

INSECTS OF THE SUBFAMILY ENCYRTINÆ WITH BRANCHED ANTENNÆ.

BY
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(With Plates XLVI-XLVII.)

In a paper entitled "A new and remarkable Encyrtid," published in 1890 (Insect Life, vol. III, pp. 145-148), I showed that up to 1889 Westwood's single specimen of *Tetracnemus diversicornis*, captured in 1835, was the only acknowledged encyrtine with branched antennæ ever found. It is true that in 1885 Mr. Ashmead had described his *Tetracnemus floridanus*, but he had placed it in the subfamily Eulophinæ, not recognizing its encyrtine affinities. In 1889, however (Proc. Entom. Soc., Washington, I, 503), Mr. Ashmead announced that his species was a true encyrtine, and since that recent date five additional species, belonging to four new genera, have been found, while *Tetracnemus floridanus* has been shown to belong to still another new genus, making five in all. It is the purpose of this paper to describe the new forms and to bring the groups together to facilitate the characterization of additional genera and species which I feel sure will be discovered in the near future.

Although the forms to be described in this paper agree in the abnormal branching of the antennæ of the male sex, they can not be said to form a natural group. *Tetracladia*, *Calocerinus* and probably *Tetracnemus* seem closely allied, and, were tribal divisions necessary in the subfamily, these three genera would be grouped together. *Hexacladia*, *Tanaostigma*, and *Pentacnemus*, however, all of which we fortunately know in both sexes, differ widely from the other three genera. *Pentacnemus* would plainly belong near *Copidosoma* in any natural arrangement of the known genera, but *Hexacladia* and *Tanaostigma* introduce new features into the encyrtine system and would form tribes by themselves. There exists, however, in the National Museum collection a new genus, reared in large series by Messrs. Coquillett and Koebele in California from a gall on mesquit, which plainly possesses strong affinities with *Tanaostigma*, but of which unfortunately we know only the female sex. The male may prove to have branched antennæ.

With this understanding of the diversity of the forms, the use of a purely provisional tribal name, *Tetracnemini*, may not be objected to. For the present it may include all Encyrtinæ whose males have branched

antennæ, but may later be restricted to *Tetracnemus*, *Tetracladia*, *Calocerinus*, and allied forms.

The host relations of these insects may prove as variable as their structure. As yet we know with certainty the habits of but one—*Pentacnemus bucculatricis*—which was reared in large numbers from the overwintered cocoons of *Bucculatrix thujella* Pack., which had been sent to Dr. Riley from Cadet, Washington County, Mo., by Mr. J. G. Barlow. All of the specimens of *Tanaostigma coursetiæ* were extracted from the swollen ovaries of dry herbarium specimens of *Willardia mexicana*, a rare leguminous plant, which was supposed to belong to the genus *Coursetia* at the time the description was drawn up, but which was subsequently made the type of the new genus *Willardia*. The most careful dissection shows no trace of any insect other than the *Tanaostigma*, but as we can not but suppose that this insect is parasitic, the swollen ovaries must have originally been damaged by some other insect, perhaps by some small rhyncophorus beetle. The other five species were all captured, *Tetracnemus diversicornis* on oak, *Tetracladia texana* by sweeping grass, and *Calocerinus floridanus* upon oak. Concerning *Hexacladia smithii* and *Tetracladia gracilis* we have no further information than that they were collected, the former at Chapada, Brazil, by Mr. H. H. Smith, and the latter at Jacksonville, Fla., by Mr. Ashmead.

The genera may be separated by the following artificial key:

Provisional tribe Tetracnemini.

MALES.

Antennæ with four branches.

Mesoscutum with a transverse oblique impressed line..... *Tanaostigma* How.

Mesoscutum normal.

Scapulæ widely separated at tips; antennæ 10-jointed..... *Tetracnemus* Westw.

Scapulæ meeting at tips; antennæ 11-jointed.

Sixth funicle-joint of the antennæ more than twice as long as the other five together..... *Calocerinus* n. g.

