paler at midline; mesonotal scutellum blackish; pleura paler brown, black markings around leg bases; sternum yellowish except reddish brown posteriorly on mesosternum. Legs missing. Membrane of fore wing very faintly yellow-tinged; longitudinal veins amber brown, cross

veins deeper brown; basal costals and some subcostals faintly brown-margined; cross veins in about 6 rows from apex to bulla, about 2 rows basad of bulla, the latter in disc of wing somewhat thickened. Humeral cross vein and bases of Sc and R in both fore and hind wings purplish black. Stigmatic cross veins about 8 in number, simple, aslant. Abdominal segments dark reddish brown, 2-6 somewhat translucent, 7-10 opaque; all with narrowly black posterior margins; terga 2-6 with dark brown oblique lateral streaks and midway spots, arcuate brown marks margining pleural fold. Indistinct dark lateral patches on all sterna, small dark anterolateral triangles on 2-6; midline faintly paler. Caudal filaments missing. Genitalia as in Fig. 38.

Female imago and nymph.—Unknown.

Type-locality.—Rio Pedregoso, Costa Rica.

Location of type.—Private collection of J. R. Traver.

Material.—Species described from a single male imago.

Discussion.—Only 3 other species of this genus are predominantly brown; of these, *T. zonalis* and *T. venezuelana* lack oblique streaks on the abdominal terga and *T. valens* lacks midway spots; the genitalia of all 3 are unlike those of *T. hilaroides*. The dorsal projection of the forceps base in *T. hilaroides* is almost identical to that of *T. hilaris*, but the penes differ markedly, *T. hilaroides* lacking the lapels of *T. hilaris* but having instead a definite earlike process and a distinct but short lateral pouch. The penes of *T. hilaroides* bear some resemblance to those of *T. mexicanus* as figured by Demoulin, but with shorter and stouter spears.

Thraulodes humeralis Navas

Thraulodes humeralis Navas 1935, 101, 1 fig.

Femora once-banded; no basal costals shown, most cross veins dark; abdominal segments white, terga with dark posterior margins and oblique lateral streaks.

Male imago.—Fore wing 8.5 mm. Thorax fulvous, with median longitudinal ferruginous band, widened on mesonotum; brown longitudinal streaks laterally on anterior part of mesonotum. Legs yellowish white. Fore femur subfuscous apically (?) ("in medio apicale," Navas); femora II and III ferruginous in apical $\frac{1}{4}$; tibiae fuscous apically. Wings hyaline, veins yellowish; cross veins in fore wing brownish, including the humeral vein; Sc and R brown at base; 9-10 oblique stigmatic cross veins. Costal angulation of hind wing low. Abdomen white; terga with brown posterior margins and oblique lateral streaks. Caudal filaments white, segments brown at joinings. Description of genitalia of no specific value.

Female imago.—Fore wing 10 mm. Thorax and abdomen more obscure than in male.

Nymph.—Unknown.

Type-locality.—Salle, Mexico.

Location of type.—Paris Museum.

Material.—Navas described this species from 1 imago of each sex. He mentions also an imperfect subimago from Guatemala.

Discussion.—Navas stated that *T. humeralis* resembles *T. plicatus*, which we now consider a synonym of *T. telegraphicus*. However, neither oblique lateral streaks nor dark posterior margins are found in the latter species. Until the genitalia of *T. humeralis* have been figured, its relation to other species of the genus is problematical.

Thraulodes irretitus Navas

Thraulodes irretitus Navas 1924, 67, 3 fig.

Femora twice-banded; basal costals present, cross veins dark, abdominal segments white, terga with isolated spots.

Male imago.—Fore wing 8 mm? (given as 3 mm, presumably a misprint for 8, since body of male is 8 mm). Thorax fulvous, with broad brown longitudinal stripes. Legs yellow; femora with broad brown median and apical bands, tibiae widely brown at base and apex. Venation mostly brown. Cross veins of fore wing brown, very distinct, those in outer $\frac{1}{3}$ of wing very lightly, basal costals more heavily brown-margined; some stigmatic cross veins forked, many anastomosed. Costal angulation of hind wing $\frac{1}{2}$ way between base and apex; subcosta brown, humeral vein brownish-black. Abdomen white, translucent; each tergum with 4 small spots each side forming brown streaks or blotches; apical terga largely brown. Caudal filaments white, basal joinings brown, apical joinings yellowish. No figure of genitalia; description of no specific value.

Female imago.—Fore wing 10 mm. Yellowish dorsally, pale ventrally. Anterior terga with dark posterior margins, all have lateral brown triangular spots decreasing in size posteriorly.

Nymph.—Unknown.

Type-locality.—Costa Rica.

Location of type.—Paris Museum.

Material.—Species described by at least 1 imago of each sex.

Discussion.—According to Navas, this species resembles *T. hilaris*. It has many features in common with that species: double-banded femora; cross veins dark, some margined, stigmatic cross veins anastomosed; pale abdomen. However no mention is made of the oblique lateral streaks which occur in *T. hilaris*, and the 4 spots on each side of the terga are more like those of *T. laetus* than *T. hilaris*. Until a figure of the genitalia has been made available, the relation of this species to others in the genus cannot be determined.

Thraulodes itatiajanus Traver and Edmunds, new species

(Fig. 24, and 43)

Femora once-banded; a few very faint basal costals;

midterga pale yellow with dark reddish brown midway and other markings; curved row of dark dots on middle sterna; genitalia distinctive.

Male imago.—Body 9 mm; fore wing 10 mm. Turbinate eyes very dark reddish brown, circular, contiguous apically. Head dark red-brown between eyes, frontal margin widely pale; scape and pedicel of antenna blackish brown, filament pale grayish brown. Thorax rather bright reddish brown; pronotum darker on midline, black markings present laterally and above leg bases. Mesonotal shield narrowly black-margined anterolaterally; scutellum rather creamy, black-tipped. Creamy markings and black streaks present on pleura above leg bases. Metanotum slightly darker on posterior margin, black spot above leg bases. Legs light canary yellow. Fore femur with wide dark red apical band, black on proximal edge and along posterior margin; black postbasal spot on posterior margin; wide black apical band on tibia; tarsus smoky brown, narrowly paler at joinings; distal segment and claw very dark blackish brown, segment 1 narrowly pale at base. Legs II and III as in leg I, but apical femoral band not quite as wide and paler red, no dark postbasal spot; black tips on tibiae narrower. Wings hyaline. Fore wing faintly yellow-tinged along costal margin; longitudinal veins and most cross veins yellow; 3-4 very pale indistinct basal costals, about 12 stigmatic veins, very slanting, 1 forked near costa. Humeral veins in both fore and hind wings black; black streak on extreme base of R_1 ; short dark streak at bulla on Sc. Costal angulation of hind wing basad of midlength. Venation as in Fig. 24.

Abdominal tergum 1 blackish brown in basal $\frac{1}{2}$; apical $\frac{1}{2}$ and all of 2-6 translucent yellow tinged with pale fawn color as bands across midportion, leaving intersegmental areas pale. Large dark red-brown midway spots on 3-4, reduced to a dash on 2, replaced by a series of dark dots on 5-6, running together to form a transverse band extending parallel to anterior margin almost to the pale midline. On 2-7, very small stigmatic dots; larger dark dot in anterolateral angle of 2, similar spot above stigmatic dot nearer middle of segment on 3-7; short black transverse dash or spot near side of midline on 3-6. Tergum 7 mahogany red dorsally; 8-10 each with a rose-colored triangle occupying dorsal area, 8 paler than 9 and 10; lateral areas of 7-10 chalky white; anterior margins of 7-8 narrowly blackish. Small dark red stigmatic dots and longitudinal streak above pleural fold on 7-8; posterior margin of 7 and a lateral dash in midway position on anterior margin; pale mid-dorsal line on 9. Pleural fold outlined by 3 narrow parallel longitudinal lines. Sterna very pale yellowish; across 2-7 a curved row of small dark dots, 3 dots on each side, from ganglionic area to anterolateral angle, largest of these in anterolateral angle; ganglia on 6-7 dark brown. Caudal filaments black at each joining near base; shortly beyond, alternate segments mostly brownish black, narrow dark joinings on intervening

segment; still farther out, 2 lighter segments between the black ones, joinings on the more proximal of these 2 segments with dark narrow margin, apical segment with very narrow indistinct dark margin; toward tip, markings narrower, much less distinct, often 3 lighter segments between darkest ones. Genitalia appear distinctive; penes slender, outcurved from base; forceps slender; forceps base angulate laterally, short conic dorsal projection of the "deflatable" type (see Fig. 43).

Female and nymph.—Unknown.

Holotype.—Male imago, originally pinned, now in alcohol, description drawn from specimen when pinned. Brazil; Itatiaia Parque Nacional; I-48; C. D. Marett, collector. In private collection of J. R. Traver.

Discussion.—Two other species of this genus having rather similar lines of small dark dots on the sterna are *T. bomplandi* and *T. daidaleus*. Both of those species differ from *T. itatiajanus* in color pattern of the abdominal terga and in type of genitalia. Although there is some vague resemblance in type of penes between this species and *T. papilionis*, no other possible similarity exists between them.

Thraulodes laetus (Eaton)

(Fig. 63)

Calliarcys (provisional) *laetus* Eaton 1883, in writing of Pl. 13.

Thraulodes laetus Eaton 1884, 110, 3 fig.

Thraulodes laetus Ulmer 1919, 34; Ulmer 1920, 116; Needham and Murphy 1924, 42; Kimmins 1960, 302.

Femora twice-banded; no basal costals; abdominal segments 2-6 white, terga with isolated spots and (?) midway spots.

Male imago.—Fore wing 8 mm. Dorsum of thorax rich yellowish brown. All femora whitish; grayish black band preceding middle, broad reddish band at apex; tibiae yellowish, grayish black apically; tarsi yellowish, joinings grayish black. Wings hyaline; venation pale amber; humeral cross veins and area around wing bases tinged with fuscous; no basal costals; in stigmatic area about 9 simple curved cross veins. Abdominal segments 2-6 white; "series of small triangular spots on each side of dorsum" (Eaton), one of which probably represents the midway spot; spiracles black; segments 7-10 reddish black dorsally; tergum 8 pale yellow at middle of posterior margin, "the bordering enlarged abruptly on each side into a triangular spot, whose point reaches the base" (Eaton) of 7. Terga 9 and 10 with yellowish oblong spot each side and black longitudinal streak along pleural fold. Ganglionic areas of sterna "light warm sepia brown" (Eaton). Caudal filaments not mentioned. Genitalia as in Fig. 63 (redrawn after Eaton).

Female imago and nymph.—Unknown.

Type-locality.—Colombia.

Location of type.—British Museum (Nat. Hist.).

Material.—Eaton described this, the type-species

of the genus, from a single male imago, the tip of its abdomen now missing (Kimmins 1960).

Discussion.—*Thraulodes traverae* is very close to *T. laetus*, although probably not synonymous with it. In the former species, dorsal markings on some of the terga are formed by the coalition of submedian spots; no such dorsal markings are indicated for *T. laetus*. Eaton's figure of the genitalia of *T. laetus* shows no dorsal projection on the forceps base, such as occurs in *T. traverae*; this might be a case in which a "deflatable" conelike structure might have been present, not shown on Eaton's figure.

Thraulodes lepidus (Eaton)

(Figs. 18, 19, 27, 58)

Thraulodes lepidus Eaton 1884, 109; Eaton 1892, 8.

Thraulodes lepidus Ulmer 1919, 34; Ulmer 1920, 116; Kimmins 1934, 343, 1 fig.; Traver 1946, 431; Kimmins 1960, 303.

Thraulodes lepida Ulmer 1943, 22, 2 fig.

Thraulodes pedregoso Traver 1946, 430, 3 fig. **New synonymy.**

Femora twice-banded; basal costals present, cross veins dark, subcostal space of fore wing amber-tinged; abdominal segments 2-6 whitish, terga with dark posterior margins and oblique streaks.

Male imago.—Fore wing 8-9 mm. Dorsum of thorax rich yellow brown, tinged posteriorly with whitish ochre; black strip along pleura. Fore femur and tibia reddish black; black longitudinal streak on femur, tibia black-tipped; third and fourth tarsal segments darkened. Femora II and III light reddish brown, pale band beyond middle; tibiae and tarsi "opaque amber-yellowish" (Eaton). Longitudinal veins of fore wing amber to dark brown; cross veins dark brown; basal costals present; cross veins between C and first half of MP and from MP to CuP near base only, slightly thickened; cross veins moderately numerous, "in about 8 irregular series" (Eaton) across wing. (Eaton says venation as in Fig. 23, No. 2 and Fig. 23, No. 3, Pl. 13, 1883.) Rich amber tinge in subcostal space of fore wing, except for short distance just beyond bulla, likewise on "subcostal edge of marginal area as far as bulla" (Eaton). Humeral cross vein blackish near base, pale apically. Abdominal segments 2-6 "transparent whitish" (Eaton); fuscous oblique lateral streaks and dark posterior margins on terga; 7-10 rich yellowish brown, paler yellow laterally; posterior margins narrowly black. Sterna yellowish ochre. Abdominal pattern as in Fig. 18, and 19 (as *T. pedregoso*). Caudal filaments whitish; near base alternate joinings blackish; in midarea every third, and apically every fourth joining blackish. Genitalia as in Fig. 27 (redrawn after Kimmins). Penis enlarged (as *T. pedregoso*), Fig. 58.

Female imago.—Fore wing 10 mm. Amber tinge in submarginal area of fore wing "hardly extends halfway from great cross vein to bulla, where again it occupies a short space or forms a small spot"

(Eaton); basal costals and subcostals more prominently margined than elsewhere in wing.

Nymph.—Unknown.

Type-locality.—Chiriqui, Panama.

Location of type.—McLachlan Museum (other specimens in British Museum (Nat. Hist.), Godwin and Salvin Collection).

Material.—Species described from at least 3 ♂ and 1 ♀ imagos. Ulmer reports 3 other specimens from Costa Rica, now in Stettiner Museum. Eaton postulates that 1 specimen from Guatemala may belong here. *T. pedregoso* was described from 10 ♂ and 4 ♀ imagos, from Rio Pedregoso, Costa Rica.

Discussion.—Traver (1946) indicated the close resemblance of *T. pedregoso* to *T. lepidus*, but pointed out that the penes appeared to lack the lateral spines present on the latter species. Further careful examination of the genitalia of *T. pedregoso* bears out this observation; further, a narrow lateral pouch is present on specimens of *T. pedregoso*; lapels are less extensive; abdominal color is distinctly yellowish rather than whitish. Nonetheless the remarkably broad dorsal extension of the forceps base and the amber-tinged subcostal area of the fore wing are so distinctive that we now believe *T. pedregoso* to be synonymous with *T. lepidus* in spite of the differences just noted.

Thraulodes lunatus Traver and Edmunds,
new species
(Fig. 6, 7, 35)

Femora once-banded; basal costals present, several cross veins orange, some thickened; terga 3–6 white with distinctive dark lunate lateral markings; genitalia somewhat as in *T. trijunctus*.

Male imago.—Body 5.5 mm; fore wing 6.75 mm. Head grayish white. Scape of antenna gray, pedicel brown, filament missing. Turbinate eyes orange, circular, contiguous apically. Pronotum yellowish brown; wide dark brown middorsal and lateral longitudinal stripes. Mesonotum yellowish brown; tip of scutellum dark brown, preceded by small pale spot. Pleura grayish brown, darker around leg bases. Metanotum reddish brown, shaded laterally with dark gray; on each side of midline 2 small dark dots, 1 pair near anterior, the other near posterior margin. Sternum mainly yellowish white; on mesosternum a brown area containing 3 darker spots: 1 at midline, 2 near posterior margin. Legs I and III missing, except for the 2 basal segments; these, and base of leg II, greenish. Leg II yellow with distinct greenish tinge, especially near base of femur and on tarsus; femur with apical brown band, black line on its proximal edge; near apex of tibia, 2 parallel black longitudinal lines. Tarsal joinings very narrowly darker; claws greenish. Wings hyaline; longitudinals along costal margin of fore wing yellow, others pale silvery white. Most cross veins in disk and in apical $\frac{1}{3}$ of wing orange in color, some narrowly margined, 4 or

5 behind R_1 are quite thickened, as are those in 2 irregular rows in disc basad of bullae; cross veins rather sparse. Humeral cross vein black; 8–9 basal costals, distinct; 8–10 stigmatic veins, most of these anastomosed. Costal angulation of hind wing basad of midlength.

Basal and middle abdominal segments predominantly translucent whitish. Tergum 1 mostly dark smoky brown, posterolateral angles pale; 2 smoky brown in midarea, midline pale, curved dark mark laterally; 3 with some brown shading each side of midline. Terga 3–6 with curved reddish to blackish brown lunate markings laterally, these open on dorsal side, darkest portion of each in about midway position. Tergum 7 pale reddish brown dorsally; a transverse lateral band on each side contains a darker spot; anterior and lateral margins pale. Terga 8–10 semi-opaque, yellowish to dark reddish brown, 8 pale on midline at anterior and posterior margins. Abdominal sterna unmarked. Abdominal pattern as shown in Fig. 6, 7. Caudal filaments white; at extreme base, each segment black at joining; beyond, every second, then third, and then every fourth segment black at joining, intermediate segments wholly pale. Genitalia as in Fig. 35.

Female.—Unknown.

