

A REVISION OF THE FUNNELWEB  
MYGALOMORPH SPIDER  
SUBFAMILY ISCHNOTHELINAE  
(ARANEAE, DIPLURIDAE)

FREDERICK A. COYLE

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(ARANEAE, DIPLURIDAE)

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## ABSTRACT

The tropical diplurid spider subfamily Ischnothelinae is revised for the first time. The monophyly of this subfamily is supported by six putative synapomorphies: an elongate cymbial apophysis, two rows of cheliceral teeth, a procurved transverse fovea, collariform trichobothrial bases, fused silk spigots, and long, tapering, pseudosegmented terminal posterior lateral spinneret articles. Five genera are recognized: *Ischnothele* Ausserer (with 11 species in South America, Central America, and the Antilles), *Andethele*, new genus (with 3 species in the Andes Mountains of Peru), *Lathrothele* Benoit (with 4 species in Africa), *Indothele*, new genus (with 4 species in India and Sri Lanka), and *Thelechoris* Karsch (with 2 species in Africa and Madagascar). Phylogenies (based on cladistic analyses using two different sets of outgroups), biogeographic hypotheses, a key, diagnoses, descriptions, tables of quantitative character values, illustrations, analyses of variation, natural history information, locality records, and distribution maps are presented for the 24 recognized species. The cladistic analyses provide strong support for the monophyly of the Old World branch of the subfamily, the genera *Andethele* and *Thelechoris*, and the Greater Antillean and South American (*goloboffi*) clades of *Ischnothele*, and weaker or ambiguous support for the monophyly of *Ischnothele*, *Lathrothele*, and *Indothele*. Ten species are newly described: *Ischnothele jeremie*, *I. gacia*,

*I. huambisa*, and *I. goloboffi*; *Andethele lucma*, *A. huanca*, and *A. tarma*; *Indothele lanka*, *I. rothi*, and *I. mala*. Fourteen specific names are newly synonymized: *Ischnothele ecuadorensis* Schmidt with *Ischnothele digitata* (O. P.-Cambridge); *Entomothele pusilla* Simon, *Thelechoris zebrina* Simon, *Thelechoris funesta* Fischel, *Thelechoris obtusa* Fischel, and *Ischnothele sexpunctata* Bücheler, da Costa, and Lucas with *Ischnothele caudata* Ausserer; *Ischnothele siemensi* F. O. P.-Cambridge with *Ischnothele guianensis* (Walckenaer); *Ischnothele indigens* Vellard, *Ischnothele zorodes* Mello-Leitão, *Ischnothele campestris* Schiapelli and Gerschman, *Ischnothele affinis* Schiapelli and Gerschman, and *Ischnothele cranwelli* Gerschman and Schiapelli with *Ischnothele annulata* Tullgren; *Lathrothele marmoratus* Benoit with *Lathrothele grabensis* Benoit; and *Thelechoris karschi* Bösenberg and Lenz with *Thelechoris striatipes* (Simon). Several species previously placed in ischnotheline genera are not ischnothelines: *Ischnothele annectens* (Bertkau), *Ischnothele simplicata* Saito, *Ischnothele strandi* Spassky, *Ischnothele lineata* (Karsch), *Ischnothele indicola* Tikader, and *Thelechoris australis* Purcell. Evidence is presented that suggests that *Ischnothele longicauda* and *Lathrothele grabensis* may each consist of more than one species and that *Thelechoris rutenbergi* and *T. striatipes* may be conspecific.

## INTRODUCTION

Ischnotheline spiders are small to medium-size (5–22 mm long) tropical diplurids distinguished by an elongate cymbial apophysis, two rows of cheliceral teeth, a procurved transverse fovea, and very long, tapered, posterior lateral spinnerets that are used to construct conspicuous sheet and curtain capture webs with tubular retreats (figs. 1–9). A wide distribution (Antilles, Central and South America, Africa, Madagascar, India, and Sri Lanka), high endemism, high local population densities, conspicuous perennial webs that often harbor symbionts, subsocial behavior, and other attributes make this taxon worthy of the attention of biogeographers, ecologists, behaviorists, and other biologists.