Sixth funicle-joint shorter than fifth..... *Tetracladia* n. g.

Antennæ with five branches..... *Pentacnemus* n. g.

Antennæ with six branches..... *Hexacladia* Ashm.

FEMALES.

Antennal scape with a leaf-like expansion below..... *Tanaostigma* How.

Antennal scape subcylindrical.

Antennæ arising at clypeal margin..... *Pentacnemus* n. g.

Antennæ arising from above clypeus..... *Hexacladia* Ashm.

TETRACNEMUS Westwood.

Westwood's original description of this genus and its single species was published in Magazine of Natural History, 1837, Vol. 1, new series, pp. 257-259, under the title "A new genus of British parasitic Hymenoptera," and is here copied:

"Genus quasi intermedium inter *Encyrtum* et *Eulophum*. Corpus

oblongum, minutum. *Caput* thorace paullo angustius. *Ocelli* distantes *Antennæ* capite cum thorace longiores; 8-articulatæ; articulo 1mo, elongato; 2do, parvo, obconico; 3tio, 4to, et 5to, minimis, singulo ramum elongatum supra emittenti; 6to longo, tenui, apice supra ramum emittenti; 7mo, paullo breviori; ultimo, magno, oblongo-ovato. *Thorax* ut in Encyrtis formatus, *scutello* magno subrotundato. *Alæ* anticæ nervo subcostali, cum costa spatio parvo conjuncto, et ad apicem ramum parvum clavatum et curvatum emittente. *Pedes* sat longi atque graciles, intermedii ut in Encyrto formati. *Tarsi* 5-articulati pulvillo magno. *Abdomen* parvum, ovatum, subdepressum; apice subacuminatum. Mas.

"Species unica mihi adhuc cognita.

"*Tetrachemus diversicornis* Westw.

"*Caput* nigro-æneum, vertico tenuissime et transverse rugosum. *Antennæ* nigrae, pilosæ. *Thorax* æneus, scabriculus; *tegulae* piceæ. *Abdomen* nigricans. *Pedes* nigricantes, geniculis rufescentibus, tarsis piceis, calcaribus et articulo basali pedum intermediorum, luteis. Long corp. $\frac{1}{2}$ lin.; expans. alar. 1 lin. Habitat in quercetis apud Sylvam Coombe, die 3tio Julii, 1835, captus."

TANAOSTIGMA Howard.

The following description of this genus and its sole species is copied from Insect Life, Vol. III, No. 4, November, 1890, pp. 147-149:

"*Male*.—Resembles somewhat closely *Tetracnemus* Westwood. *Antennæ* 11-jointed+2 ring-joints; scape with a slight expansion below, the expansion faintly serrate; pedicel one-third as long as scape, narrowed at base; joints 1, 2, 3, and 4 of the funicle (not counting ring-joints) each with a single long hairy dorsal apical ramus, each ramus bent forward and reaching to base of club; joints 1 and 2 short, subequal in length, and considerably broader than long; joint 3 one-third longer than 2; joint 4 rather more than twice as long as 3; joint 5 rather more than three times as long as 4, gradually widening towards tip; joint 6 a little longer than 4, gradually widening from 5; club oval, somewhat flattened, twice as long as joint 6 of the funicle and slightly wider, joints plain. Face sunken in and shriveled in death; ocelli forming a straight line. Mesocutum with a faint transverse, slightly oblique impressed line just anterior to and almost parallel with the scuto-scapular furrow, and connected with this by a faint median longitudinal impressed line; scapulae just meeting at tip, the mesoscutellum therefore pointed anteriorly, rounded posteriorly. Wings hyaline, not ciliate; marginal vein long; postmarginal less than one-third as long as marginal; stigmal a trifle more than twice as long as postmarginal and descending almost vertically into the wing, the club bending abruptly outwards. Abdomen very short, almost truncate behind. Middle tarsi short, two-thirds the length of the short tibiae; mesotibial spur rather slender for this group, but longer than the first tarsal joint and acutely pointed.

