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REVISION OF THE MILLIPED GENUS DELTOTARIA
(POLYDESMIDA: XYSTODESMIDAE)¹

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Introduction

Deltotaria is a distinctive genus of the family Xystodesmidae, characterized particularly by the appreciably elongated coxal apophysis of the male gonopod. Although its component species occupy a fairly extensive generic range in the Southern Appalachians and may be locally abundant, *Deltotaria* was not proposed until 1942, with only three species subsequently added to the present. Presumably the various forms of *Deltotaria* are even more prone to local endemism than species of related genera, and if this is so many years may elapse before all have been discovered and classified.

Existing descriptions are in general adequate for recognition of the species, but are scattered over a period of years in different journals, and variations particularly in the execution of the illustrations give an impression of greater differences between some of the species than actually exist in nature. Having had the opportunity to study the types of three of the species, as well as to obtain fresh material of several in the field, I believe that a brief summary of *Deltotaria*,

¹ This study was undertaken with the aid of a grant from the National Science Foundation.

including descriptions of two new species and some remarks on the status of others, will be useful to other workers interested in xystodesmids. The present paper constitutes the fifth in a series of generic synopses within this family of diplopods.

MATERIALS AND METHODS

The methods of study outlined in previous parts of this series have been generally followed and do not require explanation. A departure from the usual procedure in illustration occurs in the orientation of the gonopods. In general the mesial aspect shows most of the important structures in xystodesmid gonopods; in *Deltotaria*, however, a ventrolateral aspect of the gonopod—as it would be seen in situ—reveals diagnostic features best and has been adopted for this particular case, although the gonopods have been removed from the specimens and cleared of muscle tissue so that the coxa and the sternal apodeme could also be shown. Fortunately, the gonopods of the two species that I was unable to personally study have also been illustrated from this aspect and permit a satisfactory comparison of figures.

The type specimens of three species, *D. brimleii*, *brimleardia*, and *tela*, are in the collection of the Academy of Natural Sciences of Philadelphia (ANSP), and I am very much indebted to James A. G. Rehn and Harold J. Grant, Jr., for the opportunity to study them. The holotype of *D. philia* is in the personal collection of R. V. Chamberlin at the University of Utah, but has been temporarily misplaced and thus is not available for examination. Types of the two new species here described are in the U.S. National Museum. Thus, of the six forms which are recognized in the genus, I have seen the types of five, and have seen two of the species in life. It is once more a pleasure to express my thanks to Leslie Hubricht, who obtained specimens of both of the new forms and most generously donated them to me (RLH).

REVIEW OF THE LITERATURE

Deltotaria was not proposed until 1942, when the genus and its type species *brimleii* were defined by Nell B. Causey, who pointed out the general affinity of the genus with *Apheloria*. The original description is short, but concise and generally satisfactory. The type specimens of *brimleii* were from Swannanoa, North Carolina.

Several years later, R. V. Chamberlin (1947) published the description of a second species from North Carolina which he named *Deltotaria nigrimontis*. Allocation of this species to *Deltotaria* was presumably made on the basis of the telopodite shape, which is similar to that of *brimleii*. In other respects the gonopods of the two are

rather dissimilar, *nigrimontis* having a large acute prefemoral process but completely lacking a distinct coxal apophysis, the one outstanding character on which *Deltotaria* was founded. In 1949 I erected a third new name in *Deltotaria* for a species that differed from the type species in the same ways as did *nigrimontis*. Subsequent study has shown that my *D. coronata* is a subspecies of *Dixioria pela*, and that *D. nigrimontis* is a member of the genus *Sigiria*. My revision of *Dixioria* (1956) contains a detailed discussion of this situation.

Two other species from western North Carolina, congeneric with *D. brimleii*, were named by Causey—*D. tela* (1950a) and *D. brimleardia* (1950b)—both with coxal apophyses on the gonopods and thus confirming the generic significance of the character.

In 1949, Chamberlin named a new xystodesmid species from north Georgia and made it the type of the genus *Phanoria*, which was diagnosed with the following words: "Telopodite of male gonopod a simple apically acute blade curved in a semicircle; on anterior side of coxa a process in form of an erect blade, in this differing, for example, from *Sigmoria*." The illustration of the gonopod of *Phanoria philia* depicts a configuration perfectly typical of *Deltotaria*, and *philia* was subsequently transferred to that genus by Chamberlin and Hoffman (1958).

So far, then, four valid species have been proposed in *Deltotaria*, to which the present account adds two more, both from western North Carolina, clearly the center of abundance for the genus.

TAXONOMIC CHARACTERS

Many of the xystodesmid genera of the southern Appalachian region are readily distinguishable on the basis of general appearance, once the student has first learned to recognize their species by use of the male genitalia. Thus, the recognition of such genera as *Nannaria*, *Boraria*, *Cherokia*, and *Pleurolooma* is easy enough, but the correct allocation of specimens in the genera *Apheloria*, *Sigmoria*, *Sigiria*, *Cleptoria*, and *Brachoria* (among others) is by no means simple even with male specimens at hand. In the present state of knowledge the generic position of females usually cannot be determined except in the few areas where the fauna is well known and association with males is possible. Fortunately, although *Deltotaria* seems to be a member of this generic complex, it is specialized enough to be readily identifiable. The males, of course, are characterized by the conspicuous coxal apophysis of the gonopods, but both sexes may be placed at once in *Deltotaria* by the complete absence of cranial setae. These setae are often, or even commonly, rubbed off in preserved material of other genera, but their occurrence can be verified by the setal sockets visible when the head is suitably oriented in strong