Nymph.—Certain nymphs taken in the same general area as the adults are associated with the imago described here because of the similar abdominal color pattern, even though these have not been reared. Body of nymph bright yellow. Dark markings on head include: a reddish curved line anterior to antenna and margining the clypeus; gray longitudinal streaks on clypeus; transverse gray lines on labrum; gray blotches on mandibles and hypopharynx. On mesonotum, a dark mark laterally on anterior margin preceding wing base; longitudinal black streak between legs II and III. Posterolateral margin of metanotum black, this line recurved above leg base. Dark lunate markings on abdominal terga essentially as in adult. Legs yellow. On fore femur a short dark longitudinal dash near middle; black streak apically near anterior margin, the latter present also on other femora; a poorly defined orange band near base on all femora, this may have a lateral extension toward apex. Fore tibia in mature nymph black basally on inner margin; prominent black pre-apical band; apex narrowly orange; other tibiae with narrow reddish apical margin only. Apex of tarsi, and tips of claws, orange-shaded. On claw, 3 large and 3 smaller denticles, followed by a series of very small denticles. Gills pale; moderately narrow, about $\frac{1}{4}$ as wide as long; tuning-fork shaped; tip short, $\frac{1}{5}$ of length of body of gill; main trachea grayish black, no lateral branches. Labrum generally almost straight across apical margin, may be very slightly emarginate; lateral angulation slightly below middle (6.25 lengths above angulation to 5.5 lengths below); gray shading basally. Mandible quite curved on outer margin, no hump present; about 2 times as long below as above

anterior articulatory process. Below crown of maxilla, 13 or 14 long pectinate spines. On tibia III, 2 long spines at apical angle on one side, 2-3 on other side; 5-6 long grooved spines ventrally along apical margin; 2 irregular rows of similar spines on apical $\frac{1}{2}$ of ventral surface; 3 spines along one margin of tarsus, row of long slender hairs on opposite margin. Dr. L. Berner collected 23 nymphs from the following localities: Arroyo del Mecó, 40 miles north of Victoria, Tamaulipas Prov., Mexico, 26-XII-39 (JRT); Rio Potosi, Nuevo Leon Prov., Mexico, 20-XII-39 (JRT); Rio Santa Lucia, N. L. Prov., Mexico, below Linares, XII-39 (JRT).

Holotype.—Male imago. Mexico; 44 miles north of Ciudad Victoria, Tamaulipas Prov., taken at light, 16-VIII-53; R. B. Selander, collector. In collection of the University of Utah.

Discussion.—The distinctive abdominal pattern plus the orange cross veins should distinguish this species from any others known in the genus.

Thraulodes mexicanus (Eaton)

(Fig. 62)

Calliarcys (provisional) *mexicanus* Eaton 1883 (in writing of Pl. 13, 1 fig.).

Thraulodes mexicanus Eaton 1884, 109; Eaton 1892, 8.

Thraulodes mexicanus Ulmer 1919, 34; Kimmins 1960, 303; Demoulin 1963, 1, 1 fig.

Legs of male not mentioned, femora of female perhaps twice-banded; no basal costals; abdominal segments 2-7 white, posterior margins of terga darkened.

Male imago.—Fore wing 7 mm. From Eaton's original description: "Thorax fuscous above. Abdomen white, with segments 8-10 and the apical margins of segments 2-7 fuscous. Setae white with black joinings. Fore wings vitreous; 10 slightly curved and mostly simple (rarely anastomosing near the costa) cross veinlets exclusively in the pterostigmatic portion of the marginal area of the fore wing" (Eaton). Demoulin has given good figures of wings and genitalia. Head, legs, most of thorax, and all but the apical portions of abdomen are now missing or badly eaten out by museum pests, he reports. Hence identification must be based on Eaton's description and Demoulin's figures of parts that remain of the type-specimen. The type-male, now in the Brussels Museum, where it was placed after World War II along with others of the deSelys collection, seems to have been overlooked by some and misnamed by others, until located by Kimmins and redescribed by Demoulin. Genitalia as in Fig. 62 (redrawn after Demoulin).

Female imago.—Fore wing 8 mm. Thorax "raw umber brown" (Eaton). Fore femur blackish brown, tibia whitish with base and broad pre-apical band "pitch-black"; basal tarsal segments and joinings whitish, remainder black; femur II whitish at base and narrow band before middle, elsewhere blackish brown (should this mean twice-banded?). Femur III whitish in basal half, tibiae and tarsi whitish, tips of

tibiae and distal segments of tarsi black. Humeral cross vein in fore wing blackish brown; venation pale, cross veins numerous, none in basal costal space. Abdomen "pitch brown, opaque at joinings" (Eaton). Subanal plate described by Eaton as "obtusely rounded and entire"; an obtusely rounded condition is most unusual for this genus.

Nymph.—Unknown.

Type-locality.—Mexico.

Location of type.—Brussels Museum.

Material.—Eaton described this species from 1 imago of each sex.

Discussion.—It is unfortunate that Eaton gave no description of the legs of the male, which may or may not have been similar to those of the female he places in this species; it might even be that this female does not belong with the male. The white abdomen of the male which, by original description lacks all markings except the dark posterior margins of terga, would seem to be distinctive. Demoulin considers the genitalia quite similar to those of *T. ulmeri*, but in this we do not concur. The penes seem to bear some resemblance to those of *T. hilaroides*, but neither the dorsal projection of the forceps base nor the forceps limbs are as in that species.

Thraulodes osiris Traver and Edmunds, new species

(Fig. 36)

Legs of male missing; no basal costals; midterga translucent with fawn-colored transverse bands; faint midway spots, prominent stigmatic dots; penes much as in *T. trijunctus* and *T. packeri*.

Male imago.—Body 7 mm; fore wing 7 mm. Head brownish black; frontal margin very narrowly pale; scape and pedicel of antenna dark brown, filament missing. Turbinate eyes very large, dark gray, circular, contiguous apically. Pronotum pale reddish brown, darker in midarea, pale yellowish brown laterally; oblique reddish brown streak from middle of posterior margin forward to anterior margin. Mesonotal shield bright reddish brown, black-margined anterolaterally; darker red patches posterolaterally above leg bases; scutellum yellowish, tipped with reddish brown; pleura reddish brown with gray shading, black markings above leg bases. Metanotum slightly darker red-brown than mesonotum, posterior margin narrowly black. Prosternum yellowish; mesosternum very dark brown in middle, paler anteriorly; metasternum pale reddish brown. Legs missing, except coxa and trochanter; on leg I, pale yellowish with red tinge, on other legs dark reddish brown. Wings hyaline, whitish; longitudinal veins of fore wing along costal margin yellowish, all others pale yellowish white; no basal costals; humeral cross vein in both fore and hind wings and basic areas of Sc and R₁ blackish brown; 6-7 stigmatic veins, simple, slightly aslant; cross veins rather sparse; fork of MA slightly

asymmetrical. Costal angulation of hind wing basad of midlength.

Abdominal segment 1 mostly reddish brown, tergum darker than sternum, paler on posterior margin, gray-shaded laterally. Segments 2-5 and basal $\frac{1}{3}$ of 6 translucent, both terga and sterna with pale reddish brown transverse bands much paler on sterna than terga, leaving intersegmental areas and region adjacent to pleural fold pale yellowish white; posterior $\frac{2}{3}$ of 6 deeper fawn color than 2-5, but not so dark as 7-10, not paler laterally; 7-10 concolorous with 1, but narrowly purplish brown on anterior margins; black longitudinal streaks above pleural fold on 8 and 9. Midway gray spots on terga 2-5, rather faint on all, especially on 2; of moderate size only. Prominent black stigmatic dots on 2-7, faintly indicated also on 1; from each a faint dark streak extends rearward along pleural fold; pale area surrounds this dot on 7. Caudal filaments missing. Penes much as in *T. packeri* and *T. centralis*. Genitalia as in Fig. 36.

Female imago.—Body 6.5 mm; fore wing 7.5 mm. Head and thorax much as in male, but mesonotal shield duller in color. Pronotum blackish at midline on anterior and posterior margins; submedian black lines each side of midline in anterior $\frac{1}{2}$; blackish oblique streak from halfway mark on posterior margin runs forward near to but not reaching anterior margin, where an extension runs laterad to point opposite its starting point on posterior margin. Fore wing faintly yellow-tinged; main longitudinal veins yellowish; 8-9 stigmatic cross veins, no basal costals. Abdominal tergum 1 mostly blackish; 2-6 heavily shaded with grayed reddish brown; pale brown median area on 7, posterolateral angles yellow; 8 wholly yellow; 9-10 brighter reddish brown, no gray shading. Pale triangular spot in anterolateral area on 2-6, surrounded by dark background; midway spots very indistinct; stigmatic dots prominent, on 2-6, 2 dark lines extend rearward from each dot, upper line curved and darker in color. Posterior margins of terga narrowly dark grayish brown. Sterna yellowish; on 2-6, grayish shading next to pleural fold; an orange spot each side of midline on 7; faint brown shading along midlines on 2-6. Caudal filaments missing. Subanal plate emarginate apically, pale.

Another female imago, apparently much faded and hence paler on thorax and abdomen, but with essentially the same markings as the allotype, seems to be of this species. Its principal importance lies in the fact that leg II on 1 side still remains on the specimen. This leg, pale yellowish in the main, has a single blackish pre-apical femoral band; tibia narrowly black-tipped. This female taken 2-8 miles north of Puye, Napo-Pastaza, Ecuador; 9-II-55; E. I. Schlinger and E. S. Ross, collectors (CAS).

Nymph.—Unknown.

Holotype.—Male imago. Ecuador; 6-8 miles west of Napo-Pastaza; 10-II-55; E. I. Schlinger and E. S. Ross, collectors. In collection of California Academy of Sciences.

Allotype.—Female imago. Same data as for holotype (CAS).

Discussion.—This species, by type of penes, is allied to *T. trijunctus*, *T. packeri*, and *T. centralis*; in general appearance, it is nearest to *T. centralis*, from which it differs as follows: terga 2-5 whitish, bands of shading more reddish, sterna not as heavily shaded; stigmatic dots much more prominent; fewer cross veins in apical $\frac{1}{3}$ of fore wing; locality Ecuador.

Thraulodes packeri Traver and Edmunds,
new species

(Fig. 8, 9, 21, 31, 61, 71, 73, 74, 79, 82)

Femur III twice-banded; basal costals present; midterga pale, midway spots, oblique lateral streaks and dark posterior margins present; penes of a modified *trijunctus* type, forceps show relationship to *T. hilaris*.

Male imago.—Body 8 mm; fore wing 8 mm. Head brownish between ocelli, frontal margin pale. Scape of antenna pale, pedicel brownish, filament very pale brown. Turbinate eyes orange brown, nearly circular but slightly flattened at region of contiguity. Pronotum yellow; midline, posterior margin and large lateral patches black. Mesonotum pale reddish brown; dark brown midstripe and posterolateral areas above wing bases; scutellum mostly black, preceded by a pale spot; interrupted dark brown line on pleura above leg bases. Metanotum reddish brown; black submedian dashes each side of scutellum, these extended laterally; posterolateral area and narrow pencilings above leg bases black. Thoracic sternum pale brown, midarea yellowish. Legs light canary. Femur I dark red in apical $\frac{2}{3}$, this area margined with black and enclosing black longitudinal streak; extreme tip black; tibia yellowish red, extreme tip pale, black at base and with wide black pre-apical band; basal tarsal segments pale, other segments distinctly orange-tinged except at apices. Femur II with orange pre-apical band, not darker on proximal edge; tibia faintly red-tinged at apex; tarsal joinings narrowly darkened. Femur III twice-banded; pre-apical band as in femur II, incomplete grayish brown band postbasally; tibia and tarsus as in leg II, but tibia not red-shaded at tip. Wings hyaline whitish. Longitudinal veins in fore wing amber yellow along costal margin, pale yellowish brown elsewhere. Cross veins blackish except in cubito-anal area; those in costal, subcostal, and more strongly in radial spaces slightly thickened, likewise a few in basal $\frac{1}{2}$ of disc; in radial space, 1 at bulla heavily margined, also another apical of it; cross veins rather sparse, 3 complete and 2 incomplete rows from apex to bulla; humeral veins in both fore and hind wings heavily black-margined; 4-5 basal costals, 3 between bulla and stigma, 5-6 stigmatics, simple and slightly aslant. Costal angulation of hind wing rather blunt, at about midlength of wing; pale except humeral vein. Venation as in Fig. 21.

All abdominal terga narrowly black on posterior margins. Terga 1-6 basically whitish, each with blackish brown oblique lateral streaks and black mid-

way spots; tergum 1 with narrow brown longitudinal streak preceding posterior margin; 2 heavily shaded across dorsum with dark grayish brown in posterior $\frac{2}{3}$, leaving anterior margin and narrow midline widely pale; 4-6 pale except for small dark triangle on 4 on each side, at start of oblique streak; small orange dot on midline at anterior margin of 6. Tergum 7 widely orange brown except for pale posterolateral angle; tergum 8 has orange shading in middorsal area only, mainly as a triangle based on anterior margin, its tip about $\frac{1}{2}$ way to posterior margin, black longitudinal line above pleural fold; 9 and 10 wholly orange brown; midway spot faintly indicated on 7, absent from 8-10. Sterna very faintly orange-tinged in mid-areas only, especially on 7-9; no dark markings. Abdominal pattern as shown in Fig. 8, 9. Caudal filaments missing, except basal part of middle filament, which is whitish; at extreme base every third joining narrowly brown, beyond this every fourth or fifth joining darkened; further out, no dark joinings. Cerci presumably would have been as in female. Penes of a modified *trijunctus* type; forceps show relationship to *T. hilaris* (Fig. 31).

Female imago.—Body 8.5 mm; fore wing 9 mm. Head yellow on frons and posterior margin; 2 black dots below middle ocellus; grayish brown between eyes, black transverse dash each side of midline. Antennae as in male. Pronotum yellowish or pale reddish brown; wide blackish midstreak, crescentic at posterior margin, may enclose 2 small yellow dots preceding crescent; in pale specimens, 2 black dots above base of fore leg, darker specimens as in male. Mesonotum yellowish to pale reddish brown, darker submedian streaks; on pale specimens, dark reddish brown patches on each side preceding the pale but dark-tipped scutellum, scutellum dark brown in other specimens. Metanotum and pleura as in male. Thoracic sternum pale yellow, posterior $\frac{1}{2}$ of mesosternum faintly brown-tinged. Legs as in male except as noted. Tibia I may be mostly black; segments 2-5 of tarsus I shaded with smoky brown; femora II and III each twice-banded, pre-apical band may be darkened on proximal edge; narrow gray longitudinal penciling across middle areas. Fore wings with 4 complete and 2 incomplete rows of cross veins from apex to bulla; 6-7 basal costal cross veins, 8-10 stigmatic cross veins, usually several of these anastomosed; most cross veins in upper $\frac{2}{3}$ of wing heavier than in male, more cross veins narrowly margined; faint brown cloud at fork of MA. Abdominal terga yellowish to orange brown; narrow black posterior margins, prominent blackish midway spots on 2-7 or 2-9, oblique lateral streaks or dark posterolateral patches on terga 2-6 usually present; tergum 8 yellowish, may be shaded medially with smoky brown, black line above pleural fold as in male; terga 9 and 10 bright red-brown, 9 may be somewhat the darker. Abdominal sterna yellowish, 7 and 8 often shaded medially with pale brown or gray. Caudal filaments white; near base, each segment rather widely black at join-

ing; next, alternate segments more widely black at joinings; still farther out, every fourth segment with wider black markings than those intervening. Ova of the type in which the entire chorionic surface appears divided into hexagonal or pentagonal blocks; within each block is a rounded plaque containing a coiled thread (Fig. 61); 35-40 plaques visible on surface.

Nymph.—Nymphs have pale reddish brown heads, anterior margin of clypeus black; antennae very pale brown, darker at base; 2 pairs of oblique streaks on vertex near posterior margin. Thorax grayed olive brown, pronotum more reddish; pale median triangle posteriorly on pronotum, dark anterior to this, brownish blotches laterally, posterior margin dark; dark marks above leg bases. Pale V-shaped mark on mesonotal shield, anterolateral margins outlined in black; interrupted black stripe on pleura above leg bases; scutellum pale yellowish. Curved brown mark above base of leg III. Femora mostly yellow; incomplete postbasal and complete pre-apical dark brown bands united along posterior margins; small dark dot at base, apex dark; black streak apically along posterior margin; tibiae and tarsi pale yellow, tibia I dark at tip, inconspicuous median band on tarsi. Thoracic sterna pale. Dorsum of abdomen reddish brown; dark posterior margins, dark midway spots, some show oblique lateral streaks. In male, pale middorsal triangles on 4-5; 3 with pale midline; dark blotches on 1-3 each side of midline. In female, pale triangles on 3-4 and 6-8 or on 4-7; 9 pale dorsally, 10 very dark red brown except pale anterior margin and lateral triangles. Sterna pale yellowish, apicals faintly orange-tinged. Gills narrow, $\frac{1}{6}$ to $\frac{1}{7}$ as wide as long; dark grayish black along main trachea, margins widely pale; no lateral branches from main trachea; tips about $\frac{1}{3}$ length of body of gill. Caudal filaments pale reddish brown; at base, alternate joinings darkened; then every third, next every fourth joining dark; in apical $\frac{1}{2}$, no dark joinings. Labrum of intermediate type, distance above angulation very slightly greater than distance below this point (Fig. 74); slightly emarginate apically; 3 low crenulations. Very slight hump on outer margin of mandible, this structure of intermediate length, distance below anterior articulatory process equal to 2 units above (Fig. 71, 79). Below crown of maxilla, 14-17 pectinate spines. Labium as in Fig. 82. Hypopharynx as in Fig. 73. At apex of tibia III, a rather long stout spine at each outer angle; row of 5-6 grooved indistinctly pinnate spines on ventro-apical margin, 2 incomplete rows of similar spines along apical $\frac{1}{2}$ of ventral surface. On margin of tarsus III, 3 long and 3 shorter spines, plus usual row of long hairs; 6-7 large denticles on claw, plus several shorter ones near base. Ova as in adult. Nymphs described are from same location as the female subimago listed here.