"*Female*.—Antennæ with the same number of joints as in the male; scape with a rather broad, leaf-like expansion below; pedicel short and rounded; flagellum broad, flattened, slightly clavate, the joints of the funicle all broader than long, convex basally, concave apically, gradually increasing in length and width from 1 to 6; club as long as the first four funicle joints together. Face short; cheeks scarcely rounded; antennal grooves very sharp; ocelli in a straight line or the middle one is very slightly anterior to the lateral ones. Thoracic and wing characters as in male. Abdomen punctate, turned upward at tip; ovipositor slightly extruded and pointed upward.

Tanaostigma coursetiæ Howard.

"*Female*.—Length 1.8^{mm}; expanse 4^{mm}; greatest width of fore wing 0.64^{mm}. Head, face, thorax, and abdomen finely, closely, and evenly punctured. General color blue-black; palpi white; a narrow black band above mouth; just above this a broad yellow-white band extending across the face around the base of the eyes to a short distance behind the genæ; above this a narrow black transverse band from eye to eye at base of antennæ; above this a yellow-white band of about the same width, from eye to eye; antennal groove yellow-white; a light-yellowish spot behind the eyes and above the first-mentioned yellow band, and a narrow line of the same color across occipital margin between the eyes; propleura and mesopleura edged above and in front by a narrow yellowish band; antennæ black; front coxæ edged with yellowish-white; other coxæ and all femora and tibiæ black, lighter at joints; front tarsi dusky; middle tarsi yellow-white; hind tarsi yellow-white; last joint black, first joint dusky at base. Thorax and abdomen with sparse silvery scale-like pubescence, easily rubbed off.

"*Male*.—Length 1.4^{mm}; expanse 3.2^{mm}; greatest width of fore wing 0.62^{mm}. General color uniform metallic blue-black. Head, thorax, and abdomen very faintly shagreened, shining, almost smooth. Coloration of legs as in female.

"Described from 3 ♀, 9 ♂ specimens, all more or less mutilated, taken from ovaries of *Coursetia* (?) *mexicana* collected in the Alamos Mountains, Mexico, by Dr. Edward Palmer."

HEXACLADIA Ashmead.

The following descriptions of this genus and its sole species are copied from *Insect Life*, Vol. III, Nos. 11 and 12, August, 1891, pp. 456-457:

"Head very broadly transverse, including the eyes, much wider than the thorax, the face full convex, the space between the eyes and the mandibles longer than the length of the eye. Eye broadly oval, bare. Ocelli three, rather close together and subtriangularly arranged. Labrum very small, transverse, twice as wide as long. Mandibles very small, oblong, truncate at tips, bidentate. Maxillary palpi rather long, five-jointed; labiales short, three-jointed. Antennæ in both sexes

eleven-jointed, inserted on the middle of the face, the scape long, cylindrical, projected far above the vertex; in the male the six funicle joints each furnished with a long hairy ramus, the basal one being the longest, the others gradually diminishing in length to the last; the first funicle joint is very short, the following all long, at least thrice longer than the first; club long, fusiform, three-jointed. In the female the flagellum is subclavate, the first funicle joint being remarkably long, almost as long as the five following joints together; the last five funicles are short and very gradually increase in length and width to the club, the latter composed of three joints. The thorax in the male is strongly developed, highly convex, resembling somewhat an Eucharid; in the female less strongly developed. Mesonotum transverse, smooth, polished, without trace of furrows. Scutellum longer than wide, rounded behind and highly convex. Axillæ transverse, convex. Metathorax short, smooth, the spiracles very large, rounded. Middle legs slightly the longest, their tibiæ long, slender, cylindric, about one-third longer than the tarsi, the spur more than half the length of the basal tarsal joint, the tarsi stouter than the posterior tarsi, the joints after the first very short. The posterior femora and tibiæ are slightly dilated, the tarsi slender, cylindrical, and almost as long as the tibiæ.