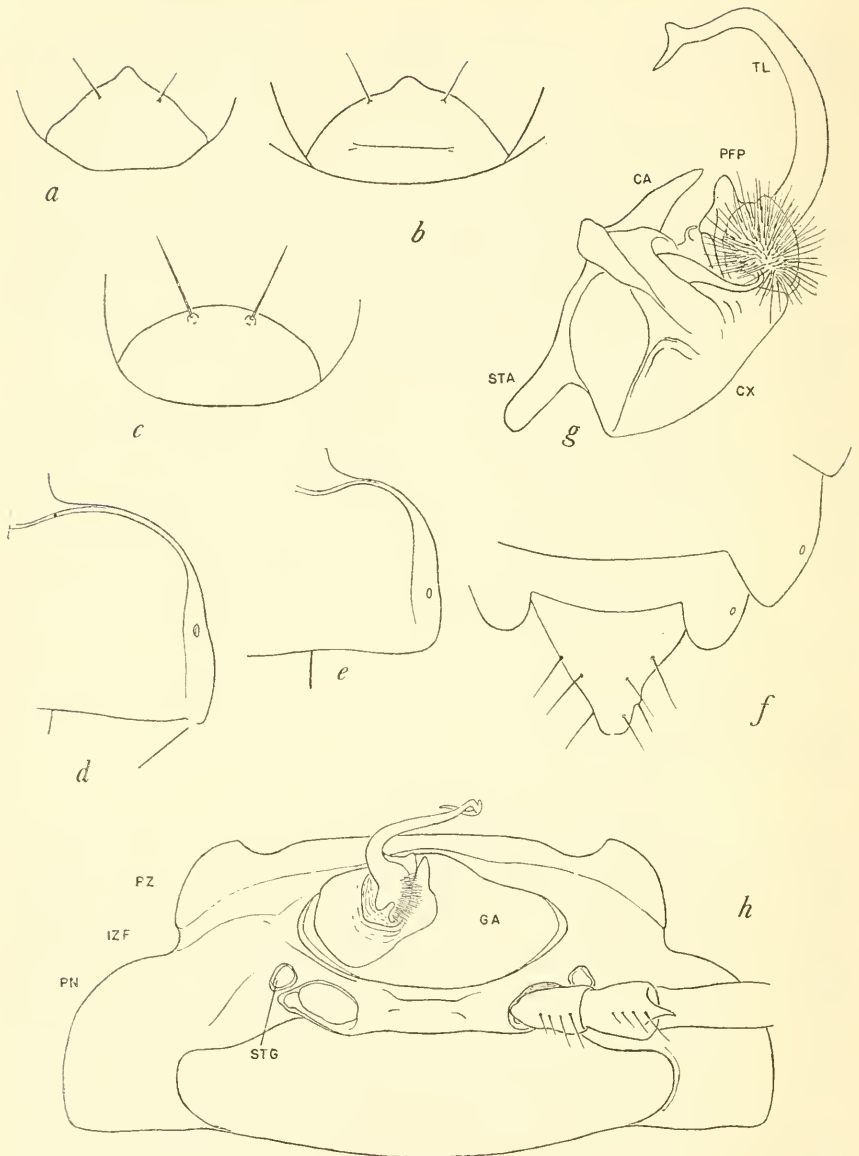


FIGURE 1.—Structural details of *Deltotaria*: *a*, Hypoproct of *D. mariana*; *b*, same, of *D. tela*; *c*, same, of *D. lea*; *d*, paranotum of 13th segment, dorsal aspect, of *D. tela*; *e*, same, of *D. mariana*; *f*, epiproct and paranota of segments 18 and 19 of *D. mariana*; *g*, left gonopod, mesal aspect, of *D. mariana*; *h*, ventral aspect of segment 7, with 8th leg of right side and gonopod of left side removed, of *D. mariana*. Abbreviations: CA, coxal apophysis; CX, coxa; GA, gonopod aperture; IZF, interzonal furrow; PFP, prefemoral process; PZ, prozonite; STA, sternal apodeme; STG, stigma; TL, telopodite. The straight line in figure 1*d* points to the caudal projection of the paranotum characteristic of several species.

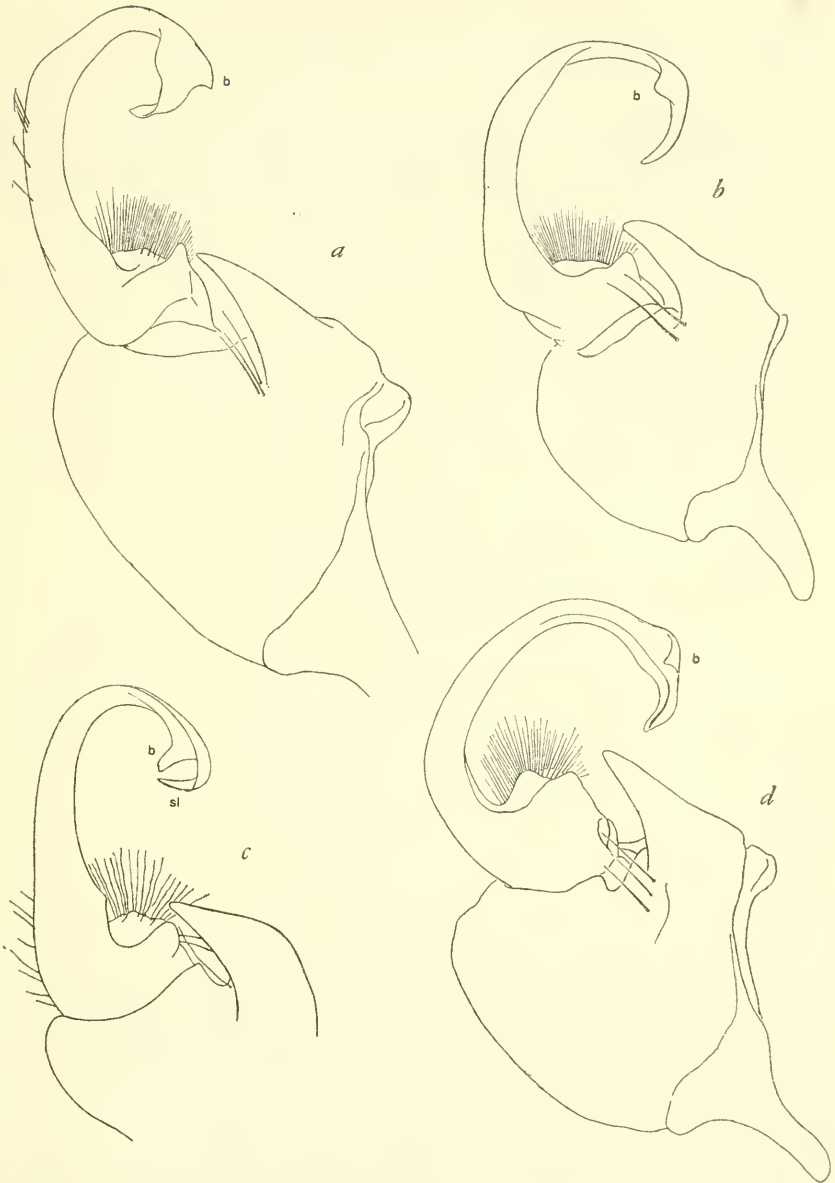


FIGURE 2.—Left gonopods, in mesal aspect, of four species of *Deltotaria*: *a*, *D. tela*, toptype from Bent Creek, N.C.; *b*, *D. brimleardia*, holotype from Sevier County, Tenn.; *c*, *D. brimleii*, holotype from Swannanoa, N.C. (figure from Causey, 1942); *d*, *D. mariana*, holotype, from Transylvania County, N.C. *2*, *a*, *b*, and *d* drawn to the same scale; figure *2c* enlarged from the original drawing to approximately the correct scale. Abbreviations: *b*, process B of telopodite; *sl*, solenomerite.