Holotype.—Male imago, reared from nymph. Dept. Cortes, 2 miles north of Caracol, at bridge on Highway no. 1, Rio Blanco, Honduras; 18-X-64, J. S.

Packer, collector. In collection of the University of Utah.

Allotype.—Female imago, reared from nymph. Dept. El Paraiso, Escuela Agricola Panamericana, Rio Yeguaré; Honduras; 26-X-64, J. S. Packer, collector (UU).

Paratypes.—Two ♀ imagos, 1 ♀ subimago, all reared from nymphs. One imago, same data as allotype (UU); other imago, same data as holotype (UU). Subimago, Dept. Olancho, 45 miles east of junction of Highway no. 3 and Salama Rd., Honduras, small stream; 6-XI-64; J. S. Packer, collector (UU).

Discussion.—We take pleasure in naming this species for Mr. Packer, whose rearing of imagos from nymphs has established with certainty the relation between nymphal and winged stages. Mr. Packer summarizes the types of streams from which he obtained *Thraulodes* nymphs as follows: "They are typically found wherever well aerated water flows over rocky bottoms."

By type of penes, this species is allied to *T. trijunctus*, *T. centralis*, *T. osiris*, and *T. spangleri*; the abdominal markings should distinguish it from those 4 species. The very long slender forceps limbs and the more elongate dorsal projection found in *T. packeri* show its relationships to *T. hilaris*, *T. lepidus*, *T. valens*, *T. hilaroides*, and *T. spangleri*. From *T. prolongatus*, which has rather similar abdominal markings, it can be told by reason of the dark cross veins and the type of genitalia. The ova serve to set *T. packeri* apart from *T. trijunctus* and *T. spangleri*, the only representatives of the above-named species for which these structures are known.

Thraulodes papilionis Traver and Edmunds,
new species
(Fig. 16, 17, 55)

Femora once-banded; no basal costals; midterga whitish with very pale gray dorsolateral butterfly-shaped patches; genitalia distinctive.

Male imago.—Body 6 mm; fore wing 6 mm. Head blackish brown, frontal margin very narrowly pale; scape of antenna pale brown, pedicel dark brown, base paler; filament white. Turbinate eyes quite large, dark gray, circular, contiguous apically. Pronotum very pale yellow, posterior margin black, most evident on posterolateral angles. Mesonotal shield quite bright yellow, margined with brown; posterolateral areas above wing bases reddish brown; scutellum pale, narrowly margined in pale brown. Pleura largely pale yellowish; wide reddish brown and some narrower blackish markings above leg bases. Prosternum wholly pale; mesosternum dark reddish brown in midarea, anterior margin brown. Legs yellow. A deeper yellow apical band on fore femur, upper and lower margins and proximal edge of band brownish black; blackish apical band on tibia; apical portion of distal tarsal segment dark shaded. Femora II and III not darkened at apex; tibia II with blackish apical spot,

not present on tibia III; tarsi as in leg I. Wings hyaline, white. Longitudinal veins of costal margin of fore wing pale yellowish, others still paler. All cross veins except reddish brown humeral vein wholly pale; no basal costals; 8-9 simple slanting stigmatic veins; reddish brown shading at wing base and on bases of Sc and R₁. Costal angulation of hind wing slightly basad of midlength; humeral vein blackish.

Abdominal segments 2-6 and base of 7 whitish, very transparent; very pale gray markings on terga. Tergum 1 pale at midline, posterolaterally and along pleural fold; darker longitudinal band at lateral angle of dorsolateral gray patch; dark spot on posterior margin beside midline. Pale gray dorsolateral patches on 2-7, smallest on 2, faintest on 7; on 4-6 somewhat butterfly-shaped; pale middorsal line on 3-4, with submedian dark oblique dashes; middorsal line on 6 dark gray in posterior ½; rather small elongate lateral gray patches posterolaterally, in same position as midways but posterior; dark stigmatic dots on 2-7; position of main trachea indicated by double curved dark lines from each dot. Tergum 8 with partial dorsal patch only; 7 mostly yellowish, 8-10 pale yellowish brown; dark anterior margins on 9 and 10; longitudinal black streak above pleural fold on 8 and 9. Abdominal sterna unmarked. Abdominal pattern as shown in Fig. 16, 17. Caudal filaments white. At base, each segment black at joining; next a black segment alternates with a pale one, one of the latter narrowly dark at joining; still farther out, a long dark area alternates with an equally long pale one, several segments included in each such area. Genitalia appear to be unique; penes long, slender, spears long and upcurved; lateral margins of forceps base somewhat angulate; no dorsal projection. Genitalia as in Fig. 55.

Female and nymph.—Unknown.

Holotype.—Male imago. Colombia; Tollima, 18 miles west of Honda; 16-III-55; E. I. Schlinger and E. S. Ross, collectors. Specimen in collection of California Academy of Sciences.

Discussion.—The abdominal markings vaguely resemble those of *T. gonzalesi* but are much paler gray; the genitalia are entirely different in structure.

Thraulodes paysandensis Traver
(Fig. 4, 5, 46, 68)

Thraulodes paysandensis Traver 1964, 33, 4 fig.

Femora twice-banded; no basal costals; abdominal segments 2-6 yellowish, terga with wide reddish posterior margins, midway and isolated spots; genitalia appear distinctive.

Male imago.—Fore wing 7.5 mm. Pro- and meta-nota bright reddish brown, mesonotum yellowish brown; black pleural markings. Legs yellowish. All femora with bright red post-basal and apical bands, on femur I the latter band narrowly black along proximal edge. Tibia I faintly red-tinged at each

end; tarsus II faintly red-tinged, joinings of segments slightly darkened. Wings hyaline, longitudinal veins yellow, cross veins rather paler; 7-8 irregular rows of cross veins from apex to bullae; costal margin faintly yellow-tinged. No basal costals; humeral vein in both fore and hind wings blackish; stigmatic area opaque, about 14 simple slanting cross veins. Abdominal segments 2-6 translucent yellow; terga with wide reddish brown bands at middle of posterior margins, widest on 6; anterior margin of 6 narrowly reddish, red triangle from this on middorsal line; blackish midway spots connected to outer margins of posterior bands, small black dot laterad of these; black stigmatic dots. From anterior margins of 3-6, short submedian streaks. Tergum 1 dark reddish brown, 7-10 bright red-brown, 9 darkest; posterior margins darker; paler streaks parallel mid-dorsal line on 7, 8 and 10, pale lateral triangle on 8; on 7-8, black streak parallel to pleural fold, sterna faintly red-tinged, deepest on 7-9; ganglionic areas faintly dark-outlined. Abdominal markings as shown in Fig. 4, 5. Caudal filaments white, joinings of segments alternately wide and narrow, deep reddish black. Genitalia as in Fig. 46.

Female imago.—Fore wing 8 mm. As in male except as noted. On femur I, both bands black-shaded; grayish brown rather than red-brown posterior margins dorsally on 2-6, 7-10 largely yellowish with reddish shading.

Nymph.—Unknown.

Type-locality.—Rio Uruguay, Santa Rita, Paysandu, Uruguay.

Location of type.—University at Montevideo, Uruguay.

Material.—Species described from 3 ♂ and 58 ♀ imagos. Half of these in private collection of J. R. Traver, others in University at Montevideo.

Discussion.—The bright red double femoral bands, markings of abdominal terga, and the rather unusual penes distinguish this species from others in the genus. While the penes bear some resemblance to those of *T. ulmeri* and *T. zonalis*, and perhaps also to *T. regulus*, differences are at once noticeable. In tergal markings this species comes closest to *T. traversae* but differs in genitalic structure. The ova are unique among those we have studied.

Thraulodes prolongatus Traver

(Fig. 14, 15, 49)

Thraulodes prolongatus Traver 1946, 434, 2 fig.

Femora lack distinct bands but darker toward apex; no basal costals; abdominal segments 2-6 yellowish white, terga with narrow dark posterior margins, oblique lateral streaks, dorsal and submedian markings, midway spots. Genitalia distinctive.

Male imago.—Fore wing 6-6.5 mm. Thorax reddish brown; dark triangular midmark on pronotum, white black lateral band; mesonotal scutellum yellowish, brown-tipped; faint dark pencilings on pleura.

Legs yellowish. Fore femur with reddish brown spot at extreme base; wide longitudinal reddish brown band from middle to apex, bordered posteriorly with yellowish, black line along posterior margin near apex, large black streak or blotch beyond middle on anterior margin, thus a darker apical area but no distinct band is formed; apex very narrowly black-tipped. Tibia I black-tipped, extreme base reddish brown with black posterior margin. No distinct bands or other markings on legs II and III, although femora are darker toward apices. Wings hyaline; longitudinal veins very pale amber, cross veins paler, no basal costals; humeral cross vein reddish brown, black at base only; faint reddish shading at extreme bases of both fore and hind wings. Stigmatic area of fore wing opaque whitish; about 11 stigmatic veins, slanting, some curved, a few forked and slightly anastomosed near costal margin. Abdominal segments 2-6 yellowish, somewhat translucent; tergum 1, midarea of 2, and large saddleshaped area dorsally on 3, purplish brown, small pale areas within these; on tergum 4, submedian circular purplish marks, each enclosing a pale spot; on 5-6, pale midline, each side of which is a darker area, on 6 a median chestnut brown spot; midway spots on 3-6, joined to submedians on 3-4; oblique lateral streaks 2-6, and tiny stigmatic dots. Segments 7-10 reddish brown, posterior margins of 7-9 narrowly darkened. Sternum yellowish, unmarked. Caudal filaments white, joinings of segments black; in midregion, every fourth joining wide, those between narrower. Abdominal markings as shown in Fig. 14, 15. Genitalia as in Fig. 49.

Female imago.—Fore wing 6.5 mm. As in male, but markings on abdominal terga paler, apical segments seem concolorous with preceding ones. Subanal plate long, only a slight emargination at apex.

Nymph.—Unknown.

Type-locality.—Rio Pedregoso, Costa Rica.

Location of type.—Private collection of J. R. Traver.

Material.—Species described from 2 ♂ and 1 ♀ imagos.

Discussion.—Genitalia distinctive because of the structure of the penes, which might be considered a modification of the *speciosus* type with very much elongated ears, except for the short and angulate lateral pouch which is unlike any others we have seen in this genus. The seeming blunt lateral process thus formed is not homologous with that structure on *T. furcifulus*.

Thraulodes regulus Traver and Edmunds, new species

(Fig. 42)

Femora once-banded; no basal costal cross veins; terga 1-10 dark brown; midway spots incorporated in dark transverse bands; joinings of basal segments of caudal filaments dark, all others pale.

Male imago.—Body 6-6.5 mm; fore wing 6-6.5 mm.

Head brownish, paler on frontal margin; scape of antenna pale, pedicel dark brown, filament pale. Turbinate eyes rather flat; dark grayish brown, contiguous apically. Pronotum largely dark brown, lateral and posterior margins narrowly pale; dark brown stripe above fore leg. Mesonotum dark reddish brown, margined laterally with black; scutellum brownish, black-margined; metanotum darker reddish brown; pleura paler, narrow dark streaks above leg bases. Prosternum and anterior $\frac{1}{2}$ of mesosternum pale, remainder brown with paler midline. Legs yellowish. Fore femur with wide reddish brown apical band, widely blackish brown on proximal edge, tip narrowly black; apex of tibia widely black, narrowly dark at base; distal segment of tarsus brownish black, claws pale brown. Femur II with dark spot near apex, no dark band; narrow pale brown apical band on femur III, incompletely darker at proximal edge; tibiae II and III unmarked; distal segments of tarsi II and III dark brown, tarsal segments narrowly dark at joinings. Wings pale whitish, hyaline. Longitudinal veins in anterior $\frac{1}{2}$ of fore wing, in basal half of Sc and R_1 in hind wing, and stigmatic cross veins, very pale yellowish, all other veins colorless, except humeral vein in fore wing and extreme bases of Sc and R_1 in both wings, which are brownish. No basal costal cross veins; 5-6 stigmatic cross veins, slightly aslant, simple. Costal angulation of hind wing quite acute, near midlength of wing; Sc rather long.

Tergum 1 mainly dark brown, margins paler; a pale spot each side. Terga 2-10 largely occupied by brown transverse bands, very dark on 2-4 in 1 specimen, paler in midarea on the other; rather paler on 5, posterior margins and posterolateral areas paler; 6-8 darker than 5, paler than 2-4; midway spots on 3-5, nearer the lateral margin than usual, incorporated in the dark transverse bands; on same segments faint brownish spots near posterolateral angle. Pleural fold narrowly outlined in pale brown. Sternum 1 dark brown, all others brown-shaded, 2-5 rather paler. Ganglionic areas on 7 and 8 light brown. Caudal filaments pale yellowish, with narrow black joinings of segments near base only; first 3 such joinings narrowly black, then 1 pale joining followed by 1 black one; beyond this point 3 or 4 joinings very faintly brownish; all others pale. Penes somewhat as in *T. zonalis*; forceps base with no dorsal projection. Genitalia as in Fig. 42.

Female and nymph.—Unknown.

Holotype.—Male imago. Peru: Huanuco Prov., Rio Huallaga, Tingo Maria, collected at light; 29/31-VII-63; W. L. Peters, collector. In collection of the University of Utah.

Paratype.—Male imago. Peru; same location as holotype; 17/19-VIII-63; same collector (UU).

Discussion.—In only 1 other species of which the caudal filaments are known are the dark joinings confined to the basal region; this occurs in the female of *T. gonzalesi*. Filaments of the male of that species

are missing. The species appears distinctive by reason of the very dark terga contrasting with the pale sterna, the dark joinings of caudal filaments confined to the basal area, and the rather unusual genitalia.

Thraulodes schlingerii Traver and Edmunds,
new species
(Fig. 45, 54)

Turbinate eyes large, oval, long axis transverse. Femora once-banded; no basal costals; terga 2-5 pale with light reddish brown shading, 6 concolorous with 7-10; midway transverse dashes, prominent stigmatic dots; genitalia of modified *speciosus* type.

Male imago.—Body 6.5-7.5 mm; fore wing 6.5-7.25 mm. Head dark brown; scape and pedicel of antenna brown, filament paler brown. Turbinate eyes very large, bright orange to orange brown, rather oval, set so that the long axis is transverse, inner ends contiguous. Pronotum yellowish brown; darker brown middorsal and lateral longitudinal streaks, lateral margins black. Mesonotal shield light yellowish to reddish brown, anterior margin darker; dark triangular area on each side adjoining wing base and anterior to scutellum; tip of scutellum black, preceded by pale area. Metanotum reddish brown, darker mid-dorsally and laterally. Pleura pale; black markings above leg bases. Prosternum pale, meso- and metasterna mainly dark brown. Legs yellow. Fore femur with wide apical reddish brown band, proximal edge incompletely blackish; tibia narrowly black at base, wide dark apical band; distal segment of tarsus and claws smoky brown. Femora II and III with narrow pre-apical bands, complete blackish bands on proximal edges, apices pale; tibiae unmarked; tarsi faintly brown-shaded, joinings narrowly darker. Fore wings very faintly yellow-tinged. Longitudinal veins pale yellowish, cross veins in disk pale yellowish; humeral veins in both fore and hind wings blackish; 5-6 simple slanting stigmatic veins; no basal costals. Costal angulation of hind wing slightly basad of midlength.

Abdominal segments 2-5 and sterna 1, 6, and 7 pale yellowish, translucent; terga of these segments distinctly shaded with bands of very pale reddish to olive brown dorsally. Terga 6-10 rose-color; 6 brightest, 7-10 a more subdued hue; lateral margins of 6 and 7 pale, wider on 7. Black longitudinal streaks parallel pleural fold on 8-9. Posterior margin of 6 bright rose-red, on 7-10 dark red-brown. Transverse grayish midway marks on 2-5; prominent black stigmatic dots, 1-7. Sterna very faintly shaded with pale reddish brown. Caudal filaments missing. Genitalia of a modified *speciosus* type; short conic dorsal projection of the "deflatable" type; forceps base slightly angulate laterally; spears very slender, strongly up-curved. Genitalia as in Fig. 45.

Variations as follows. Abdominal segments 1-5, especially terga, distinctly shaded with light reddish to olive brown; terga 6-9 rather dull brown, 10 tinged with reddish brown, or on others, 6 and 7 more reddish. Posterior margins of 1, and 7-9 as well as 6,

rose-red; longitudinal streak above pleural fold rose-color; tergum 8 distinctly yellowish; more extensive pale areas on 7. In a few others, 6-10 much paler, but still definitely rose-tinged, most marked on 6. Caudal filaments white; at extreme base 1 brownish segment, followed by 1 white with black apical joinings; beyond this, black areas alternate with pale ones, usually 2 or 3 segments in each such area.

Female imago.—Females believed to be of this species but not included among the types, have the following features. Body 7-8 mm; fore wing 8-9 mm. Head blackish. Pronotum yellowish, reddish brown shading in midarea; lateral and posterolateral margins black. Mesonotum light reddish brown, shield yellowish, darker at anterior and posterolateral areas; scutellum dark-margined, preceded by pale area; metanotum pale red-brown. Legs and wings much as in male, tibiae II and III usually not dark-tipped. Abdominal terga 1-7 heavily marked with rather saddle-shaped reddish brown dorsolateral patches, leaving wide pale posterolateral triangles and intersegmental areas; anterior margins darker red-brown to purplish black; transverse midway spots and stigmatic dots as in male. Terga 8-10 paler, especially 8, which has reddish midline and narrow black anterior margin; midareas of 9 and 10 reddish; black longitudinal streaks parallel to pleural fold on 8 and 9. Sterna pale yellowish; black streak in posterolateral angle of 7, black dot similarly placed on 8; these markings present on spent females as well as those filled with ova. Round plaques on chorion of ova, each containing a coiled thread; halo of small granules surrounds each plaque. Ova as in Fig. 54.