"Abdomen, in both sexes, is small in proportion to the thorax; in the male it is long, oval, composed of seven segments, the first much the longest, the others short, all of about an equal length; in the female it is subcompressed, composed of six segments, the hypopygium being plowshare shaped, the ovipositor slightly exserted; as in the male, the first segment is the longest.

"Wings banded; the submarginal attains to the middle of the wing before jointing the costa, the costal cell being somewhat wide; the marginal vein is thickened and a little longer than the stigmal; the stigmal clavate curved upwards; the postmarginal is longer in the male than in the female."

***Hexacladia smithii* Ashmead.**

"*Male*.—Length, 1.8^{mm}; wing expanse, 4^{mm}. Head brownish-yellow, smooth, polished, the vertex fuscous; face very convex, with a few scattered, shallow punctures. Eyes broadly oval, brown. Antennæ black, the scape pale rufous, with a dusky streak above, the six funicular joints each furnished with a long hairy branch. Thorax black, impunctured, highly polished; collar brownish-yellow; scutellum shining, but microscopically shagreened. Anterior legs, including coxæ, brownish-yellow; middle and posterior legs black; in the middle pair the knees, tips of tibiæ, tibial spur, and tarsi are brownish-yellow. Abdomen black, the dorsum concave, probably unnaturally so in the dry specimen. Wings hyaline, with two transverse brown bands that do not extend entirely across the wing, terminating at about its center; the first and narrower is situated at about two-thirds the length

of the subcostal vein, the second and broader one just beneath the marginal.

Female.—Length, 2^{mm}. Head much wider than in the male, and except a streak on the face below the base of the antennæ, entirely black. Antennæ subclavate, brown, the scape and pedicel rufous. Thorax above black, highly polished; the basal half of the scutellum is bright red; collar, mesopleura, anterior legs, middle coxæ, tips of middle and posterior tibiæ, and their tarsi, rufous; the rest of the legs dark fuscous. Abdomen short, rather strongly compressed, black, shining. The apical half of the anterior wings, except the margins, is wholly brown, the basal half hyaline, with the narrow subcostal band as in the male.

“Described from one ♀ and two ♂ specimens, taken by Mr. Herbert H. Smith, at Chapada, South America, during the month of April, and in honor of whom this beautiful chalcid is named.”

PENTACNEMUS gen. nov.

Male.—Antennæ inserted at margin of clypeus; scape subcylindrical, not quite reaching to anterior ocellus; pedicel short, stout, as broad as long; joint 1 of funicle as long as pedicel; joints 2 to 6 increasing in length; joints 1 to 5 each emitting a long hairy branch from apical end, the second and third branches longest, the first and fifth subequal, the third joint nearly equal in length to joints 4, 5, and 6 of the funicle combined; club elongate ovate, nearly equal in length to joints 5 and 6 of the funicle. Ocelli at the angles of an obtuse-angle triangle. Occipital margin very sharp. Mesoscutum without grooves. Scapulæ meeting at tips. Mesoscutellum as long as mesoscutum, well arched laterally. Submarginal vein gives off stigma at a little less than half the length of fore wing. Marginal vein wanting. Stigmal vein short, oblique; postmarginal shorter than stigmal. Middle tibial spur long, slender, as long as first tarsal joint.

Female.—Resembles in some respects *Copidosoma*, particularly in antennal structure. The scape is long and cylindrical; pedicel short, obconical, stout; joint 1 of funicle narrower than pedicel; joints 1 to 6 of funicle subequal in length and width; club large, laterally somewhat flattened, and very obliquely truncate, nearly equaling in length the five preceding funicle joints. Face differs from *Copidosoma* in being closely and shallowly punctuate instead of with sparse deep punctures. In other respects resembles the male.

Pentacnemus bucculatricis sp. nov.

Male.—Length, 1^{mm}; expanse, 2.5^{mm}; greatest width of fore wing 0.5^{mm}. Head and mesonotum very closely punctuate; abdomen smooth, shining. Color: Head and mesoscutum brilliant metallic green, mesoscutellum dark metallic bronze; other parts of trunk shining black, except that the abdomen has a variable brown spot below at base; antennæ

uniform dark brown; all coxæ black, all femora and tibiæ dark brown, light at tips; middle tibial spur nearly white; all tarsi light honey-yellow, black at tips; wings perfectly hyaline; wing veins rather light, except the short post marginal, which is brown.