Our previous knowledge of the systematics of this subfamily has been discouragingly poor. Although consistently treated as a group of diplurids since it was first recognized by

F. O. P.-Cambridge (1897), hypotheses about the phylogenetic position of Ischnothelinae within the family have shifted (see below). No one has attempted an analysis of relationships among its species, most of which are poorly known. The 37 species that have heretofore been placed in ischnotheline genera (*Ischnothele*, *Thelechoris*, and *Lathrothele*) were described by 23 authors (or sets of authors) in 30 separate papers; with few exceptions (Benoit, 1964, 1965; Coyle and Meigs, 1990), these descriptions were brief, poorly illustrated, based on extremely small samples, and written without an examination of the types of previously described species. Given this state of affairs, it is not surprising that Raven (1985a) was unable to resolve the relationships among these three genera.

The goal of my research and the objective of this paper are to improve our understand-



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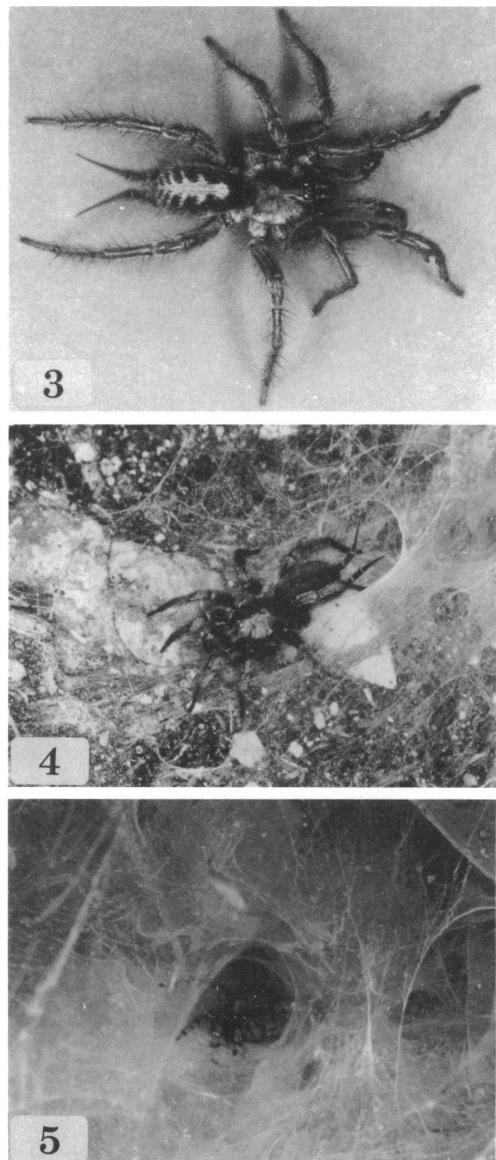
Figs. 1, 2. *Ischnothelid* females in webs. 1. *I. guianensis* approaching isopod on capture web; Puerto Maldonado, Peru. 2. *I. reggae* in mouth of retreat; arrow points to kleptoparasite (*Mysmenopsis monsticola*); Hardwar Gap, Jamaica.

ing of ischnotheline systematics so that these remarkable spiders will be easily accessible for further study. Data have come chiefly from nearly 1200 adult specimens and observations generously shared by museums and individuals and gathered during my own fieldwork in Argentina, Peru, Costa Rica, Mexico, Jamaica, Kenya, Zaire, and Malawi. Using these data, I have systematically analyzed intra- and interpopulation variation in quantitative and qualitative characters and have thereby tested hypotheses about the reproductive integrity of these populations and sets of populations and about the evolutionary relationships of the species.