Nymph.—Unknown.

Holotype.—Male imago. Peru: Huanuco Prov., Rio Huallaga, Tingo Maria, 13-VIII-63; W. L. Peters, collector. In collection of University of Utah.

Paratype males.—Peru: 22 from Huallaga Prov., Tingo Maria, XII-63, M. Rojas, collector (UU); 2 from same area, 17/19-VIII-63, W. L. Peters, collector (UU); 1 from Rio Pachitea, Pto Inca, VIII-61, J. Schunke, collector (UU); 1 from Huallaga Prov., Tingo Maria, VI/XI-60 (UU); 1 from Pucallpa, Rio Ucayali, VI/XI-60, J. Schunke, collector (UU). Four from Yurac, 67 miles east of Tingo Maria, 28-IX-54, E. I. Schlinger and E. S. Ross, collectors (CAS).

Discussion.—We take pleasure in naming this species for E. I. Schlinger, in recognition of the many specimens he collected in Peru in collaboration with E. S. Ross.

The following features taken together should differentiate males of *T. schlingeri*: very large transversely oriented turbinate eyes; femora once-banded; tergum 6 concolorous with 7-10; penes of modified *speciosus* type. The females are very similar to those we believe to be *T. telegraphicus* but differ thus: slightly smaller size; less extensive shading on pronotum; tibiae II and III usually not dark-tipped; ter-

gal shading more restricted, hence more extensive pale areas; rather fewer stigmatic veins.

Thraulodes spangleri Traver and Edmunds,
new species
(Fig. 30, 53, 57)

All femora once-banded; basal costal cross veins present; midterga pale, with oblique lateral streaks and narrow dark posterior margins, no midway spots; penes of the *trijunctus* type; basal segment of forceps angulate $\frac{1}{3}$ from base.

Male imago.—Body 6-6.5 mm; fore wing 5.5-6 mm. Frontal margin of head grayish, remainder pale reddish brown; frontomedian carina brownish black. Antennae yellowish, pedicel brown-shaded at apex. Turbinate eyes quite large, reddish brown, contiguous apically; almost circular in outline from dorsal aspect. Thorax reddish brown dorsally, pleura and venter paler. Wide black median stripe on pronotum; lateral margins widely very dark brown, black streak above leg bases adjoins this dark margin; anterior margin may also be dark brown. Mesonotal scutellum pale but dark-tipped, pale yellow area precedes it; darker brown strip on mesonotal shield each side of this pale area. Posterior margin of metanotum yellowish; anterior and lateral margins and 2 patches on each side darker brown, these patches often black-margined. Interrupted black longitudinal line on mesopleura above leg bases, often concentrated into a single darker spot. Prosternum grayish, dark submedian marks near posterior margin. Anteromedian area of mesosternum grayish, remainder light red-brown; conspicuous black median spot just posterior to leg bases; on each side a small brownish spot nearer leg bases on posterior margin. Metasternum pale red-brown, indistinctly darker preceding leg bases.

Legs yellow. Basal $\frac{1}{3}$ of femur I yellowish, remainder occupied by a dark red area heavily shaded with black but leaving a slender pale oblique streak at anterior margin and a pale triangular spot near posterior margin. Femora II and III each with a single bright reddish pre-apical band which is blackish along its anterior margin. Tibia I black at base and apex; tibiae II and III unmarked. Apical segment and claws of tarsus I blackish brown; other tarsi pale, claws smoky. Wings hyaline. Longitudinal veins very pale yellow, except brownish at fork of MA. Most cross veins dark brown. Pale reddish shading at extreme bases of both fore and hind wings. Humeral cross vein of fore wing heavily black-margined. Dark basal costal cross veins present, 3-6 in number before the bulla; may be very slightly thickened. Stigmatic cross veins slanting, pale brown, paler than basal costal cross veins, 7-9 in number; most are single but a few may be anastomosed. Between bulla and stigmatic area a pale space in both costal and subcostal spaces, cross veins here almost indistinguishable; 2 radial cross veins nearest base distinctly thickened and margined. Several cross veins in disc behind R_1 somewhat thickened; fork of MA

slightly darkened. Most cross veins behind CuA of fore wing pale. About 5 rather regular rows of cross veins across wing from apex to bulla. Venation of hind wing pale.

Abdominal segments 1-6 basically yellowish white, hyaline, some with dark markings as indicated; segments 7-10 darker, semi-opaque, sterna paler than terga. Terga 2-6 with narrow black posterior margins not extending to pleural fold, and leaving midline pale. Tergum 1 largely blackish brown; tergum 2 pale at midline and along posterior margin. Terga 2-4 and often also 5-6, with very dark brown oblique lateral streaks, wider at points of departure from dark posterior margins, becoming narrower and zigzag nearer the pleural fold, decreasing in size to rearward. No indication of midway spots; no isolated spots except in pale specimens lacking the oblique lateral streaks on 5-6, a small dark dot is present at each end of the dark posterior margin. In some specimens, faint smoky submedian spots may be present on 6 near but not on the anterior margins. Two dark dots in stigmatic areas, the anterior the larger, in the pleural fold; this fold faintly dark-outlined. Terga 7-10 quite bright reddish to reddish brown, 10 paler than 7-9; posterolateral triangles paler, least evident on 9. Anterior margin of 7 very narrowly pale, edge of dark area narrowly black and somewhat scalloped in appearance; small dark dot in anterolateral angle, above pleural fold; midline narrowly pale. Tergum 8 pale on posterior margin; dark area here emarginate at center; longitudinal black line laterally above pleural fold. Abdominal sterna 7-10 unmarked. Sternum 2 with dark brown oblique streak or patch beginning anteriorly each side of midline and extending posterolaterally toward pleural fold; in dark specimens these patches may be connected by a cross band anteriorly. On sternum 3, smaller and paler streaks are often present as on 2; dark specimens may show similar but still paler streaks on 4 which may be wholly lacking on pale forms. Sterna 7-9 yellowish to very pale reddish brown; small dark spot often present over ganglia on 7, occasionally also on 8. Caudal filaments white. Near base, every second segment reddish black at joining. Beyond base, every fourth segment black at joining. Penes and forceps base yellowish; forceps limbs white, penultimate segment smoky brown. Dorsal extension of forceps base appears intermediate between *T. hilaris* and *T. packeri*, lower and narrower than the former, but neither as narrow nor as pointed as in *T. packeri*. Forceps limbs quite distinctly angulate at approximately $\frac{1}{3}$ of length of long segment from base, angulation thus being nearer the base than in either *T. hilaris* or *T. packeri*. Penes of a modified *trijunctus* type (Fig. 30); lateral pouches less extensive than in *T. packeri*; lapels seldom extend as far toward outer margin as in Kinmins' figure of the genitalia of *T. hilaris*. Genitalia as in Fig. 53.

Female imago.—Body 5.5-7 mm; fore wing 6-6.5 mm. Head grayish, purplish brown shading between eyes in most specimens. Thorax essentially as in male

but mesonotum often paler; in some females, oblique rose-color streaks on mesopleura above and preceding leg bases. Legs and wings as in male except as noted. Femoral band on leg II rather paler; no indication of the pale area in costal-subcostal spaces of fore wing between bulla and stigmatic area, which area is present in the male; 5-6 basal costal cross veins; stigmatic cross veins frequently anastomosed, same number as in male. Abdomen somewhat variable in color, but dark posterior margins and oblique lateral streaks present as in male. In spent females, dorsum of abdomen much shaded with purplish rose color on terga 2-6; tergum 8 pale yellowish white; rose-color band on 9; short oblique dark submedian dashes each side of mid-line on 2-6; venter pale yellowish white. In specimens still containing ova, segments 2-6 or 7 orange shaded, transverse bands on terga appear grayed reddish brown. Venter unmarked, as in spent females. Caudal filaments as in male. Chorionic pattern of ova rather similar to that of *T. traversac* (cf. Fig. 69) as to relative numbers of large rounded plaques, differing mainly in that the small dots surrounding the large plaques are rather smaller. Pattern of ova thus quite distinct from that found on ova of *T. packeri*.

Holotype.—Male imago. Mexico: Arriaga, Chiapas Province; 22-VIII-65. P. J. Spangler, collector. In collection of the University of Utah.

Allotype.—Female imago. Same data as holotype (UU).

Paratypes.—One hundred eleven ♂ imagos, 71 ♀ imagos, as follows: 95 ♂ from Mexico, same data as holotype; 14 from Honduras, 5 miles W. Jct. of Jicara Galan; 9-VII-65; 2 from Costa Rica, 10 miles N.W. of Liberia, 25-VII-65. Fifty-six ♀ from Mexico; 15 from Honduras, as aforementioned. P. J. Spangler, collector (UU).

Discussion.—This species is allied to *T. hilaris* and *T. packeri*, but smaller in size than either of those species. It is distinguished from *T. hilaris* by (1) narrower and slightly shorter dorsal extension of forceps base; (2) curvature of basal segment of forceps not quite as acute and situated nearer the base; (3) lapels on penes rarely extend to outer margin; (4) small lateral pouches present; (5) femora once-banded only. *T. spangleri* differs from *T. packeri* as follows: (1) dorsal extension of forceps base not as narrow; (2) curvature of basal segment of forceps nearer the base; (3) pale white area present in *T. spangleri* but not in *T. packeri* in costal-subcostal spaces of fore wing between bulla and stigmatic area in male; (4) 2 radial cross veins nearest base in fore wing of both sexes distinctly thickened and margined; (5) no midway spots; (6) sternum 2 with dark markings; (7) femora once-banded only; (8) ova with a different type of chorionic pattern.

The many specimens of *T. spangleri* proved to be remarkably constant in size, and generally also in color pattern. Such slight variations as occurred in

the dorsal extension of the forceps base are indicated in Fig. 57. These facts are of importance, as for no other species of *Thraulodes* have we had such a long series of specimens available for study. The few instances in which the lapels of the penes extended as far as the outer margin of that structure were mainly those in which the penes were artificially forced more strongly dorsad than usual or were turned slightly to one side. The Mexican specimens were collected not far from the type locality of *T. hilaris* as given by Eaton, yet the differences between this species and what is known of *T. hilaris* seem to indicate without a doubt that *T. spangleri* is indeed a distinct species in its own right.

We take pleasure in naming this species for P. J. Spangler, who collected all of the many specimens.

***Thraulodes speciosus* Traver**

(Fig. 44)

Thraulodes speciosus Traver 1934, 201, 1 fig.; Traver 1935, 552, 2 fig.; McDunnough 1942, 117.

Femora once-banded; basal costals present; abdominal segments 4-6 yellowish, terga with dark posterior margins and dark oblique streaks; genitalia of the *speciosus* type.

Male imago.—Fore wing 8.5-9 mm. Dorsum of thorax fawn-colored, mesonotum brighter than other parts; black markings on pleura; mesonotal scutellum brown-tipped; sterna yellow, large dark brown patches on pro- and mesosterna. Legs yellowish. Fore femur reddish brown, base yellowish, basal and apical black streaks on anterior margin, tibia reddish brown near each end, claws and apical segments of tarsus reddish brown. Femora II and III red-tinged, wide reddish brown apical bands, narrowly black on proximal edges; tibiae unmarked, tarsi as in leg I. Longitudinal veins of fore wing yellowish; cross veins dark brown except in cubito-anal region; moderately numerous, forming about 6 rows from apex to bulla. In basal costal and subcostal spaces and in 2 or 3 rows in disk basad of bulla, cross veins narrowly dark-margined; about 10 stigmatic veins, finer than basals, irregularly spaced, a few forked and anastomosed; humeral vein in both fore and hind wings dark brown; small purplish clouds at bullae on Sc and Rs. Terga I and 2 dark reddish brown, 3 semi-hyaline pale smoky brown; 4-6 yellowish, semi-hyaline brown oblique lateral streaks forming edges of posterolateral dark triangles; 7-10 opaque reddish brown, 8 slightly paler but without such a creamy band as occurs in *T. arizonicus*; all terga narrowly black on posterior margins. Pleural fold narrowly outlined in pale brown. Sterna 4-7 yellow, 1-3 and 8-9 reddish; all ganglionic areas darkened, deepest on 7. Caudal filaments yellowish or whitish; at base and in apical portion all joinings of segments equally wide and dark, elsewhere alternately wide and narrow. Genitalia as in Fig. 44.

Female imago. Fore wing 10 mm. Markings as in male, but abdomen reddish brown.

Nymph.—Reared by Dr. V. K. Mayo; to be described by her.

Type-locality.—Rustler Park, Chiracahua Mts., Arizona.

Type.—No. 3733 in California Academy of Science.

Material.—Species described from 2 ♂ and 2 ♀ imagos. In addition to the types, we have seen 1 ♀ imago and several subimagos of both sexes from Chiracahua Mts., collected by Dr. C. P. Alexander, these in private collection of Traver; also 1 ♂ imago on loan to us from Dr. V. K. Mayo, in her collection.

Discussion.—Differentiated from *T. arizonicus* on the following characters: abdomen more yellowish; tergum 8 not creamy although paler than 7 and 9; cross veins in several spaces narrowly margined; few creamy markings on thorax but more black pencillings. Also terga 2-3 darker than in *T. arizonicus*.

***Thraulodes telegraphicus* Needham and Murphy**

(Fig. 40, 60)

Thraulodes telegraphicus Needham and Murphy 1924, 41, 3 fig.; Navas 1935, 101; Traver 1946, 428, 4 fig. (= *plicatus*).

Femora once-banded; no basal costals; abdominal segments 2-6 whitish, terga with midway spots.

Male imago.—Fore wing 10-11 mm. Dorsum of thorax fawn-colored with brownish markings. Legs yellowish. All femora with wide brown pre-apical bands bounded by yellow and this by dark brown on proximal edge; tibiae and tarsi brownish apically. Wings hyaline; all veins of fore wing yellowish; cross veins moderately numerous; no basal costals; arcuate brown spot at base of each wing. Abdominal segments 2-6 whitish, translucent; terga with brown midway spots and quite prominent dark stigmatic dots. Tergum 1 brown; 7-10 "rich chestnut brown" (Needham and Murphy), whitish laterally, the brown color "deepening in intensity but narrowing in width to rearward" (Needham and Murphy); on 8 and 9, brown longitudinal streaks parallel pleural fold. Ganglionic areas of sterna darkened. Caudal filaments yellowish at base, paler beyond; joinings irregularly pale and black, "forming dots and dashes" (Needham and Murphy). Genitalia as in Fig. 40.

Female imago.—Fore wing 11 mm. Abdominal terga marked as in male, but deeply tinged with reddish brown, leaving white posterolateral triangles.

Nymph.—Unknown.

Type-locality.—Campaniento, Junin Prov., Peru.

Location of type.—Cornell University Collection.

Material.—Species described from 1 imago and 1 subimago of each sex.

Discussion.—In general appearance this species resembles *T. triunctus*, but differs markedly in genitalic structure; all femora once-banded; a somewhat larger species. We are holding under the name *T.*

telegraphicus several male imagos, several subimagos and at least 1 ♀ imago from Rio Huallaga, Tingo Maria, Huanuco Prov., Peru 19-VII-63 to 23-VIII 63; W. L. Peters, Collector (UU). The genitalia do not differ materially from those of *T. telegraphicus*. The abdominal coloration differs thus: Terga 2-6 washed with pale yellowish olive brown, leaving intersegmental areas pale; tergum 7 brighter red-brown than 8-10, its basal margin scalloped with blackish brown; 8 narrowly dark basally; 7-9 narrowly black on apical margins each side of midline. Caudal filaments in the following order: beyond base, a wide black segment, a pale one, a pale one with black apical margin, a pale one, a wide black.

Thraulodes traveræ Thew

(Fig. 2, 3, 66, 69)

Thraulodes traveræ Thew 1960, 120, 1 fig.

Femora twice-banded; no basal costals; abdominal segments 2-6 white, terga with dorsal, submedian, midway, and isolated spots.

Male imago.—Fore wing 7-8 mm. Dorsum of thorax yellowish brown, pronotum brownish medially, black pleural markings. Legs yellowish. Fore femur white at base and on narrow band near middle, premedian and apical brown bands, black line along anterior margin, narrow dusky longitudinal streak on mid-surface, tibia and tarsus yellowish white, tibia dark brown apically. Femora II and III colored like femur I, but pale at apex; tibiae and tarsi yellowish white, bases of tibiae light brown. Wings hyaline; longitudinal veins of fore wing pale yellow; cross veins pale, quite numerous, no basal costals; humeral vein and bases of Sc and R dark brown; stigmatic area opaque whitish, about 12 stigmatic veins, simple, curved. Abdominal segments 2-6 white, transparent; terga with dark brown submedian spots forming dorsal markings, decreasing in size posteriorly; midway spots; several isolated spots, 1 anterolaterally, another resembling $\frac{1}{2}$ an oblique lateral streak; small stigmatic dots. Segments 7-10 pale orange-brown, 1 light brown. Caudal filaments "white, with every fourth segment black, the following segments black proximally, and with distal joint of this segment narrowly black" (Thew). Abdominal markings shown in Fig. 2, 3. Genitalia as in Fig. 66 (in part after Thew, in part from paratype subimago).

Female imago.—Fore wing 6.3 mm. Markings as in male, but venation of fore wing distinctly yellowish; tibia I not dark at apex; abdomen filled with ova, orange brown.