light. The five species of *Deltotaria* examined show no trace of setal sockets, a fact that makes the genus unique among those known to me.

Except for small and almost intangible details of form and texture, the various species of *Deltotaria* are very similar in external appearance. This condition, typical of most related genera as well, directs

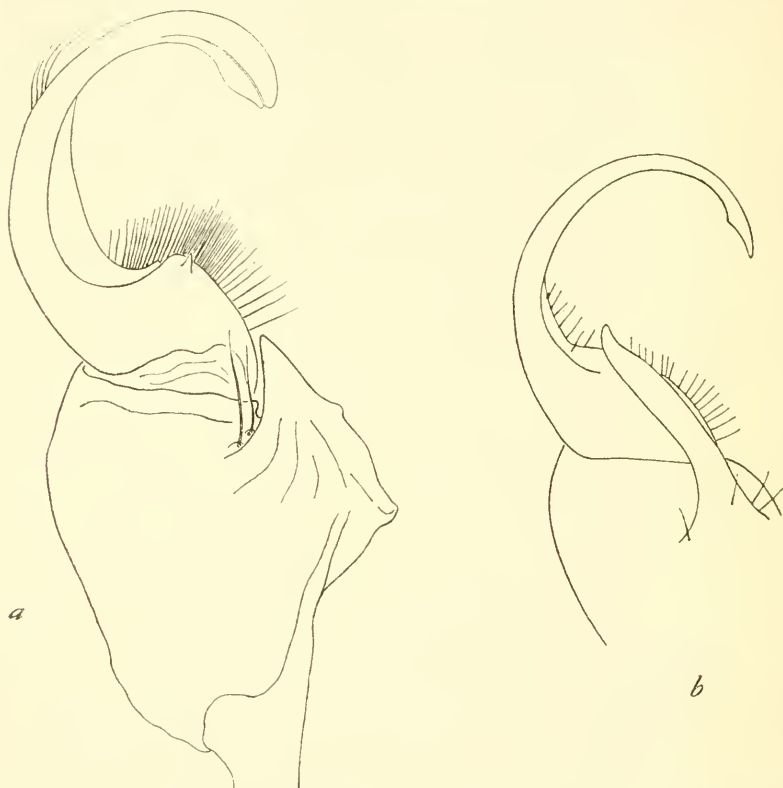


FIGURE 3.—Left gonopods, in mesal aspect, of two species of *Deltotaria*: a, *D. lea*, holotype from Lincoln County, N.C.; b, *D. philia*, holotype, from Clarkesville, Ga. (figure from Chamberlin, 1949). Figure 3a drawn to same scale as Figure 2, a, b, and d.

most of our attention to the form of the gonopods in a search for taxonomic characters at the species level.

Several details of body form, such as the submarginal pleural groove noted in the description of *D. brimleii*, deserve further attention and confirmation as valid characters. Some of the species are obviously more vaulted than others (that is to say, the paranota are obviously more depressed and continue the convexity of the dorsum), but this variable needs to be defined on the basis of a statistical study when more specimens are available.

The color pattern appears to be much the same in all of the species.

One character which seems to be constant and doubtless significant at the species level is the form of the caudolateral corner of the paranota. In two species (*tela* and *lea*) the peritremata are prolonged slightly caudad beyond the caudal edge of the paranota and result in a small but distinct projection (fig. 1d). In *brimleardia* and *mariana* (and, I suspect, also in *brimleii*), the caudolateral corner of the paranota is evenly rounded (fig. 1e). If the last three forms mentioned eventually prove to be conspecific, this character is one which may be diagnostic for a given species, but also one shared by other species

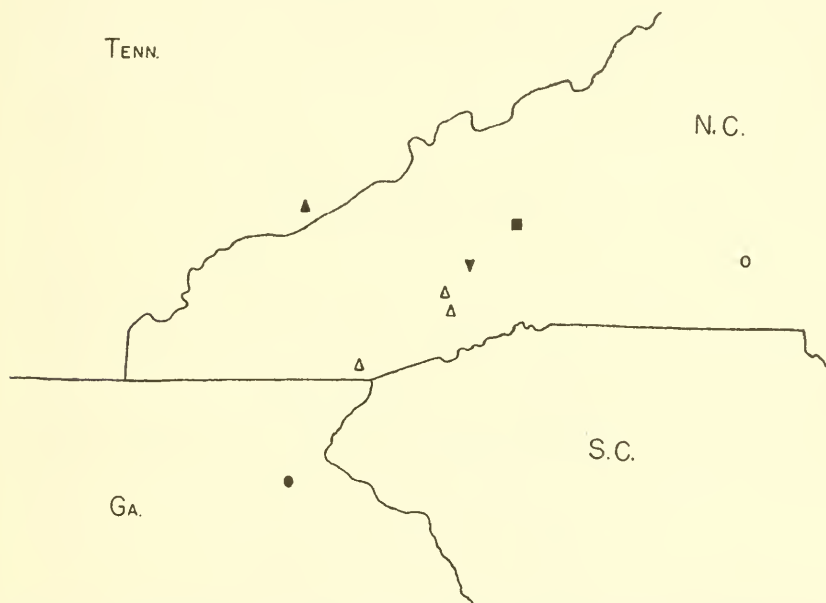


FIGURE 4.—Distribution of the six species of *Deltotaria*: Solid square, *D. brimleii*; solid triangle, *D. brimleardia*; solid inverted triangle, *D. tela*; solid spot, *D. philia*; open triangles, *D. mariana*; open spot, *D. lea*.

separated by other details. For instance, I think it very unlikely that *tela* and *lea* will be found to be conspecific, yet they are very similar in paranotal configuration.