### ISCHNOTHELINE NATURAL HISTORY

The following synopsis is primarily based on incomplete observations of 10 ischnotheline species (*Ischnothele longicauda*, *I. reggae*, *I. xera*, *I. caudata*, *I. guianensis*, *I. annulata*, *Andethele huanca*, *A. tarma*, *Lathrothele grabensis*, and *Thelechoris striatipes*). Few or no data are available for the other 14 species. More detailed species-specific information is presented in natural history sections following each species description. Additional information and discussion are to be found in Coyle and Ketner (1990), Coyle and Meigs (1989, 1990, 1992), Coyle and O'Shields (1990), and Coyle et al. (1991).

**Habitat and Microhabitat:** Except for *I. annulata*, which is distributed north and south of the Tropic of Capricorn in Argentina, the Ischnothelinae are strictly tropical. Interestingly, only one or two sets of ischnotheline species are clearly sympatric (*Ischnothele digitata* with *I. caudata* in Central America, and perhaps *L. grabensis* with *T. striatipes* in eastern Zaire) and these do not exhibit syntopy. Most (18) of the 24 ischnotheline species live at elevations below 1600 m, 3 (*I. caudata*, *L. grabensis*, and *Indothele rothi*) also live at higher elevations, and 3 others (all *Andethele* species) appear to be restricted to very high elevations (2300–4400 m) (fig. 13) where the temperatures are much cooler than those customarily experienced by the rest of the subfamily. The subfamily occupies a wide range of habitats from desertlike, dry scrub communities (figs. 11, 12, 215, 216, 439) to semi-



Figs. 3–5. 3. Male *Ischnothele guianensis* from Puerto Maldonado, Peru. 4. Female *Andethele tarma* approaching prey on capture web; Cochas Bajo, Peru. 5. Female *Thelechoris striatipes* in mouth of retreat; Kilifi, Kenya.

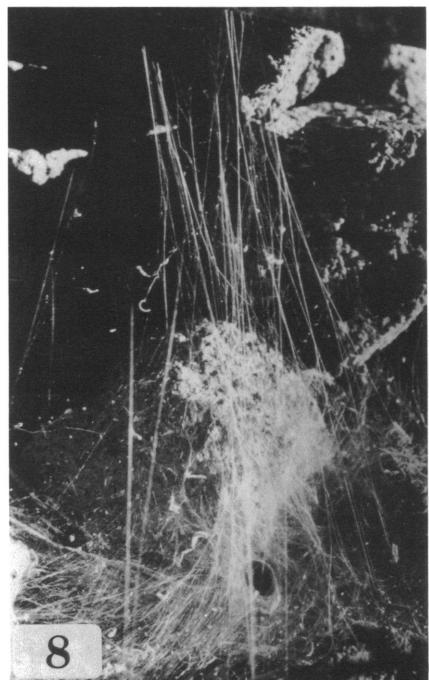
open woodland (figs. 306, 440) to rain forest, although most species appear to prefer habitats in the drier half of this spectrum. *Ischnothele guianensis*, which is distributed widely over the Amazon Basin, lives not in primary rain forest but in open canopy forest and disturbed habitats. Some species (*I. caudata*, *I.*