Nymph.—The nymph seems to be represented by specimens taken in the same area as imagos of *T. traveræ* and have abdominal and femoral markings similar to those of imagos. They are tentatively held to be of that species; specimens are now in the collection of University of Utah. Body of mature male nymph 9 mm; of female, 10 mm. Head dark reddish brown, paler in female than in male; scape and pedicel of antennae brown, filaments yellowish; small pale

spot anterior to mid ocellus; on female, smoky shading posterior to black line between eyes medially and along posterior margin; turbinate eyes of male deep red-brown. Pronotum reddish brown; median line narrowly pale; dark brown areas on each side of midline, along posterior margin and as a small lateral spot enclosed by a yellowish area. Mesonotum very dark brown anterior to wing bases; submedian U-shaped mark and area near anterior end of this mark pale, as are anterolateral angles and large areas adjoining wing bases; pale triangle on postscutum between wing cases; black pencilings on mesopleura. Thoracic sternum yellowish; ganglionic areas blackish. Legs reddish brown. Femur I with yellow patch near apex, 2 pale patches near base, black streak apically on anterior margin; apical pale spots also on femora II and III; on femur II, a single spot near base, none on femur III; ventrally, a black spot indicates probable site of a postbasal dark band, on all femora. Tibiae narrowly pale at bases and near apices, narrowly black-margined at tips; tarsi pale at base, deep smoky beyond. Claws with 7 large denticles, graduated in size from largest nearest the tip. Abdominal terga dark reddish brown in female; 2-6 yellow-tinged in male. Black markings on terga 2-7 much as in imago, as follows: submedian and midway spots 2-7, anterolateral spots also on 2-5, submedian spots only on 8; tergum 10 deeper brown, anterior margin very narrowly pale; narrow dark posterior margins usually present on 5-9. Venter yellowish, apical sterna reddish tinged; ganglionic areas darkened; small dark dots laterally on 2-8 near pleural fold, anteriorly; often a dark dash on posterolateral margin. Gills very dark gray, narrowly paler along outer margin; moderately narrow, width about $\frac{1}{4}$ of length; tip about $\frac{1}{3}$ as long as main body of gill; lateral branches absent or very minute. Labrum slightly emarginate on apical border, 5 very low crenulations within this area; lateral angulation high, at about $\frac{1}{2}$ the mid-distance from base to apex. Outer margin of mandible curved but without hump. About 10 large pectinate spines in irregular row below crown of maxilla. Tibia III has 3 large somewhat spatulate spines at the posterolateral angle apically, 2 shorter nonspatulate spines on opposite angle; 6-7 apicoventral spines, very minutely pinnate; 2 irregular rows of similar spines along apical half of ventral surface. Specimens taken by F. Plaumann, as were the imagos of this species (Nova Teutonia, Brazil; 27°11'S, 52°23'W).

Type-locality.—Nova Teutonia, Santa Catarina, Brazil.

Location of type.—Illinois State Natural History Survey Collection.

Material.—Species described from 17 ♂ imagos, 51 ♀ imagos, 2 ♂ and 6 ♀ subimagos. Of these, 1 ♂ subimago and 3 ♀ imagos in private collection of J. R. Traver. Several specimens from Uruguay, mostly subimagos, appear to belong to this species; these are from Artigas, Arroyo Invernada, taken in

February 1954 by Dr. C. S. Carbonell; some are in collection at University of Montevideo, others in private collection of J. R. Traver.

Discussion.—The fore wing of paratype male (JRT), 9.5 mm; the figure of abdominal markings made from this male. The species seems most closely allied to *T. laetus*, the type of the genus. Eaton's description of *T. laetus* does not mention dorsal markings, nor does it pinpoint the location of the several triangular spots on each side of the dorsum on the terga. The genitalia are quite similar to those of *T. laetus*, aside from a difference in the dorsal projection of forceps base (see further notes under *T. laetus*).

Thraulodes trijunctus (Banks)

(Fig. 20, 34)

Thraulodes trijunctus Banks 1918-19, 10, 1 fig.

Thraulodes trijunctus Ulmer 1943, 28; Traver 1960, 73.

Thraulodes trijunctus Thew 1960, 120.

Femur I twice-banded, others (original description) once-banded; no basal costals; abdominal segments 2-6 very pale, terga with dark midway spots and small stigmatic dots; genitalia of *trijunctus* type.

Male imago.—Fore wing about 7.5 mm. Thorax reddish brown; pronotum whitish laterally; mesonotal scutellum and area preceding it, creamy. Legs yellowish. Fore femur with dark postbasal and pre-apical bands, tibia dark apically. Femora II and III with pre-apical bands only (per Banks); tarsi faintly dusky. Wings hyaline, venation "mostly yellowish or pale brown" (Banks); no basal costals; cross veins of fore wing rather sparse; humeral vein in both fore and hind wings "broadly black" (Banks). Venation as in Fig. 20 from Arequipa specimen. Abdominal segments 2-6 very pale, translucent; each tergum with dark midway spots and small stigmatic dots. Tergum 1 dark brown; 7 "dark brown in middle, pale at each end and on the side" (Banks); 8 dark brown basally and at midline; 9 "rather darker with dark median stripe" (Banks); 10 dark in midarea, pale laterally and apically. Ganglionic areas of sterna darkened. Caudal filaments pale, "every fourth segment wholly dark, the joinings between dark" (Banks). Genitalia as in Fig. 34, from type-specimen.

Female imago.—Not known to Banks; see notes following.

Nymph.—Unknown.

Type-locality.—Lima, Peru.

Location of type.—Museum of Comparative Zoology, Cambridge, Mass.; no. 10056 in that collection.

Material.—Banks described this species from a single male imago (a second male, originally placed by him in this species, is a *Traverella*). From Arequipa, Peru, we have imagos of both sexes, which agree so well in most instances with Banks' description that we do not hesitate to include them in this species. From these specimens, now in the University of Utah collection, we add the following notes.

Male imago.—Turbinate eyes oval, rather small, not contiguous apically. Mesonotal scutellum very narrowly dark-margined. Venation of fore wing yellowish, especially C, Sc, and R as far as bulla; beyond bulla, R brownish and very slightly thickened; stigmatic area opaque, milky; cross veins brown, in costal and subcostal spaces slightly thickened; about 15 stigmatic veins, slanting, several arranged in pairs, most are simple, a few forked near Sc. Costal angulation of hind wing rather blunt, basad of midlength. Femur II with narrow postbasal band, III with small dark spot near base, both with wide pre-apical bands; tarsal joinings narrowly darker. Abdominal terga 2-6 faintly tinged with yellowish brown, pale intersegmentally; tergum 2 brown-shaded; 2-6 faintly darkened at midline; 7 with tiny pale triangles at anterior margin each side of very dark midarea; midway spots on 7-9 as well as on 2-6; 10 not darkened medially.

Female imago.—Fore wing 8 mm. Differs from male only as indicated. Tiny black spot on lateral margin of pronotum. Basal $\frac{1}{2}$ of distal tarsal segments on each leg pale, apical $\frac{1}{2}$ and claws dark brown. In fore wing, very faint traces of 2 or 3 basal costals. Abdominal segments, containing ova, pale orange brown dorsally, rather paler ventrally. Brownish black middorsal streak on all terga; on each side of this on 4-6 a pale spot at anterior margin; anterior margins of 3-9 very narrowly dark brown; tergum 8 paler than 7 and 9. Ganglionic spot on sternum 7 blackish, others smaller and brown.

Discussion.—In general appearance this species resembles *T. telegraphicus*, but it is rather smaller and differs in genitalic structure. Other species having much the same type of genitalia are *T. centralis*, *T. osiris*, *T. packeri*, and perhaps *T. bomplandi*.

Thraulodes ulmeri Edmunds

(Fig. 33)

Thraulodes ulmeri Edmunds 1950, 552, 5 fig.

Femora once-banded; a few very faint basal costals; abdominal segments 1-6 yellowish, terga with midway spots, submedian patches, stigmatic dots.

Male imago.—Fore wing 6.5 mm. Dorsum of thorax yellowish brown, pronotum paler; pale area precedes mesonotal scutellum; blackish pleural markings. Legs pale yellowish. All femora with deep yellow-brown apical bands, these fuscous on proximal, dorsal, and ventral edges; tarsi II and III faintly brown-tinged. Wings hyaline, veins pale amber, cross veins paler than longitudinal. Humeral veins in both fore and hind wings fuscous. Stigmatic area milky; about 6 cross veins, simple, slightly aslant; a few very faint basal costals. Abdominal segments 2-6 yellowish, translucent; terga with prominent brownish midway spots, largest on 3-5; dark stigmatic dots; midline narrowly pale; on 3-5, somewhat obscure grayish submedian patches each side, most evident on 4; tergum 6 with narrow purplish brown posterior margin and submedian brown spots on anterior margin. Terga

8-10 and posterior $\frac{1}{2}$ of 7 rather dark reddish brown, anterior margins of 7 and 8 blackish. Caudal filaments pale; joinings of segments purplish brown, alternately wide and narrow. Genitalia as in Fig. 33.

Female imago.—Fore wing 6-8 mm. As in male except as noted. Pronotum with distinct dark line medially; terga 1-7 rather more distinctly tinged with brown; anterior margins narrowly dark brown; 8-10 paler.

Nymph.—Unknown.

Type-locality.—Santa Catarina, Hansa-Humboldt, Brazil.

Location of type.—University of Utah Collection.

Material.—Edmunds described this species from 2 ♂ and 1 ♀ imagos, 2 ♂ and 1 ♀ subimagos. Other specimens of this species, not type-material, are in the private collection of Traver, presented by Dr. G. Ulmer; these are from same locality as the types just listed.

Discussion.—The genitalia of *T. ulmeri* appear rather distinctive.

Thraulodes valens (Eaton)

(Fig. 64)

Thraulodes valens Eaton 1892, 9.

Thraulodes valens Ulmer 1919, 34; 1920, 116; Kimmins 1934, 344, 2 fig.; Ulmer 1943, 26, 2 fig.

Femora twice-banded; basal costals present; cross veins dark; abdominal terga 2-6 brown, paler laterally, dark posterior margins and oblique lateral streaks.

Male imago.—Fore wing 11 mm. Thorax "light raw umber brown above, varied posteriorly with light yellow-ochre" (Eaton); pleura dark brown, with creamy and blackish markings. Fore femur "dark raw umber or rufopiceous" (Eaton); longitudinal black streak, black apical margin; tibia "warmer in tint" (Eaton) than femur, apex black; tarsus yellowish brown. Femora II and III broadly black-banded near base and at apex, with base and narrow band beyond middle pale; tibiae and tarsi amber-yellow, tips of tibiae black. Longitudinal veins of fore wing light amber, bases of Sc and R blackish; cross veins blackish, numerous, in 10 or 11 rows across wing (as per Eaton, but Ulmer shows fewer rows); basal costals present; about 15 stigmatic veins, many of these forked and anastomosed. Extreme base of fore wing amber-tinged. In hind wing, humeral veins and base of Sc blackish, enclosing a gray cloud. Abdominal terga "light raw umber brown" (Eaton), lateral margins and sterna paler; terga 2-6 with black posterior margins and oblique lateral streaks. Caudal filaments whitish, yellowish brown at base; at base, alternate joinings of segments blackish, elsewhere all joinings black. Genitalia as in Fig. 64 (redrawn after Kimmins).

Female imago.—Fore wing 13 mm. Quite similar to male. Abdomen rather more yellowish, dark markings prominent. Several cross veins in fore wing

thickened, especially in basal costal and subcostal spaces; cross veins numerous; brownish spots on cross veins behind bullae and at fork of Rs; about 16 stigmatic veins, 8 or 9 of these anastomosed.

Nymph.—Unknown.

Type-locality.—Boquete, Caldera, Volcan de Chiriqui, Panama.

Location of type.—British Museum (Nat. Hist.), Godman and Salvin Collection.

Material.—Eaton described this species from 2 ♂ and 1 ♀ imagos and 1 subimago. Ulmer reports 2 ♀ subimagos from San Jose, Costa Rica, now in the Hamburg Museum.

Discussion.—By the structure of the dorsal projection of the forceps base, this species is allied to *T. hilaris* and *T. lepidus*; the lateral spines and prominent apical lobes resemble those of *T. lepidus* rather than of *T. hilaris* but the very long forceps limbs with curvature very close to the base are unlike either of those.

Thraulodes venezuelana Ulmer

(Fig. 28)

Thraulodes venezuelana Ulmer 1943, 23, 2 fig.

Femora twice-banded; a few weak basal costals; abdominal segments hazel-brown, terga 1-7 with dark posterior margins, midway spots 3-6, dorsolateral spots on 7; genitalia appear distinctive.

Male imago.—Fore wing 12 mm. Dorsum of thorax yellowish to reddish brown, 2 slender oblique blackish lateral stripes each side of pronotum, posterior margin blackish; mesonotum chestnut brown, darker at wing roots. Fore femur reddish black ("rötlich pechfarber," Ulmer), broad blackish bands at base and middle, apex dark; tibia pitch-brown, tarsus yellowish. Femora II and III yellowish; black bands behind middle and at apex, these bands connected to one another by dark brown areas; tibiae yellowish, tarsi somewhat darker. Wings hyaline; venation yellowish brown; base of fore wing brown near the blackish humeral vein; costal and subcostal spaces somewhat brownish, especially in apical third; bases of C, Sc, and R blackish; no thickened cross veins, although a few in basal area behind MA are somewhat stronger, as are the 12-14 regular, oblique, slanting stigmatic cross veins; 2 or 3 weak indistinct basal costals. Venation of hind wing light brown, brownish stain near base of black humeral vein. Abdominal segments hazel-brown, 3-6 translucent; terga 1-6 with black posterior margins; present also but less evident on 7 and 8; round blackish midway spots on 3-6, near anterior margin; on 7 a large purplish black spot on each side, these 2 spots facing one another occupy most of the tergum; 8-10 dark brown; blackish brown stigmatic dots on 2-6. Abdominal sterna concolorous with terga, last 3 somewhat lighter, midsterna with dark brown posterior margins; ganglionic areas darkened. Caudal filaments yellowish

brown; joinings of segments at base widely black, beyond this alternately dark brown and yellowish brown, apically all joinings dark brown. Genitalia as in Fig. 28 (redrawn after Ulmer).

Female imago and nymph.—Unknown.

Type-locality.—Venezuela.

Location of type.—Vienna Museum.

Material.—Species described from a single male imago.

Discussion.—The type of penes of this species seems unlike that of any other member of the genus. This species is distinguished from *T. hilaroides* and *T. zonalis* (which, like *T. venezuelana*, are predominantly brown on both dorsum and venter of abdomen) by the overall appearance of the genitalia and by the large dorsolateral blotches on tergum 7; this species lacks the oblique lateral streaks present in *T. hilaroides*, as does *T. zonalis*.

***Thraulodes zonalis* Trayer and Edmunds,
new species
(Fig. 25, 41)**

Third femur twice-banded; no basal costals, a few thickened stigmatic cross veins; abdomen orange-brown, midterga with dark posterior margins and midway spots.

Male imago.—Body 6.25 mm; fore wing 6.25 mm. Head dark brown; antenna dark brown except apical $\frac{1}{3}$ of filament; turbinate eyes rather small, circular, orange, barely contiguous apically, basal portions of eyes visible in dorsal view laterad of turbinates. Thorax mainly dark reddish or mahogany brown. Pronotum with faint darker oblique streak; black spot above leg base; mesonotal scutellum almost black, preceded by pale lateral areas; metanotum paler, dark transverse band precedes posterior margin, dark area each side of midline anteriorly. Legs yellowish. Fore femur dark orange brown, black along outer margin and at apex; tibia blackish brown at each end; last 3 tarsal segments smoky brown basally, basal segments faintly smoke-tinged, claws smoky. Femur II with apical orange band bordered on proximal edge with narrow black stripe, outer margin narrowly blackish, 2 dark spots within this pale basal area, arranged in tandem; tibia black at each end, apical band the wider; tarsal segments 3 and 4 faintly smoky, joinings darker, 5 blackish except at base and apex, claws smoky. Femur III twice-banded, only a narrow pale strip between bands; apical band as in femur II, basal band mottled smoky brown, no dark margins; tibia and tarsus as in leg II. Wings hyaline, whitish; longitudinal veins in both wings yellowish, most cross veins indistinct; no basal costals. In apical area, C, Sc, and R_1 somewhat thickened; 3-5 stigmatic veins, these on 2 or 3 in subcostal space also thickened, stigmatics simple, slanting, slightly curved. Arcuate brown band surrounds extreme base in both fore and hind wings, passing through humeral cross veins; in fore wing a small pale spot basad of humeral in costal

space, larger pale spot below it. Costal angulation of hind wing slightly basad of midlength; cross veins from angulation to R slightly thickened. Venation as in Fig. 25.

Abdomen orange brown above and below, 2-6 somewhat translucent; very little difference in color between 2-6 and 7-10. Faint darker midway spots on terga 3-7; posterior margins of all terga narrowly black. Pleural fold narrowly blackish; 2 small darker areas, 1 of these a stigmatic dot, near anterior and posterior margins of terga respectively. Sterna 1-3 with dark posterior margins, widest on 1; midsterna narrowly paler at midline; ganglionic areas of 7 and 8 darkened. Caudal filaments missing. Penes bear some resemblance to those of *T. paysandensis* and *T. ulmeri*. Genitalia as in Fig. 41.

Female.—Unknown.