The gonopods are basically similar in general form, with specific differences chiefly in the shape of the coxal apophysis and the terminal end of the telopodite. The former is not distinctive for four of the species, but is appreciably shortened in *lea* and remarkably elongated in *philia*. The prefemur of the telopodite is produced on the coxal side into a short, blunt homolog of a prefemoral process in all of the

forms, and in *lea* this development is provided with a small acute spine.

The distal end of the telopodite is modified in all of the species, but through a considerable range of form. The simplest occurs in *philia*, where the end is only very slightly expanded, with a vague subterminal angle on the inside of the arc, the angle imparting a somewhat hastate shape. *D. lea* has the telopodite apex more expanded and laminate. In *mariana* most of the terminal expansion is caused by a broad lobation on the outer side of the subterminal arc; distad to this broad area the solenomerite is rather abruptly recurved. This general form is elaborated by *brimleardia* in which a subterminal lobe or process (labeled "B" on the drawings) occurs. Process B becomes even more distinct in *brimleii*, and the solenomerite is recurved to the extent of being directed toward the tip of the process. Finally, in *tela*, the end of the telopodite is rather broadly expanded and somewhat twisted so that the lobe presumably homologous with B is located on the outer edge of the gonopod arc instead of on the inside as in the other two species.

It is certainly premature to attempt groupings of species beyond a few obvious cases of affinity, and no effort is made to arrange either the key or sequence of species to reflect phylogeny. The preceding allusion to changes in the gonopods, of course, does not imply a linear evolutionary sequence within the genus, although I do not think that the homogeneity of *Deltotaria* is open to question.

With females of only two species available, I have made no attempt to utilize the cyphopod structure other than to establish its general resemblance to the form occurring in related genera.

Genus *Deltotaria* Causey

Deltotaria Causey, 1942, p. 165.—Chamberlin and Hoffman, 1958, p. 29.

Phanoria Chamberlin, 1949, p. 101 (type species, *P. philia* Chamberlin, by original designation).

TYPE SPECIES: *Deltotaria brimleii* Causey, by original designation.

DIAGNOSIS: A genus of aphelorine xystodesmids with the following characteristics (diagnostic features given in small capital letters):

Head smooth and polished, the vertigial groove terminating in a very faint and shallow, but occasionally punctuate depression; FRONS AND VERTEX WITHOUT CRANIAL SETAE; antennae slender and long, extending caudad to posterior edge of third tergite, with four sensory cones; genae swollen, without or with only a very faint median depression.

Paranota moderately developed, typically depressed and continuing slope of dorsum, peritremata not strongly set off except on caudalmost segments; ozopores normal in distribution and position, opening on

the dorsal side of the peritremata. Lateral margins of segments 2-4 not completely set off, the submarginal groove not attaining the caudal edge of the paranota. Tergites typically smooth and polished, the anterior half of the metatergites slightly coriaceous, upper surface of paranota usually distinctly wrinkled.

Sterna smooth and glabrous except for several posterior to the 7th segment; sloping upward gradually from the interzonal furrow to an acute-edged shelf between the second leg pair of each segment, not produced into subcoxal spines or lobes. Legs of normal length and form, both coxae and prefemora with ventrodistal spines.

Coxae of gonopods large, almost in contact mesally, connected by a partially sclerotized sternal remnant; EACH COXA WITH AN ELONGATE SUBCONICAL APOPHYSIS WHICH PROJECTS DISTAD TOWARD OR OVER BASE OF THE PREFEMUR, latter typically without prefemoral process; coxal macrosetae on the dorsal side of the apophysis instead of the ventral as in *Pachydesmus*. Prefemur subglobose, with long fine setae, prolonged distally without interruption into the slender, arcuate telopodite blade, which is unbranched or modified except for various subterminal expansions or lobes, the solenomerite always terminal.

Anterior edge of ventral ends of pleurotergite of third segment in females produced cephalomesad into a large rounded elongate lobe forming the point of attachment of the second leg pair, but the adjacent edge of the segment is not elevated into a high flange as in the otherwise similar corresponding region in *Pachydesmus*. Median branches of the tracheal apodemes of second sternite expanded and partially fused, the surface thus formed somewhat larger and more removed from the coxae than in related genera.

RANGE: Extreme southern Appalachians and adjoining Piedmont regions in North Carolina, Tennessee, and Georgia, and doubtless also South Carolina.

SPECIES: The following six, separable by the characters stipulated in the key and illustrated or discussed below: *brimleii*, *mariana*, *brimleardia*, *tela*, *lea*, and *philia*, the second and fifth named being new species.

RELATIONSHIPS: The genus *Deltotaria* is a member of the group of xystodesmid genera endemic to eastern United States in which the telopodite of the male gonopod is composed of a subglobose enlarged prefemoral division (usually with a distinct prefemoral process) which abruptly narrows into a normally slender, unbranched, spirally coiled or subfalcate blade. In all of these genera the body form is broad and compact, the ozopores located dorsally, the sterna broad and unarmed, and the gonopod aperture large and transversely oval. Most of the generic names in this ensemble were originally proposed for one or only a few species, and subsequent discoveries have in many cases

largely bridged the gaps between the genera or at least compelled their redefinition on the basis of characters other than those originally employed. The groups of species currently going under the names *Apheloria*, *Dixioria*, *Sigiria*, *Sigmoria*, and *Cleptoria* are at present inseparable except on the basis of gonopod structure, and some combination is doubtless to be expected as a result of future critical studies.

In most respects *Deltotaria* is very similar to the genera mentioned but differs in two important respects—the lack of cranial setae and the development of coxal apophyses on the gonopods. Both of these features are probably specializations, and on the basis of other characters I judge the relationship to be largely with the species of *Sigiria*, which occur in the same general region. The similarity of the gonopods of *Deltotaria tela* to those of *Sigiria rubromarginata* is noteworthy, and the color pattern is virtually identical in all the species of both genera.

Within the confines of generic limits, the species of *Deltotaria* show considerable individuality in specific expression. It is difficult to postulate which characters are specialized and thereby to achieve an insight into evolutionary tendencies, but my inclination is to regard the simple falcate gonopod form and the least convex body shape as in the nature of generalized features. The species of *Deltotaria* so characterized both occur in the Piedmont region on the periphery of the generic range (perhaps in a sort of relict status). The species (or subspecies) *brimleii*, *mariana*, and *brimleardia* represent the other extreme and are centrally located in the high ranges of the Blue Ridge (see fig. 4).