Female.—Length, 1.16^{mm}; expanse, 2.4^{mm}; greatest width of fore wing, 0.46^{mm}. In punctuation and coloration closely resembles the male, except that the tips of antennal scape and pedicel are lighter in color than the rest of antennæ.

Described from thirteen ♂, twenty ♀ specimens reared May 16 to 20, 1891, from over-wintered cocoons of *Bucculatrix thujella* Pack., received April 25, from J. G. Barlow, Cadet, Mo.

TETRACLADIA gen. nov.

Male.—In its four-ramose antennæ resembles *Tetracnemus* Westwood and *Tanaostigma* How. From the former it is at once distinguished by the scapulæ meeting at tip, and from the latter by its rounded occipital ridge and the absence of ring joints to the antennæ. Antennæ eleven-jointed; scape inserted half way between middle of face and mouth, slightly broadened below; pedicel conical, its breadth at tip equaling its length; joint 1 of funicle very short, broader than long; funicle joints 2, 3, and 4 very short, each giving out a long branch, of which that from joint 1 is longest and stoutest; joint 5 of funicle nearly as long as scape, giving off a short branch at tip; joint 6 somewhat shorter than joint 4; club as long as joint 5, large, ovate. Antennal grooves converge towards front, leaving a regularly rounded ridge; ocelli at corners of a somewhat obtuse-angled triangle; eyes very far apart; occipital ridge rounded. Dorsum of thorax rather flat; scapulæ meeting at tips. Submarginal vein reaches costa at half the wing length; marginal vein short, about one-sixth the length of the submarginal; postmarginal somewhat shorter than marginal; stigmal slender and very short, shorter than postmarginal, descending at a wide angle from postmarginal and bearing a large and well-marked club. Hind femora of unusual thickness.

Tetracladia texana sp. nov.

Male.—Length, 1.4^{mm}; expanse, 2.5^{mm}; greatest width of fore wing, 0.46^{mm}. Head, pro- and mesonotum very closely and finely shagreened and with small sparse punctures; a close row of small punctures around border of eyes; genal sulcus absent; entire tergal surface of abdomen also delicately shagreened, but without punctures. Color: Head, pronotum, and mesoscutum metallic green; mesoscutellum greenish bronze; abdomen and venter of thorax black; scape of antennæ brown; flagellum black; all coxæ, femora, and tibiæ, black, with faint greenish reflections on coxæ and femora, and the tips of tibiæ yellowish; middle tibial spur light honey yellow; wings nearly hyaline; wing veins dark brown, a dark shade or brownish patch just below marginal,

and a faint infuscation spreading from this and broadening towards anal margin of wing.

Described from 2 ♂ specimens collected by Nathan Banks at College Station Texas.

Tetracladia gracilis sp. nov.

Male.—Length, 1.44^{mm}; expanse, 2.9^{mm}. Longer and slenderer than *T. texana*; antennæ longer and slenderer, except joints 1, 2, 3, and 4 of the funicle, resembling closely the antennæ which Westwood has figured for *Tetracnemus diversicornis*, except that the four branches are borne on funicle joints 2, 3, 4, and 5 instead of 1, 2, 3, and 4. Head and mesoscutum closely and finely reticulate, the reticulation becoming transverse on face; no sparse punctures; genal sulcus sharp and complete; mesoscutellum and scapulæ nearly smooth, very faintly reticulate; dorsum of abdomen faintly shagreened. Color: Antennæ black; head and thorax metallic green, mesoscutellum somewhat bronzy, and scapulæ with a faint purplish reflection; mesopleura brilliant purple, greenish at base; abdomen black, shining, with greenish or bluish reflections; all coxæ and femora metallic green; all tibiæ black, yellowish at tips; all tarsi honey-yellow with dark terminal joints; middle tibial spur honey-yellow; wings perfectly hyaline.