Nymphs.—Nymphs which are probably of this species were taken by the same collectors at several locations in the Canal Zone. Body very dark red-brown, especially the females. Head slightly paler anterior to and posterior of black band between ocelli. Black V-mark posteriorly on pronotum of female, open side to rear; not seen in male. Pale V-mark on mesonotum each side of midline anteriorly, black markings laterad of this; anterior margin widely black. In male, pale spot preceding scutellum. Legs of female as follows: wide reddish brown pre-apical band on femur I, 2 dark bands on other femora; tibia I black at each end, base and tip of tarsus and base of claws paler. Femur I of male widely brown in midarea; pale spaces at base and apex, wider at base; femora II and III pale only at extreme ends. Posterior margins of all terga quite widely black; black midway spots on 3-6; sterna of female pale brown, posterior margins darkened, apicals strongly so; male more yellowish. Gills moderately narrow, width about $\frac{1}{5}$ of length; dark gray; main trachea black, no lateral branches. Caudal filaments of specimens from type locality pale brown; in basal $\frac{1}{2}$, alternate segments largely black; apically all segments narrowly dark brown at joinings. Labrum pale brownish; distance above lateral angulation about 3 lengths to 2 lengths below; very slightly emarginate apically, 3-5 low crenulations; black shading basally. Mandible pale brown, yellowish below molar area as far as anterior articulatory process; very slight hump on outer margin, quite strong curvature apically preceding incisors. On maxilla, 14-15 long pectinate spines in row below crown. No dark shading on hypopharynx. Spine at each apical margin of tibia III; 4-5 grooved pinnate spines apicoventrally, 2 partial rows of similar spines along ventral surface. On tarsus III, 5-6 spines along inner margin. Nymphs from the following localities: Canal Zone, Rio Guanabano, 3 miles north of Ft. Clayton on Chiva-Chiva Road; Rio Pedro Miguel, George Green Park on Madden Road; Rio Camaron, north edge of Ft. Clayton on Chiva-Chiva Road. From Panama: Rio Cabuya, 1 mile east of Tocumen

Airport. All were taken from 5-IX-63 to 10-IX-63 by W. L. Peters and C. M. Keenan (UU).

Holotype.—Male imago. Canal Zone; Rio Guanabano, 3 miles north of Ft. Clayton on Chiva-Chiva Road; 9-IX-63. W. L. Peters and C. M. Keenan, collectors. In University of Utah collection.

Discussion.—In general color this species belongs in the group with *T. venezuelana* and *T. hilaroides* but differs from those species in genitalic structure. Lateral pouches on penes are continuous with the earlike extensions apically, somewhat as in *T. paysonensis* and to a lesser extent in *T. ulmeri*. Penes also bear some resemblance to those of *T. regulus*.

Unnamed Adults

Thraulodes sp. Mexico; Fortin de las Flores, Veracruz, 14-VII-66; R. K. Allen (UU). Represented by 21 ♂ and 2 ♀ imagos. Allied to *T. hilaris*, *T. packeri*, and *T. spangleri*.

Male imago.—Body 7-7.5 mm; fore wing 7.5 mm. Head creamy white anterior to eyes; dusky mark each side of median carina; reddish shading around bases of antennae; scape and pedicel of antenna reddish, filament pale; ocelli black ringed at base, black transverse line anterior to eyes; turbinate eyes dark reddish brown, contiguous apically. Thoracic notum yellowish to pale reddish brown. Pronotum blackish at midline and on lateral margins. Creamy markings on mesonotum as follows: from wing roots forward to pronotum, enclosing red streak; each side of anterior lobe; scutellum and median and lateral areas preceding it. Dark shading laterally on metanotum. Black markings on pleura above bases of legs I and II, reddish spot above leg II. Sternum yellowish, mesonotum faintly brown each side adjoining leg bases. Legs yellowish. Femur I reddish brown in apical $\frac{2}{3}$, black on anterior margin; dusky median streak; tibia I narrowly black at each end except pale at extreme tip; tarsal segments 1 and 2 pale, 3 and 4 pale smoky, 5 and claw largely blackish. Femora II and III with narrow reddish pre-apical band, not darkened on one side as in *T. spangleri*; tibiae unmarked; distal tarsal segments and claws faintly smoky. More thickened cross veins in fore wing along basal $\frac{1}{2}$ of costal margin and in wing disk than in either *T. packeri* or *T. spangleri*; no such pale space in costal-subcostal spaces between bulla and stigma as occurs in *T. spangleri* 5-6 thickened basal costal cross veins, 8-10 stigmatic cross veins, not thickened, a few usually anastomosed. Abdomen yellowish white. Terga 1 and 2 dark reddish brown, posterior margins blackish; tergum 3 brown laterally; reddish to blackish brown oblique lateral streaks on terga 2-6; posterior margins narrowly black dorsally, but interrupted at midline; tiny black stigmatic dots may be present. Median areas of terga 7-9 bright reddish brown, widely creamy laterally; 10 pale, often with narrow reddish midline. Small dark submedian dots on sternum 1; faint pinkish shading on sterna 2-3; faint reddish stain at gan-

glionic areas on 2-6; 7-9 reddish brown along midline. Caudal filaments white, black joinings as in *T. spangleri*. Genitalia as in Fig. 52.

Female imago.—Body 7 mm; fore wing 7.5 mm. Essentially as in male. Darker specimen has reddish shading on vertex, in paler one reddish submedian streaks only. Thorax yellowish in pale form. Abdominal terga 2-7 largely reddish brown; pale oval spots above pleural fold; sterna 1-4 and 7-9 may be faintly red-shaded, the last 3 on midline only. Ova similar to those of *T. spangleri*.

Discussion.—In genitalic structure these specimens are rather close to *T. hilaris*, but the dorsal projection of the forceps base is less pronounced, the curvature of the long segment of the forceps limb is situated closer to the base, and femora II and III each have a single band only. Specimens differ from *T. spangleri* in the absence of a pale space in the costal-subcostal areas of the fore wing between the bulla and stigma, in the better developed dorsal projection of the forceps base and the presence of a lateral angulation; the spears of penes are somewhat shorter and stouter and the abdominal markings, especially on terga 5 and 6, are more complete. The single band on femur III, the much wider dorsal projection of the forceps base, the absence of midway spots, and the more prominent oblique lateral streaks distinguish these specimens from *T. packeri*. *T. hilaris*, *T. packeri*, *T. spangleri*, and these specimens from Fortin de las Flores seem to form a complex of closely allied species. Until more specimens of *T. hilaris* are known, we are not naming these specimens as a new species.

Thraulodes sp. Arizona; Oak Creek Canyon, Banjo Bill's Forest Camp, 24-VI-42; C. P. Alexander, collector (UU). Allied to *T. arizonicus* McDunnough.

Male imago.—Body 7.5 mm; fore wing 8 mm. Head very dark red-brown, narrowly paler on frontal margin; scape and pedicel of antenna dark red-brown, filament very pale brown. Pronotum reddish brown, darker in midarea, lateral margins blackish, creamy on posterior margin; mesonotum yellowish brown, brightest anteriorly, 2 rather pale creamy lines along anterolateral area preceding wing roots; scutellum yellowish tipped with reddish brown, preceded by creamy patch; pleura paler red-brown, creamy markings preceding wing roots and leg bases. Metanotum pale red-brown on posterior margin, creamy at midanterior margin. Prosternum concolorous with notum; pale area between pro- and mesosterna; mesosternum mostly reddish brown, paler medially and in band across central area. Legs and wings essentially as in *T. arizonicus*. Abdominal tergum 1 very dark red-brown; segments 2-7 translucent, pale tan, 2 somewhat darker than 3-7; posterior margins of terga narrowly smoky brown, slightly darker on 6 and 7; no dark posterolateral triangles, no dark oblique lateral streaks; tergum 8 yellowish dorsally, lateral and

posterior margins very pale reddish brown; 9 and 10 pale reddish brown. Pleural fold outlined in pale brown; sterna 7-9 and posterior portion of 6 brownish; ganglionic areas on 7-9 faintly darkened, on 6 outlined but not darkened. Caudal filaments pale yellowish white, faintly red-tinged near base; alternate joinings narrowly red-brown. Genitalia of the *T. speciosus* type, resembling those of *T. arizonicus* (Fig. 47).

Discussion.—This species differs from both *T. arizonicus* and *T. speciosus* in having no oblique lateral streaks on the terga, no darker shading in the posterolateral areas, a pale tan abdomen, and more creamy markings on thorax. The head is dark as in *T. speciosus*; the venation is as in *T. arizonicus*. If more specimens are available from this locality, the male just described may prove to be a species in its own right, distinct from *T. arizonicus*. Until such time we hold it as a pale variant of *T. arizonicus*.

Thraulodes sp. Mexico, 25 km east of Morelia, Michoacan Prov., 14-VI-55 (UU); collector not named.

Female imago and subimago.—One ♀ imago and several subimago females. Body 10 mm; fore wing 11 mm. Head very dark brown, frontal and posterior margins creamy; antenna pale yellowish. Thoracic notum yellow; midline and lateral margins of pronotum dark brown; mesonotal shield brightest in color; interrupted dark line on pleura above leg bases. Femur I with wide black longitudinal streaks over most of segment; tibia reddish at base, widely black at apex; tarsus smoky brown; femora II and III with reddish brown pre-apical bands darker on proximal edges, and wide pale reddish brown median band; tibia II darker at apex, distal segments of tarsi darkened. Longitudinal veins of fore wing pale brown, cross veins similar, those in radial space and the 6-7 basal costals slightly thickened, not margined; 9-10 stigmatic cross veins, 3 of these anastomosed. Abdomen yellow; posterior margins and oblique lateral streaks on 1-8 dark brown; 9 deep orange; sterna narrowly brown on anterior margins, ganglionic areas of 6 and 7 black-outlined. Caudal filaments yellow; all joinings dark near base; then alternate joinings dark; farther out, 1 wide joining alternates with 2 narrow dark ones. Ova as in Fig. 70.

Discussion.—By color pattern and darkened cross veins these specimens belong in the same group with *T. arizonicus*, *T. hilaris*, *T. lepidus*, and *T. speciosus*. The thorax is too yellow for *T. hilaris*; it is the right size for *T. lepidus* but is too large for others. The bodies are quite slender, much more so than in *T. lepidus*. In the absence of male imagos we are not naming these specimens as a new species.

Thraulodes sp. Peru; Yurac, 67 miles east of Tingo Maria, Huanuco Prov.; 16-IX-54; E. I. Schlinger and E. S. Ross, collectors (CAS). Allied to *T. schlingeri*.

Male imago.—Body 5 mm; fore wing 5.5 mm.

Bears strong resemblance to *T. schlingeri* in respect to form of eyes, once-banded femora, and tergum 6 similar in color to 7-10; faint midway spots, very tiny stigmatic dots. Differs principally in type of genitalia (Fig. 59). Females taken at the same time and place are yellowish on thorax and abdomen, but lack reddish markings on abdominal terga such as occur in *T. schlingeri*; posterior margins narrowly dark. Ova appear as in *T. schlingeri*.

Discussion.—We are not naming these as new from the few specimens now available.

Thraulodes sp. Peru; 2 miles west of San Ramon, Junin Prov.; 5-I-55; E. I. Schlinger and E. S. Ross, collectors (CAS).

Female subimago.—Teneral; body 8 mm; fore wing 9.5 mm. Thorax pale yellowish, pronotum dark on midline; femora once-banded; abdomen basically yellowish white; terga 1-7 with pale reddish brown butterflyshaped markings; midway spots incorporated within these; from each midway spot, a brown mark loops first backward then forward to anterior margin; midline margined by narrow dark lines.

Discussion.—This specimen may well represent a new species allied to *T. papilionis*.

Thraulodes sp. Peru; Huanuco, Huanuco Prov.; 16-IX-54; E. I. Schlinger and E. S. Ross, collectors (CAS).

Female imago.—Body 8 mm; fore wing 9.5 mm. Head dark brown. Thoracic notum yellow with reddish tinge. Only leg II remains; femur once-banded, tibia dark-tipped. Longitudinal veins of fore wing bright yellow along costal margin; cross veins yellow; no basal costal cross veins; about 11 stigmatic cross veins, a few anastomosed; humeral cross vein dark at base. Abdomen yellowish orange dorsally, yellow ventrally; posterior margins of terga 2-7 widely black, anterior margins with reddish brown vittae, 1 at midline, 1 each side; prominent blackish brown midway spots 2-6; small stigmatic dots 2-7; 8 with dark anterior margin, 9 black anteriorly and posteriorly; ganglionic areas 2-7 darkened. Caudal filaments missing.

Discussion.—This appears to represent a new species but we are not naming it in the absence of male specimens.

Thraulodes sp. Colombia; 14 miles south of Caqueza, Cundinamarca; 10-III-55; E. I. Schlinger and E. S. Ross, collectors (CAS).

Male subimago.—Cuticle partially shed. Body 7.5 mm; fore wing 8 mm. Head brown, pale on frontal margin. Thoracic notum light reddish brown; pronotum black laterally; brown stripe each side of mesonotum, lateral areas darker. Black transverse bands on femora mark the proximal edge of future pre-apical band; tibia I black apically. All veins pale; no basal costal cross veins; 9-10 stigmatic cross veins; humeral cross vein dark. Abdominal tergum 1

brown-shaded; 2-6 pale translucent yellowish white, faintly shaded with pale red-brown on dorsum; 3-6 with transverse midway spots; prominent black stigmatic dots on 2-6, black streak to rearward of each; 7 bright reddish brown, anterior margin narrowly dark brown; 8-10 duller red-brown, anterior margin of 8 dark brown; dark midline faintly indicated on 7-10; all ganglionic areas faintly darker. Caudal filaments missing. Genitalia (Fig. 48) of a modified *trijunctus* type; differs from *T. trijunctus* as follows: definite ears present; lateral margins of forceps base distinctly angulate; no lateral spine on penes. A very general male subimago from Tolima, 18 miles west of Honda; 16-III-55; E. I. Schlinger and E. S. Ross, collectors (CAS) is probably of the same species; differing only in having dark posterior margins on terga 6-9; it is definitely not allied to *T. papilionis*, although it is from same locality. A female subimago, same data as first male, may belong here; abdominal terga pale reddish brown, ova present; prominent midway spots; short dark dashes each side of midline on 3-7; 8 pale yellowish; other markings as in first male described. Body 7 mm; fore wing 8 mm.

Thraulodes sp. Colombia; 24 miles west of Villavicencio, 12-III-51, E. I. Schlinger and E. S. Ross, collectors (CAS).

Female imago.—Body and fore wing each 7 mm. Head pale red-brown; narrow interrupted black line on frontal margin, small black spot on vertex each side of midline. Pronotum yellow; blackish midline, dark lateral streaks, dark line above leg base. Mesonotal and metanotal bright red-brown. Legs yellow; femora with reddish brown pre-apical bands, black on proximal edge. Longitudinal veins yellow, cross veins paler; no basal costal cross veins; 7-8 stigmatic cross veins; humeral cross veins in both wings purplish black. Abdominal terga dark reddish brown; posterior margins narrowly black; blackish midway spots on 3-6, seem to be composed of 2-3 transverse spots; small pale triangles each side of midline on 2-7 at anterior margins; most of tergum 8 and lateral area of 7 yellow, dark line above pleural fold on 8. Sterna yellow; posterior margin of 7 narrowly darker. Caudal filaments missing.

Thraulodes sp. Colombia; 24 miles west of Villavicencio, 12-III-55; E. I. Schlinger and E. S. Ross, collectors (CAS).

Female subimago.—Body and fore wing each 11 mm. Head yellow, black transverse bands between ocelli. Pronotum yellow, dark-shaded at middle and on anterior margin; mesonotum bright red-brown, pale laterally and at midline; black pencilings on pleura; metanotum yellow. Legs yellow; femora once-banded. All veins pale; no basal costal cross veins. Abdomen yellow; reddish brown butterflyshaped markings dorsolaterally on terga; posterior margins pale, also small triangle each side of midline at anterior margin; midline dark on 2-3, dark-margined on 4-10; 8-10 pale yellow; midway spots within the dark dorsal blotches. Sterna pale yellow, 7 darker on poste-

rior margins at midline. Tergal markings much as in female subimago from Junin Prov.; also reminiscent of markings on male *T. papilionis*. Specimen would seem to be too large to be the female of *T. papilionis*, however.