The last three forms named constitute an interesting problem in their own right. Obviously closely related, they are also apparently sympatric and I anticipate that future collections may show them to be geographic races of one species. Uncertainty about the gonopod structure of *brimleii* (the genitalia being lost from the holotype) is perhaps the major reason that *mariana* is proposed here as a full species rather than as a subspecies of *brimleardia*.

Only one of the six forms of *Deltotaria* is known from more than one locality. This form, *mariana*, has been collected from three places over a range of some 30 miles, and all of the material is virtually identical; thus *mariana* differs consistently from the type specimen of *brimleardia*, which was taken about 40 miles west of the *mariana* localities. The specific characters employed to separate the two, while not outstanding, do appear to be constant and allow identifications to be made with some degree of confidence.

Key to the Species of *Deltotaria*

1. Distal end of gonopod simple, without a subterminal process, only slightly expanded if at all 2
 Distal end of gonopod usually expanded and with an accessory subterminal process (B) derived from the outer margin, as well as a terminal solenomerite 3
2. Apical end of telopodite not appreciably broadened, only with a low dentation on the inner side; coxal apophysis long, extending well over prefemoral division of the telopodite **philia** (Chamberlin) (p. 34)
 Apical end of telopodite at least noticeably expanded to twice the width of the narrowest part of the blade; coxal apophysis much shorter, not extending over the prefemur **lea**, new species (p. 33)
3. Process B of gonopod long, slender, digitform; solenomerite recurved strongly toward tip of the process and almost in contact with it, imparting a distinctly foreipate appearance **brimleii** Causey (p. 25)
 Process B of gonopod much smaller, little more than a rounded or subacute lobe of the margin 4
4. Apical end of gonopod broadly expanded and somewhat twisted on the main axis of the blade, bringing process B into a position on the outer side of the curvature as seen in ventrolateral aspect; caudolateral corners of paranota acute; coxa of gonopod very large with reference to size of the telopodite. **tela** Causey (p. 31)
 Apical end of gonopod slender, the outline broadened only by the presence of a slightly convex lobation of the outer margin and the accompanying development of process B; caudolateral corners of paranota rounded; coxa of gonopod not so large in comparison to size of the telopodite 5
5. Coxite of gonopod small, its greatest width only 86 percent of the length of the telopodite arc; subterminal expansion of telopodite very moderate, but the process B large and conspicuous **brimleardia** Causey (p. 30)
 Coxite of gonopod larger, its greatest width about 102 percent of the telopodite arc length; subterminal expansion of telopodite pronounced and conspicuous, but process B small and easily overlooked. **mariana**, new species (p. 28)

Deltotaria brimleii Causey

FIGURES 2c, 4

Deltotaria brimleii Causey, 1942, p. 165, figs. 1-2.—Chamberlin and Hoffman, 1958, p. 30.

TYPE SPECIMEN: Male holotype, ANSP, from Swannanoa, Buncombe County, North Carolina, collected by C. S. Brimley on May 26, 1923; female topoparatype in the collection of Nell B. Causey.

DIAGNOSIS: Telopodite of male gonopod abruptly curved distally, with a rather long, digitform subterminal process (fig. 2c, B); caudal

edge of sides of segments set off by a well-defined vertical submarginal groove; interzonal furrow also broad and distinct down the sides.

DESCRIPTION OF HOLOTYPE (originally preserved dry, later placed in alcohol, at present both gonopods and segment 11 are missing): Length indeterminate; width of body at segment 6, 8.2 mm.; segment 9, 8.3 mm.; segment 12, 8.1 mm.; depth of segment 9, 5.4 mm.; the W/D ratio thus 65 percent and indicative of depressed paranota.

Head, especially the frontal region, strongly convex, evenly so to the edges, genae likewise convex and swollen, with only a vaguely defined median depression. Labral setae about 14-16, clypeal setae about 16-18, the series not continued onto the genal margins. Labral teeth small and blunt. No cranial setae, or their sockets, present. Interantennal isthmus broad (about 1.6 mm.), twice the length of the first antennal article.

Antennal sockets unusually broad and deep for a xystodesmid species, due partly to the strong convexity of the genae. Antennae long (6.5 mm.) and slender, extending caudad to middle of third tergite, sparsely setose, articles in decreasing order of length, 6-2-3-4-5-1-7. Sensory cones four, small, seventh article without sensory areas, its marginal setae curving mesad over the sensory cones.

Collum broad, as wide as segment 2, the caudal margin nearly straight, anterior margin broadly convex, the lateral ends strongly depressed and descending, surface smooth and very finely tuberculate. Anterior marginal ridge distinct up to level of the mandibular-cranial articulation.

Paranota of segments 2-4 not swept forward, but distinctly transverse, descending, the tergites smooth except for scattered microtubercles; peritremata of these and other segments not completely set off—the submarginal groove not attaining the caudal edge of the paranota—so that a smooth raised peritremal area is continuous with a similar one along the caudal edge, enclosing a somewhat coriaceous, slightly impressed, discal paranotal area.

Scapulae marginal laterally, but the outer edge curves strongly caudal upon meeting the body cylinder before curving cephalad to join the interzonal furrow. Pores located at midlength of peritremata, on the dorsal side. Interzonal furrow very faint, almost obliterated across dorsum (the prozonite and metazonite thus meeting at a common level), but becoming a broad shallow groove down the sides and across the sternites. Surface of prozonites very finely shagreened or smooth, surface of metazonites finely granular-coriaceous, surface of paranota coriaceous with the wrinkles oriented longitudinally.

Paranota from about segment 10 gradually swept caudad, becoming increasingly angular with the peritremata larger and more conspicuous. Paranotal lobes of segment 18 acutely triangular, those of segment 19

rounded-oval. Epiproct subtriangular, distally truncate-conical, with two whorls of setae, the basalmost of which is continued down lateral edges of the segment. Paraprocts convex, nearly smooth but for fine vertical striations, the mesal margins unusually elevated. Dorsal setiferous tubercule set on the raised margin, the ventral tubercule distinctly removed from the margin and set closer to middle of the paraproctal disc. Hypoproct acutely triangular, the two paramedian tubercules set almost at the apex.