Described from 2 ♂ specimens collected in east Florida by Mr. Ashmead.

CALOCERINUS gen. nov.

Male.—Resembles *Tetracladia*, from which it differs mainly in the extraordinary length of joint 6 of the funicle, and of the branch of joint 5. Scape inserted slightly below middle of face, subcylindrical, not broadened below, long, curved slightly backwards, reaching to lateral ocellus; pedicel as broad as long; joints 1 to 4 of the funicle as in *Tetracladia*, joint 5 a trifle longer than 1 to 4 together; joint 6 about four times as long as 5, growing gradually stouter towards tip; club, long oval, slightly broader than tip of preceding joint, and nearly one-half as long. Face broad, well rounded; occipital ridge rounded, but more acute than in *Tetracladia*; ocelli forming an obtuse-angled triangle; head broader than thorax and with a very short occipito-frontal diameter; mesonotum well rounded, scutellum rounded at tip, scapulæ meeting at tip. Wing venation same as in *Tetracladia*; fore wings partially infuscated. Legs rather long; hind femora not so much enlarged as in *Tetracladia*.

The abdomen is broken off at second joint with the only specimen, and therefore its shape and other characters are unknown.

Calocerinus floridanus (Ashm.).

Tetracnemus floridanus Ashm. Proc. Entom. Sec., Acad. Nat. Sci., Phil., 1885, Vol. 12. p. XVIII.

Male.—Length, 2.1^{mm} (estimating abdomen as one-third length of body); expanse, 4.1^{mm}; greatest width of fore wing 0.58^{mm}. Face with sparse whitish pubescence, finely shagreened, with sparse shallow punctures; cheeks shagreened, but without the pubescence or the punctures which end abruptly at the faintly indicated genal sulcus; mesonotum finely and closely shagreened, without punctures. General color metallic green, with slight purplish luster at vertex; mesopleura brilliant purple, metallic green at base; antennal scape honey-yellow, pedicel and flagellum black; front and middle femora brown, tibiae lighter, tarsi very light, middle tibial spur concolorous with tarsi; hind femora black with metallic reflections, tibiae very dark brown, lighter at ends, tarsi light brown; fore wings fuscous, with brown pubescence, but with two irregular, wedge-shaped, white patches, the one with its base upon the costa immediately beyond the stigmal vein, and the other with its base upon the anal margin immediately opposite, their apices nearly meeting in the middle of the wing; basal one-fifth of the wing hairless, with a small distal patch of white pubescence, to which comes obliquely a hairless streak from the marginal vein; veins dark brown, the origin of the stigmal almost obscured by the brown pubescence, which is denser here than at any other point of the wing.

Described from one ♂ specimen collected by Mr. Ashmead near Jacksonville, Fla.

EXPLANATION TO PLATES.

PLATE XLVI.

- Fig. 1. *Tetracladia texana* Howard, male greatly enlarged (original).
2. *Tetracnemus diversicornis* Westwood; greatly enlarged (redrawn from Westwood).
3. *Tanaostigma coursetiae* Howard: *a*, ovary of *Willardia mexicana* with the *Tanaostigma* just issuing; *b*, adult male, enlarged; *c*, male antenna; *d*, female antenna; *e*, veins of fore wing; *f*, tip of middle tibia and tarsus, still more enlarged (after Howard).

PLATE XLVII.

- Fig. 1. *Pentacnemus bucculatricis* Howard: *a*, adult male, enlarged; *b*, tip of middle tibia and tarsus; *c*, veins of fore wing; *d*, tip of front tibia and tarsus; *e*, male antenna; *f*, female antenna, still more enlarged (original).
2. *Hexacladia smithii* Ashmead, adult male with outline of female antenna above, enlarged (after Ashmead).



Howard, L. O. 1892. "Insects of the subfamily Encyrtinae with branched antennae." *Proceedings of the United States National Museum* 15, 361–369.

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