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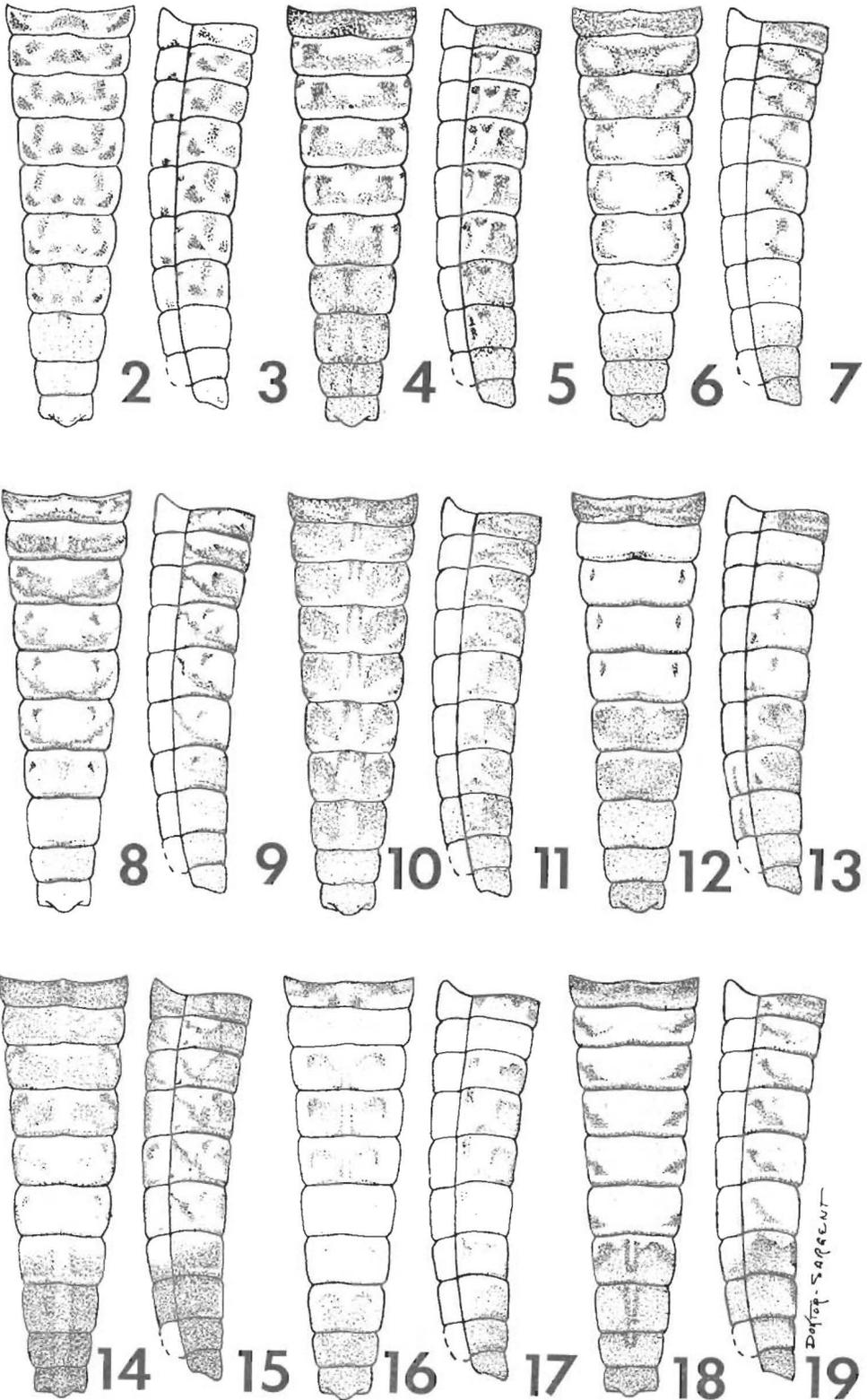


FIG. 2-19.—Abdominal pattern of male (Fig. 2 and 3, subimago; remainder, imago), dorsal (left) and lateral (right) aspects. 2, 3, *T. traveræ* Thew; 4, 5, *T. paysandensis* Traver; 6, 7, *T. lunatus*, n. sp.; 8, 9, *T. packeri*, n. sp.; 10, 11, *T. gonzalesi*, n. sp.; 12, 13, *T. ephippiatus*, n. sp.; 14, 15, *T. prolongatus* Traver; 16, 17, *T. papilionis*, n. sp.; 18, 19, *T. lepidus* (Eaton) (as *pedregoso*). Drawings by K. A. Sargent.

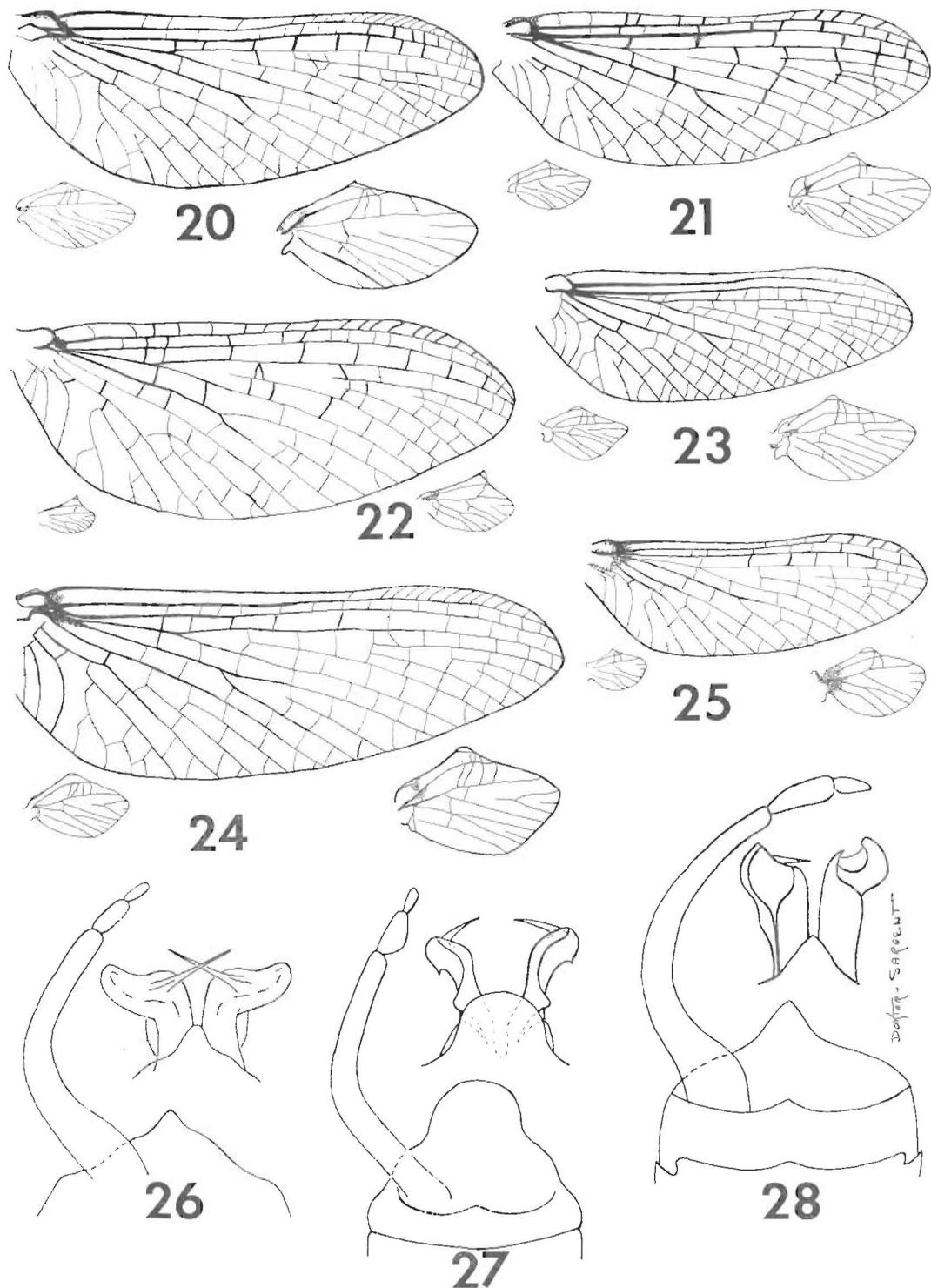


FIG. 20-25.—Wings of male imago. 20, *T. trijunctus* (Banks); 21, *T. packeri*, n. sp.; 22, *T. ephippiatus*, n. sp.; 23, *T. gonzalesi*, n. sp.; 24, *T. itatiaianus*, n. sp.; 25, *T. zonalis*, n. sp.

FIG. 26-28.—Genitalia of male imago. 26, *T. daidaleus* Thew (redrawn from original figure by Thew 1960, and from Uruguayan specimens); 27, *T. lepidus* (Eaton) (redrawn from Kimmins 1934); 28, *T. venezuelana* Ulmer (redrawn from Ulmer 1943).

Drawings by K. A. Sargent.

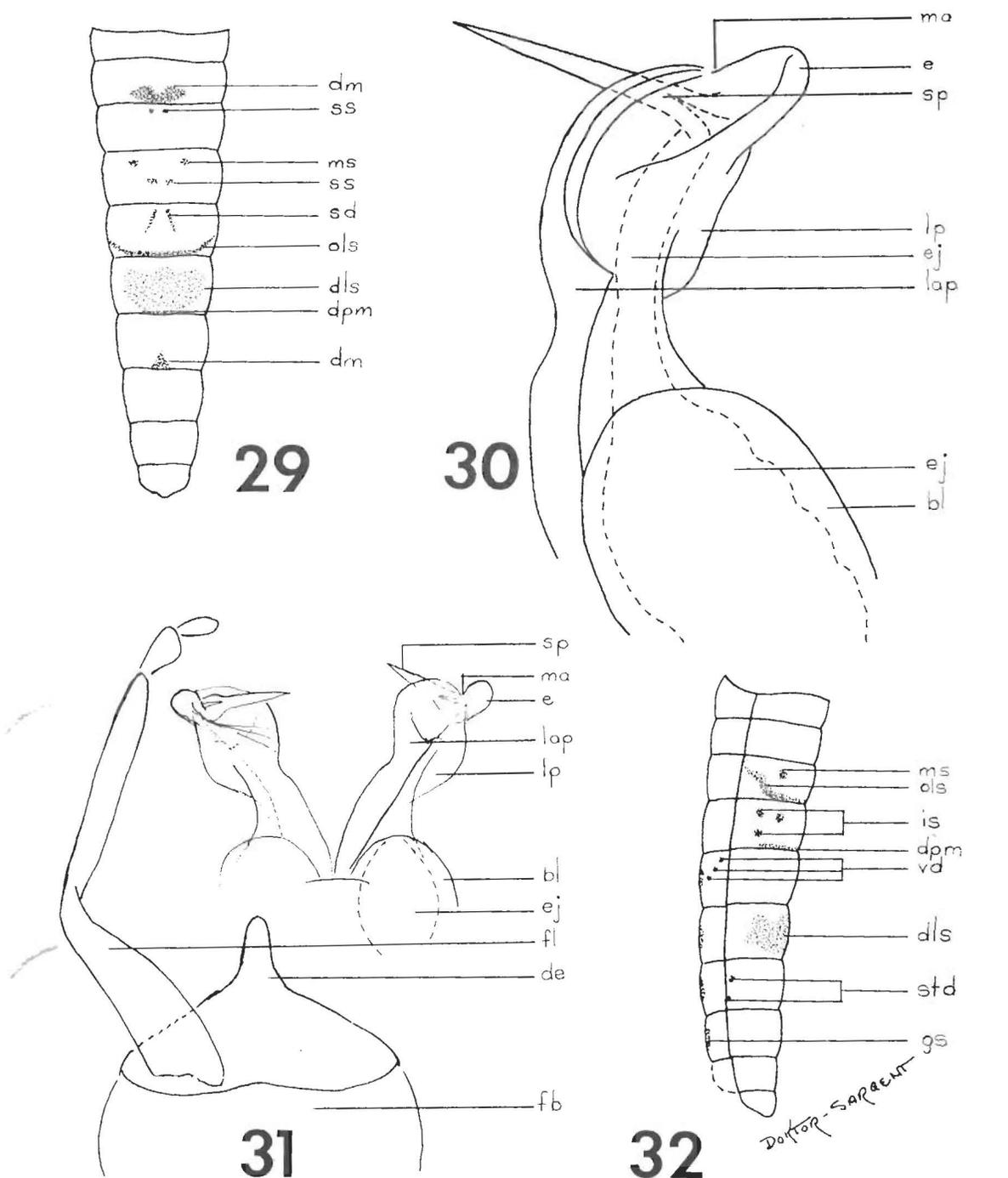


FIG. 29.—*Thraulodes* male imago, diagrammatic, abdominal pattern, dorsal aspect; FIG. 30.—*T. spangleri*, n. sp., penis of male imago enlarged; FIG. 31.—*T. packeri*, n. sp., genitalia of male imago; FIG. 32.—*Thraulodes* male imago, diagrammatic, abdominal pattern, lateral aspect. Drawings by K. A. Sargent.

EXPLANATION OF ABBREVIATIONS:

bl—basal lobe
de—dorsal extension
dls—dorsolateral spot
dm—dorsal mark
dpm—dark posterior margin
e—ear
ej—ejaculatory duct

fb—forceps base
fl—forceps limb
gs—ganglionic spot
is—isolated spots
lap—lapel
lp—lateral pouch
ma—membranous area

ms—midway spots
ols—oblique lateral streak
sd—submedian dashes
sp—spear
ss—submedian spots
std—stigmatic dots
vd—ventral dots

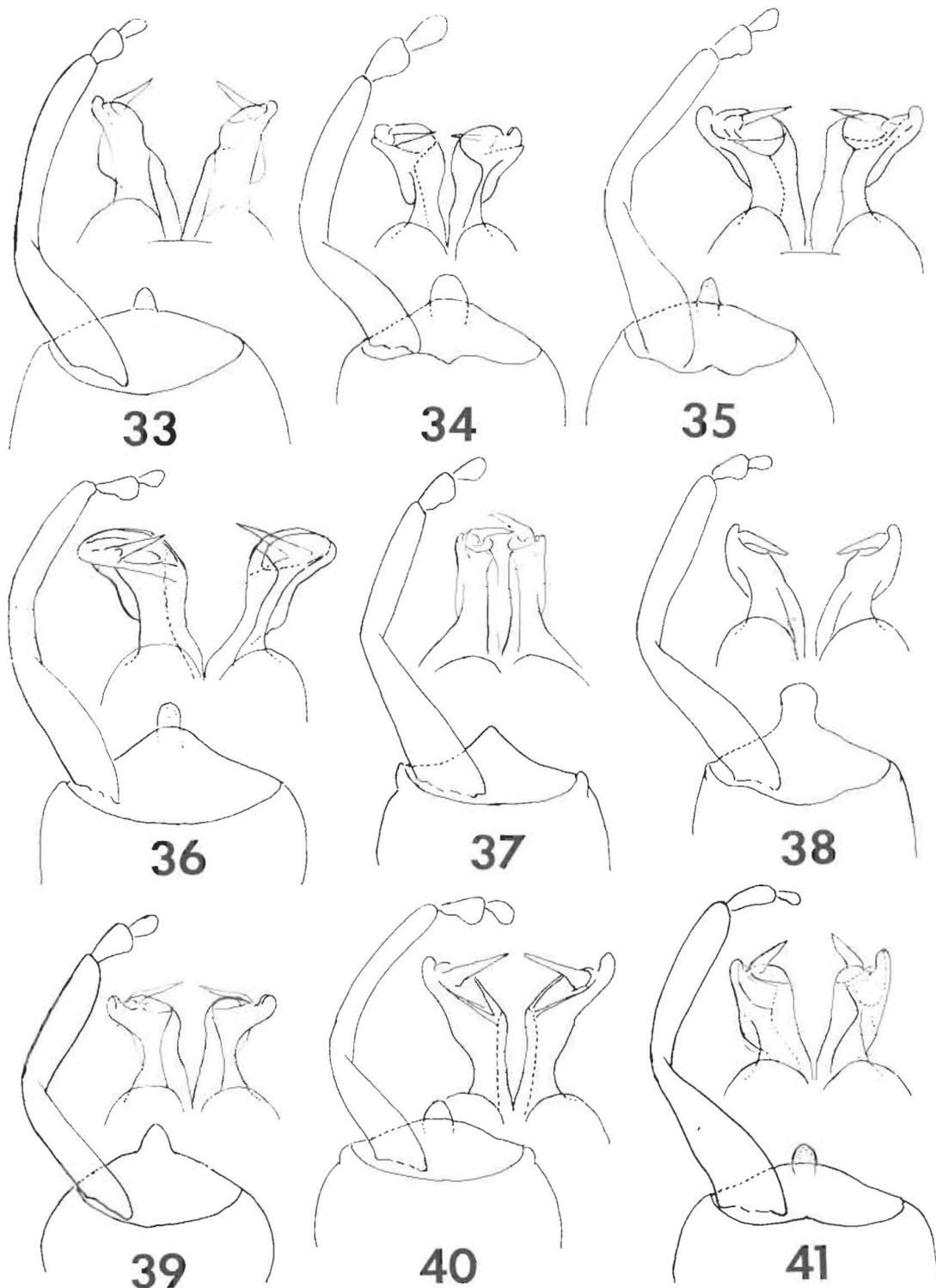


FIG. 33-41.—Genitalia of male imago. 33, *ulmeri* Edmunds; 34, *T. trijunctus* (Banks) (right penis, ventral view; left penis, dorsal view); 35, *T. lunatus*, n. sp. (right penis, ventral view; left penis dorsal view); 36, *T. osiris*, n. sp. (right penis, ventral view; left penis, dorsal view); 37, *T. ephippiatus*, n. sp.; 38, *T. hilaroides* Trayer; 39, *T. gonzalesi*, n. sp.; 40, *T. telegraphicus* Needham and Murphy (penes, dorsal view); 41, *T. zonalis*, n. sp. (right penis, ventral view; left penis, dorsal view).