Caudal margins of segments conspicuously set off by a broad, shallow, sharply defined furrow running from the under side of paranota to upper end of coxal socket, isolating the caudal edge as a distinct elevated rim; remaining surface of sides smooth and unmodified except on the anterior third of body where produced into a low subconical knob just above and between the coxal sockets.

Legs inserted on strongly elevated podosterna, the anterior face of which slopes steeply to the interzonal furrow, the posterior face being slightly overhung by the angular transverse shelf between the caudal leg pair; podosterna of segments 8-12 each with 4 to 8 scattered setae in an irregular row between the legs. Legs set about 1.5 mm. apart, those of the posterior pair distinctly closer together than the anterior. No subcoxal sternal spines nor median cruciform impression.

Legs long and slender, sparsely setose except for tibia and tarsus, which are, particularly on the dorsal surfaces, densely set with stout bristles. Pretarsus long, slender, and slightly sinuous, compressed, with a median dorsal carina and two smaller paramedian carinae; underside smooth. Coxae and prefemora with stout spines, the coxae of legs 1-14, however, not noticeably armed. Joints of legs at mid-body, in order of decreasing length 3-6-2-1-4-5.

Anterior sternites rather broad and without processes except for low indistinct knobs between legs of third and fourth pairs. Anterior legs not modified except for somewhat more strongly curved pretarsi. Seminal processes of second leg pair low, cylindrical.

Gonopod aperture large, transversely oval, with distinct raised lateral and caudal rims. Prozonite of seventh segment reduced to a narrow strip in front of the aperture. Gonopods missing from the vial; the following statement is from the original description: "In situ main blades of gonopods subparallel and perpendicular to longitudinal axis of body. Flattened apical third of main blade bent cephalad, ending in a thin subapical process and an attenuated apical hook [i.e., solenomerite]. Basal medial portion of blade thickly setose and proximal third sparsely setose. A large pointed peg on medial side of coxa and adjacent to the curved coxal spine of the gonopod." Subterminal process B is of about the same size and shape as the solenomerite, and thus more conspicuous than in other species of the genus (see fig. 2c).

REMARKS: Only the type specimens are known. I have on several occasions made unsuccessful attempts to secure fresh material in the vicinity of Swannanoa. The color in life is unknown, but enough pigmentation remained in the dried types for Causey to observe that the tergites are brown, with the paranota and caudal margins faded reddish orange, and the ventral surfaces and legs yellowish. This coloration is similar to the living coloration of *D. tela* and *mariana*, and may be characteristic for the entire genus, as it is for *Sigiria*.

On the basis of gonopod structure *D. brimleii* is certainly closest to *brimleardia* and *mariana*. Whether it resembles them in the form of the paranota cannot be stated at this time, the character being one that I did not observe at the time of studying the type of *brimleii*. My personal impression is that the three forms may be only geographic races of one polytypic species, something that can be checked with future field studies in western North Carolina.

The peculiar form of the lateral margination of the segments in *brimleii* is not inconceivably the result of the type having been first dried and subsequently placed in alcohol. For the present I can only note the situation for the attention of the investigator who may secure fresh material.

DISTRIBUTION: *D. brimleii* is so far known only from the type locality, in the Swannanoa Valley at the junction of the Blue Ridge with the Black Mountains.

Deltotaria mariana, new species

FIGURES 1, a, e-h; 2d; 4

TYPE SPECIMENS: Male holotype and female paratype, USNM 2662 from the Pink Beds Recreation Area, Pisgah National Forest, 8 miles north-northwest of Brevard, Transylvania County, North Carolina, collected on July 30, 1958, by R. L. and Marian S. Hoffman.

DIAGNOSIS: A moderate-size species of *Deltotaria* related to *D. brimleardia*, from which (as well as other members of the genus) it differs in the characteristic terminal formation of the gonopod telopodite, which is subterminally expanded with a prolonged solenomerite and with the subterminal process very small, thin, and acute.

DESCRIPTION OF HOLOTYPE: Structurally similar to *D. brimleii*, but for the following particulars:

Length 33.0 mm.; width of segment 6, 7.6 mm.; segment 12, 8.0 mm.; segment 16, 7.8 mm.

Tergites (in life) rich glossy brownish black, with caudolateral corners of paranota, posterior third of metatergites, epiproct, and circumference of collum bright orange-red; underparts pale yellowish tan, legs becoming bright yellow distally. Head and antennae (in life) brown.

Head of normal contour, not strongly convex; genae with distinct median groove; vertigial suture distinct, with a single row of small punctures. Labral setae 6-6 (the series interrupted above the labral teeth), clypeal setae 8-8, not extending laterad onto genal margins.

Antennae long (6.8 mm.), extending back to fourth tergite, the articles in decreasing order of length 2-5-6-3-4-1-7. Interantennal isthmus proportionately much narrower than in *brimleii* (18 percent of antennal length instead of 25 percent).

Collum distinctly narrower than the second tergite.

Metatergites with distinctly depressed paranota, which continue the dorsal convexity; dorsal surface of paranota and of middorsal region, particularly of segments in the posterior half of body, coriaceous, most distinctly so just behind the interzonal furrow, the sculpture visible to the eye without magnification. Peritremata only moderately developed, and do not on any segment project beyond caudal edge of the paranota (fig. 1e). Paranota of segment 19 in the form of short, rounded lobes.

Caudal edge of segments set off on the sides by a tiny narrow submarginal ridge, without a distinct submarginal furrow; sides of most segments with a distinct low conical knob above base of the posterior leg pair. Interzonal furrow very distinct down sides, and especially so in front of the stigmata.

Podosterna distinctly elevated, forming a nearly flat surface, which slopes abruptly down to the level of the prozonite well behind the interzonal furrow; surface of podosterna of most segments posterior to the gonopods with a distinct median subcircular shallow depression. Sternal setae reduced both in size and number, occurring in about four pairs only on segments 8 through 10, near the base of the coxae.

Gonopod aperture large and transverse, of the form as shown in figure 1h, the caudal edge slightly elevated above level of the intercoxal surface of the segment. Coxa of gonopods large, the coxal apophysis of about average size and shape for the genus. Prefemur with a low, rounded knob on the coxal side, distad of which the telopodite blade is rather abruptly recurved and attenuated, becoming narrower to the distal fourth where distinctly broadened by a lobation of the outer margin, and here provided with a small, thin, acute, submarginal dentate flange probably homologous with process B of *brimleii* and *brimleardia*. Distad to the expanded portion the telopodite is continued as a slender, curved, solenomerite.

VARIATION: Specimens taken near the type locality agree in most particulars with the preceding descriptive notes but differ considerably in size. The males are not only smaller than the holotype, but are also smaller than the females collected with them. Six males range in length from 26 to 32 mm. (average, 28.5 mm.) and from

6.5 to 7.0 mm. (average 6.8 mm.) in greatest width. Four females vary in length from 30 to 34 mm. (average 31.5 mm.) and in width from 7.4 to 7.6 mm (average 7.5 mm.). The females tend to have much narrower transverse bands or orange on the tergites, and, of course, to be bulkier in body form with somewhat longer and more slender legs than the males. The distribution of sternal setae appears to be constant in all of the specimens examined.

REMARKS: At the type locality, this species was collected in rich, moist, tulip-poplar forest with a scattered understory of rhododendron. Species in the xystodesmid genera *Cherokia*, *Sigmoria*, and *Nannaria* were found in association. Only the two specimens of *mariana* were obtained during an expenditure of about two man-hours of collecting, while more than 40 individuals of *Cherokia georgiana* were found. The species was also obtained a few miles away by Leslie Hubricht, who secured 11 specimens wandering at night. This locality differs from that just described in having more rhododendron and hemlock. At Highlands, North Carolina, specimens were found in well-drained oak-hickory forest with a *Kalmia* understory. The species is apparently very secretive; only a few have been obtained at Highlands despite field work extending over a period of almost 10 years.

DISTRIBUTION: Extreme western North Carolina, chiefly on the headwater drainage system of the French Broad River. Known from three localities in the Pisgah and Blue Ridge ranges, the species can be expected to occur in adjoining parts of South Carolina and Georgia. Specimens are at hand from the following localities:

NORTH CAROLINA: TRANSYLVANIA COUNTY: Along the Chubb Gap Trail, Pink Beds Recreation Area, 8 miles NNW of Brevard, 1♂, 1♀, July 30, 1958, R. L. and M. S. Hoffman (USNM, types). Sycamore Flats Camp Ground, Pisgah National Forest, 5 miles north of Brevard, 6♂, 5♀, May 26, 1958, Leslie Hubricht (RLH). MACON COUNTY: East side of Satulah Mountain near Highlands, 1♂, 1♀, June 1, 1954, R. L. and R. B. Hoffman (RLH). Highlands Plateau, without exact locality, 1♂, July 1955, J. C. Knepton (RLH).

Deltotaria brimleardia Causey

FIGURES 2b, 4

Deltotaria brimleardia Causey, 1950a, p. 7, figs. 2-3.—Chamberlin and Hoffman, 1958, p. 29.

TYPE SPECIMEN: Male holotype, ANSP, from Ramsey Prong, Great Smoky Mountains National Park, Sevier County, Tennessee, collected by Henry Hanson on July 10, 1947.

DIAGNOSIS: A small species of the genus, similar to *D. mariana* in size, paranotal shape, and general appearance of the gonopods, but differing in the much smaller coxae, the less expanded subterminal part of the telopodite, and the distinctly larger marginal process B of the latter area.

DESCRIPTION OF HOLOTYPE: Adult male, preserved just after moulting, at present colorless and soft, about 25 mm. in length and 6.0 mm. in greatest width.

The specimen differs from the description of *D. brimleii* in much the same ways as does *mariana*, but with the following noteworthy structural details:

Labral setae about 12–13, clypeal setae about 16–16; in addition to these there are four or five submarginal setae in a row up to about the midlength of the genae, these not observed in the other species of the genus. Labral teeth large and distinct. Genae with median groove.

Podosterna not strongly elevated, their median surface sloping evenly from the caudal edge down to the interzonal furrow. All sterna posterior to gonopods entirely glabrous, no subcoxal setae even on eighth segment.

Caudal edges of sides of segments not noticeably set off by submarginal ridges or furrows; lower sides not produced into low knobs above the coxae.

Gonopod aperture large and transverse, similar in shape to that of *mariana*, but the caudal edge is not margined and flush with the intercoxal surface of segment 7. Gonopod coxae small in proportion to size of the telopodite, differing considerably from *mariana* in this respect (compare fig. 1, *b* and *d*). Telopodite blade much less acutely bent in the postfemoral region, and subterminal expansion less pronounced. Process B of telopodite surpassed by a long, slender, solenomerite, evenly and slightly curved instead of noticeably recurved as in *mariana* and *brimleii*.

REMARKS: It is unfortunate that only one imperfect specimen of this form is available for study. Its affinities are clearly with *mariana*, and I anticipate the discovery of intermediate forms by future collecting in the Pisgah and Balsam Ranges. If, however, the characters that serve to distinguish the two at the present (such as the presence of setae on the genal margins and their absence from the sternites in *brimleardia*) are found to be constant for the population of the Great Smokies, subspecific status for *mariana* would still be desirable. This latter form is very homogeneous over its known range, the males from Highlands showing no approach whatever to the characters of *brimleardia*.

Deltotaria tela Causey

FIGURES 1,*b,d*; 2*a*; 4

Deltotaria tela Causey, 1950b, p. 38, figs. 3–5.—Chamberlin and Hoffman, 1958, p. 30.

TYPE SPECIMEN: Holotype male, ANSP, from the Bent Creek Forest Experiment Station, about 7 miles southwest of Asheville, Buncombe

County, North Carolina, collected by Nell B. Causey on April 30, 1939.

DIAGNOSIS: A large broad species of the genus, in which the gonopod is characterized by the pronounced subterminal expanded area. The very slightly elevated podosterna also appear to signalize this form.

DESCRIPTION OF TOPOTYPE: Adult male 33 mm. in length; width of segment 6, 9.0 mm.; segment 9, 9.0 mm.; segment 12, 8.5 mm.; segment 16, 7.6 mm.

Color in life dark glossy brownish black, with upper surface of paranota, caudal edges of metatergites, epiproct, and circumference of collum bright orange red, underparts dirty white, legs grading to pink distally; head and antennae brown.