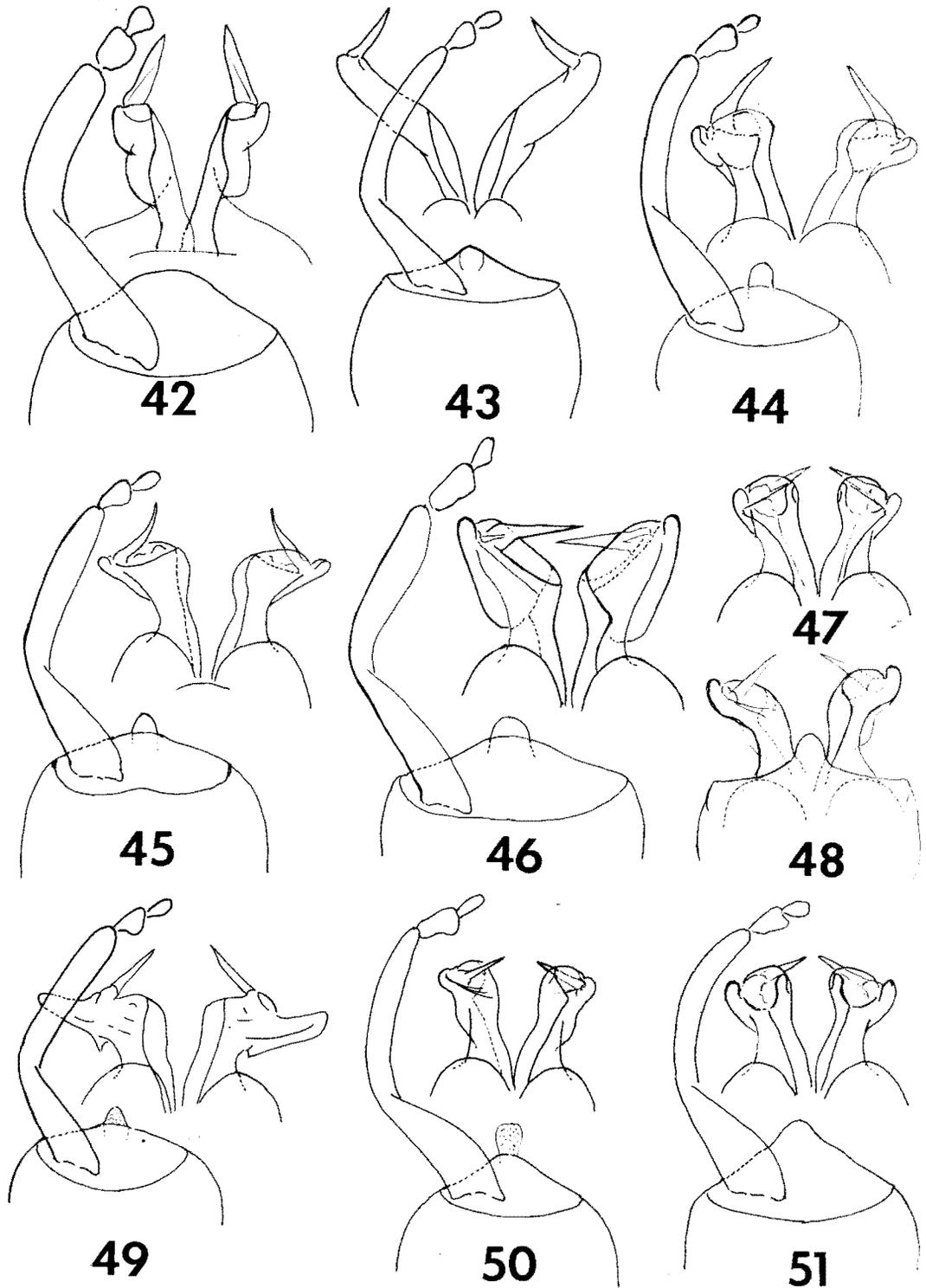


FIG. 42-51.—Genitalia of male (Fig. 48, subimago; remainder, imago). 42, *T. regulus*, n. sp.; 43, *T. itatiaianus*, n. sp.; 44, *T. speciosus*, Traver; 45, *T. schlingeri*, n. sp.; 46, *T. paysandensis* Traver (right penis, ventral view; left penis, dorsal view); 47, *Thraulodes* sp., ally of *T. arizonicus*; McDunnough; 48, *Thraulodes* sp., near Caqueza, Cundinamarca, Colombia (right penis, ventral view; left penis, dorsal view); 49, *T. prolongatus* Traver; 50, *T. centralis* Traver. (Right penis, ventral view; left penis, dorsal view); 51, *T. arizonicus* McDunnough.

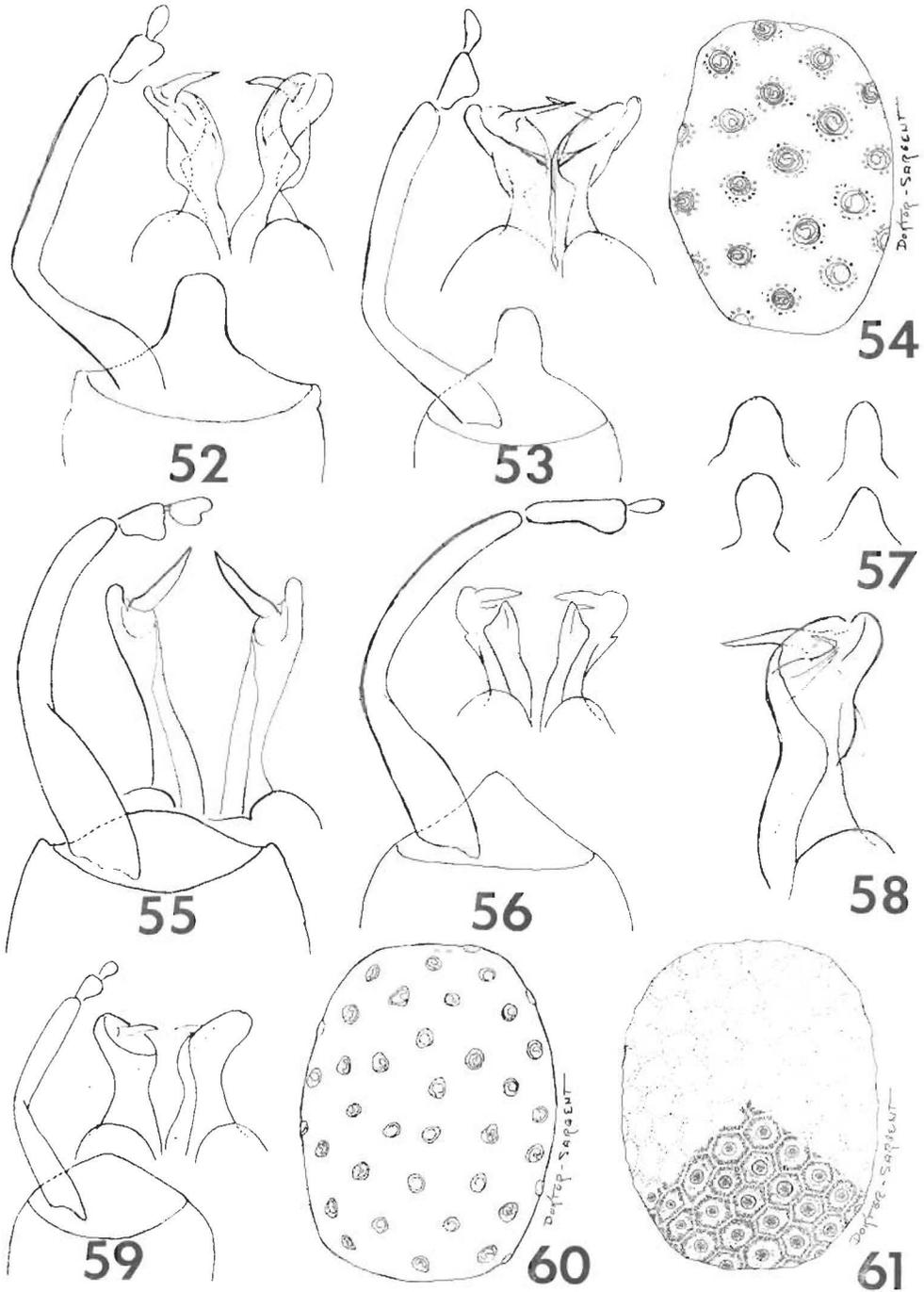
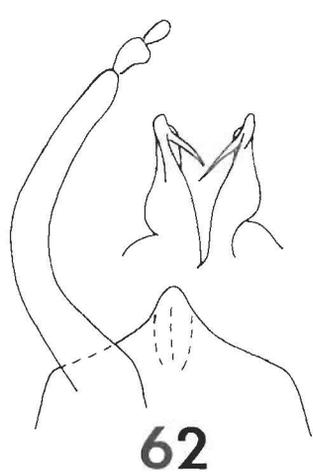
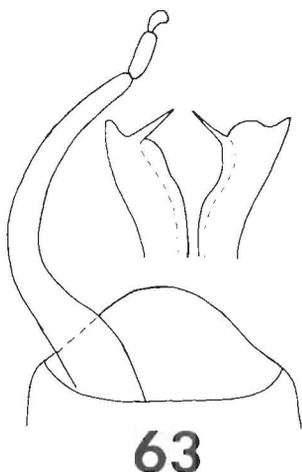


FIG. 52, 53, 55-59.—Genitalia of male imago. 52, *Thraulodes* sp., ally of *T. spangleri*, et al. (right penis, ventral view; left penis, dorsal view); 53, *T. spangleri*, n. sp. (right penis, ventral view; left penis, dorsal view); 55, *T. papilionis*, n. sp.; 56, *T. jurficulus* Traver; 57, *T. spangleri*, n. sp.; modifications of dorsal projections of forceps bases; 58, *T. lepidus* (Eaton) (as *pedrigoso*), penis of male enlarged, showing details; 59, *Thraulodes* sp., ally of *T. schlingeri*, n. sp., et al.

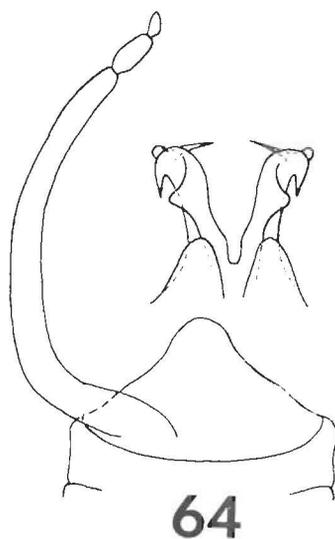
FIG. 54, 60, 61.—Ovum. 54, *T. schlingeri*, n. sp.; 60, *T. telegraphicus* Needham and Murphy; 61, *T. packeri*, n. sp. Drawings by K. A. Sargent.



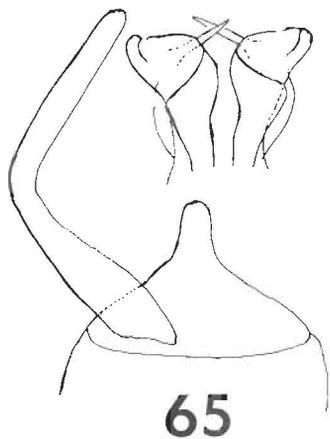
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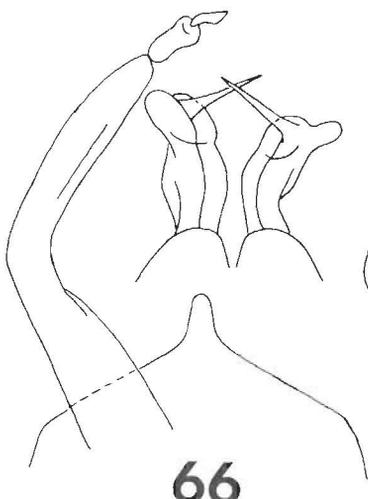
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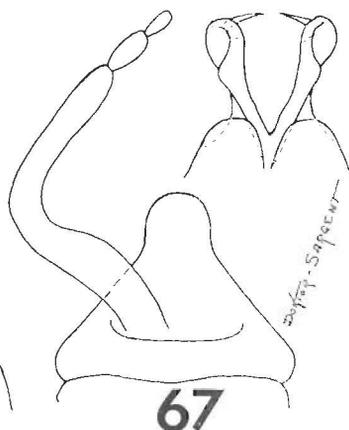
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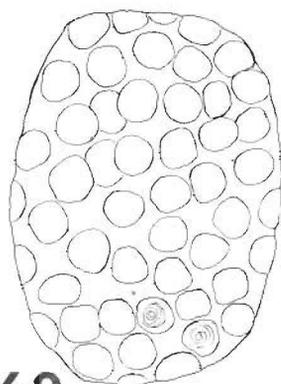
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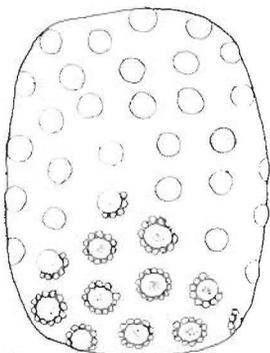
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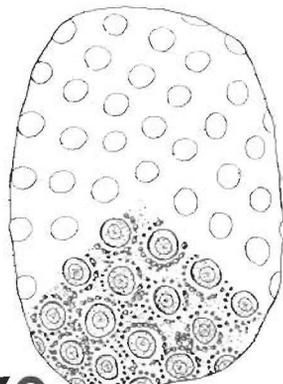
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FIG. 62-67.—Genitalia of male imago. 62, *T. mexicanus* (Eaton) (redrawn from Demoulin 1963); 63, *T. lactus* (Eaton) (redrawn from Eaton 1883, Pl. XIII, 23, no. 3); 64, *T. valens* (Eaton) (redrawn from Kimmins 1934); 65, *T. bomplandi* (Esben Petersen) (redrawn from Esben Petersen 1912); 66, *T. traverac* Thew (redrawn from Thew 1960, and from paratype subimago male shedding cuticle); 67, *T. hiliaris* (Eaton) (redrawn from Kimmins 1934).

FIG. 68-70.—Ovum. 68, *T. paysandensis* Traver; 69, *T. traverac* Thew; 70, *Thraulodes* sp., E. Morelia, Mexico. Drawings by K. A. Sargent.

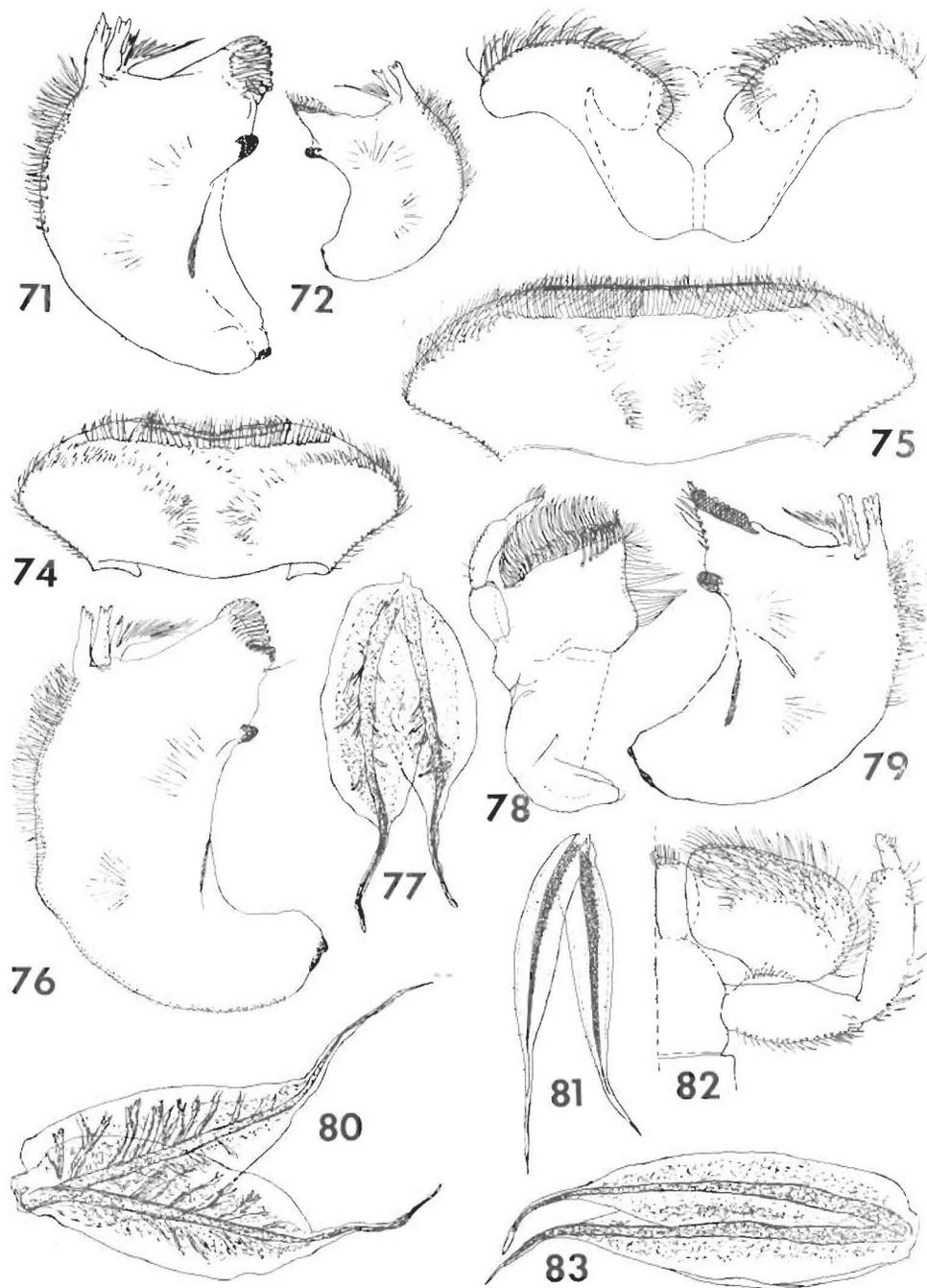


FIG. 71-83. —Nymphs. 71, *T. packeri*, n. sp., left mandible; 72, *T. gonzalesi*, n. sp., right mandible; 73, *T. packeri*, hypopharynx; 74, same, labrum; 75, *Thraulodes* sp., labrum (Aguas de Prata, Brazil, J. Illies); 76, *Thraulodes* sp., left mandible; (Aguas de Prata, Brazil, J. Illies); 77, *Thraulodes* sp., gill 5 (Santa Clara Brook, Brazil, F. Plaumann, 27°49'S, 49°35'W); 78, *T. gonzalesi*, n. sp., maxilla; 79, *T. packeri*, n. sp., right mandible; 80, *Thraulodes* sp., gill 3 (Bocaina, Piurras River, Brazil, F. Plaumann, 27°48'S, 49°55'W); 81, *T. gonzalesi*, n. sp., gill 3; 82, *T. packeri*, n. sp., labium; 83, *Thraulodes* sp., gill 3 (Campos Novas, Brazil, F. Plaumann, 27°48'S, 49°55'W). Drawings by R. Lang.