Head somewhat flattened between the antennal sockets, vertical groove distinct but not punctate. Median genal depressions distinct, continuous with the flat surface of the clypeus. Labral setae about 12-12, clypeal setae about 9-9, not extending onto lower genal margins. Interantennal isthmus proportionately narrow (1.2 mm.), only 17 per cent of the antennal length (7.0 mm.).

Antennae extending back to middle of fourth tergite, article 2 the longest, articles 3-6 subequal in length, article 1 much longer than 7.

Collum distinctly broader than the following tergite, extending ventrolaterad about 0.5 mm. below it on each side; anterolateral marginal groove distinct.

Form of tergites similar to that described for *D. brimleii*. Caudolateral corners of paranota produced into a small acute lobe which projects beyond caudal edge of each paranotum. Paranota of segment 18 elongate-triangular, those of segment 19 distally rounded lobes.

Hypoproct semicircular, but with a small and distinct median angle.

Caudal edges of segments set off by a fine but distinct marginal ridge running from under side of paranota down to coxal sockets, this ridge set off by a slight, shallow depression suggesting that found more conspicuously in *brimleii*. Remainder of sides of segments smooth except on segments anterior to eighth, which are produced into low conical knobs over the coxae.

Podosterna low and vaguely defined, sloping upward very gradually from level of the interzonal furrow, and with one and often two distinct broad median depressions. Podosterna with transverse rows of scattered setae as far back as segment 15.

Gonopod aperture large and transversely ovoid, its lateral ends rounded, the caudolateral edges flanged, with a low flange in front of the depressed intercoxal surface of the segment.

Gonopods with noticeably large coxae. Telopodite distinctly less curved than in the other species, the distalmost fourth abruptly recurved proximad and strongly expanded, the lamellate area extended

into a thin, flat, slightly twisted solenomerite. Prefemoral division of gonopod with a small, upright conical prefemoral process.

REMARKS: The described specimen agrees closely in all respects with the holotype. The apparent difference in bulk of the telopodite of the gonopods suggested by Causey's illustration and the present drawing is due to differences in drawing technique.

D. tela is apparently not common. Three attempts were made to secure fresh material at the type locality before I was rewarded by finding a male and female deep in rhododendron leaf litter within a yard of the edge of Bent Creek. A subsequent visit to the locality several years later was again fruitless.

This species seems to have little in common with *D. mariana* and *brimleii*, its geographically closest relatives, and except for gonopod structure is perhaps closest to *D. lea*, a similarly large and robust form. So far *tela* is known only from the holotype, and from the two topotypes that I collected on June 15, 1953.

Deltotaria lea, new species

FIGURES 1c, 3a, 4

TYPE SPECIMEN: Male holotype, USNM 6663, from 4.5 miles southeast of Lincolnton, Lincoln County, North Carolina, collected by Leslie Hubricht on April 59, 1956.

DIAGNOSIS: Distinguished by the short coxal apophysis of the gonopod, the broad postfemoral part, and the simple, laminately expanded apex of the telopodite. The evenly rounded outline of the hypoproct may also be characteristic of this species.

DESCRIPTION OF HOLOTYPE: A large member of the genus, structurally similar to *D. brimleii* with the following exceptions:

Length about 38 mm.; width at segment 6, 9.0 mm.; segment 12, 9.8 mm.; segment 16, 8.6 mm.

Head less convex; labral setae about 12-12, clypeal setae about 16-16, this series extending onto ventral margin of genae, latter not especially tumid, and antennal socket correspondingly not so deep as in *brimleii*. Antennae long, 7.6 mm., extending back to fourth tergite, the articles in decreasing order of length 2-6-5-3-4-1-7, but articles 3 through 6 are virtually of the same size. Interantennal isthmus about 1.5 mm. wide, much narrower in proportion to antennal length (20 percent) than in *brimleii*.

Marginal groove of collum very short and faint, noticeable only with considerable magnification, not attaining either the lateral angle of the collum nor the level of the mandibular-cranial articulation.

Paranotal lobes of segment 19 acutely subtriangular instead of rounded oblong.

Paraprocts smooth, without vertical striation. Hypoproct without median projection (figure 1c), the caudal edge almost evenly semi-circular.

Caudal edge of sides of segments set off by a small fine vertical submarginal ridge, which, however, is not preceded by a distinct furrow. Lateral surface of anterior segments not produced into small lobes or knobs above bases of the legs.

Podosterna of segments posterior to gonopods with conspicuous deep lateral incisions that separate the coxal sockets; on the segments immediately following the seventh these lateral notches are connected by shallow transverse grooves that bisect the podosterna.

Gonopod aperture large and transverse, the outer portions acutely angular; edges produced into elevated flanges only laterally, the caudal edge of aperture level with sternum between eighth leg pair. Gonopods of moderate size, the coxal apophysis shorter and broader than in other species, distinctly striate at the base. Prefemur of gonopods with only a low eminence on the coxal side, which is provided, however, with a small erect spiculate process. Postfemoral division of telopodite blade very broad and flat in comparison with that of other species, the blade becoming rather abruptly attenuated distally, narrowest just beyond middle of its length, thence broader and laminate and slightly twisted out of line with the major axis of the telopodite.

Deltotaria philia (Chamberlin)

FIGURES 3b, 4

Phanoria philia Chamberlin, 1949, p. 101, fig. 25.

Deltotaria philia Chamberlin and Hoffman, 1958, p. 30.

TYPE SPECIMEN: Male holotype in the Chamberlin collection, from Clarkesville, Habersham County, Georgia, collected by Wilton Ivie on April 27, 1943.

DIAGNOSIS: This form differs from other members of the genus in the exceptionally long coxal apophysis and the slender, acuminate or subhastate apex of the telopodite.

DESCRIPTION: The following is from the original description:

Dorsum dark brown, with a rather broad yellow band across caudal border of each tergite and its keels, the lateral borders of the latter and the cauda also yellow.

Posterior coxae bearing apically conical points or spines, but the sternites not spined.

Telopodite of male gonopod apically of hastate form. Anterior process from coxa a straight, apically acute blade. See further Fig. 25.

Width of male holotype, 9 mm."

REMARKS: Three attempts to secure fresh material during the summer of 1958 were totally unsuccessful although a number of

localities around Clarkesville were explored. Probably collecting earlier in the year will disclose the species at various localities in the Piedmont and foothills of the Blue Ridge in northern Georgia.

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