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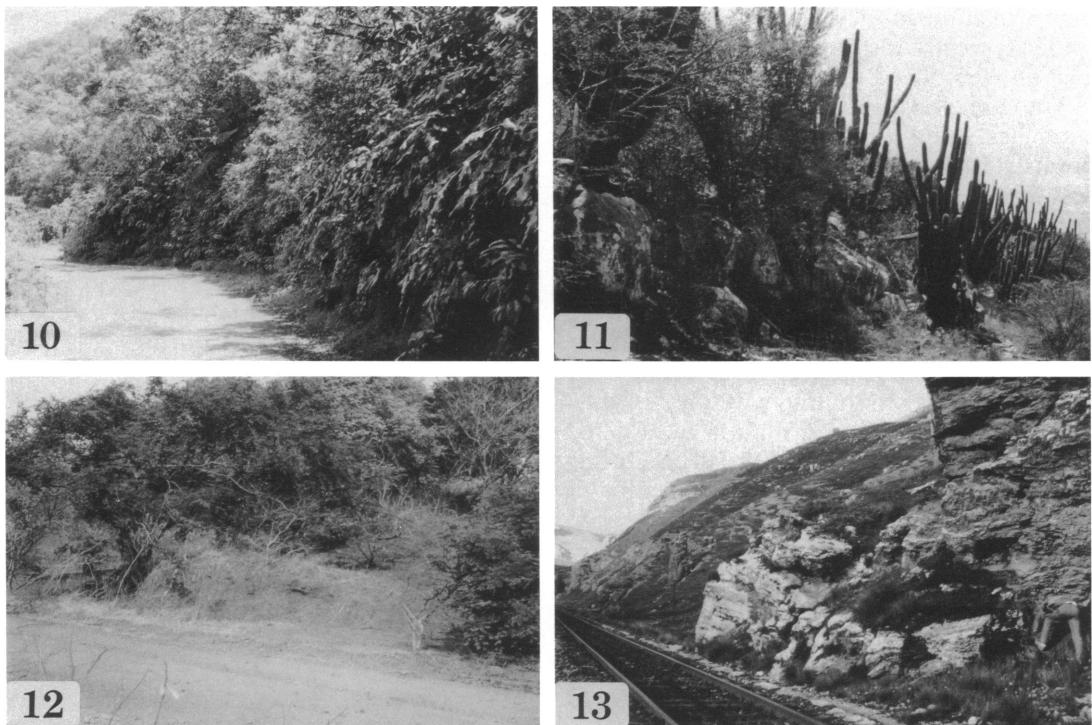


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Figs. 6-9. 6, 7. Web and habitat of *Ischnothelus guianensis* at Puerto Maldonado, Peru. 6. Spider in capture web on palm tree trunk. 7. Same palm tree in backyard of residence. 8, 9. Webs and habitat of *Thelechoris striatipes* at Kitani Lodge, Tsavo West National Park, Kenya. 8. Web, showing retreat entrance and vertical lines above capture web. 9. Several webs, some of which are contiguous, on rocks.

*guianensis*, and *T. striatipes*) are often abundant in artificial habitats such as towns (on trees, shrubbery, and fences) (figs. 7, 441) and oil palm and banana groves. Some species (*I. caudata*, *I. longicauda*), and at least one pair of sister species (*I. reggae* and *I. xera*), occupy a remarkably wide range of habitats (especially in terms of rainfall and available moisture) (figs. 10, 11).

The webs of many ischnotheline species are more common on road banks and rocky slopes or outcrops (figs. 10, 11, 13, 306) than in the more gently sloping terrain nearby. Some species (*I. digitata*, *I. guianensis*, and *T. striatipes*) also build their webs in shrubs and on rough or plant-covered tree trunks (figs. 7, 441). Key microhabitat requirements for all species are natural crevices, cavities,



Figs. 10–13. Habitats of *Ischnothelinae* and *Andethelinae*. 10. *I. reggae*; edge of moist montane forest at Hardwar Gap, Jamaica. 11. *I. xera*; cactus thorn scrub at Fort Clarence, Jamaica. 12. *I. caudata*; xeric scrub at La Mula, Panama (photo by Arthur Decae). 13. *A. huanca*; rock outcrop in alpine grassland near Santa Rosa de Sacco, Peru.

or other small concealed spaces to house the retreat portion of the web and enough surface irregularities, rocks, exposed roots, branches, or leaves to support the capture web. Where such features are abundant, the population density for some species may be so high (5–10 webs per m<sup>2</sup>) that numerous occupied conspecific webs are contiguous or nearly so (fig. 9).

**Web Structure and Prey Capture:** Ischnotheline webs consist of two functionally distinct parts, a tubular retreat hidden in an enclosed space and an exposed capture web (figs. 1, 2, 4–6, 217, 307). The retreat tube opens out into the capture web via one or two (sometimes more) divergent access tunnels penetrating a three-dimensional complex of sheets, one or a few of which extend outward, somewhat fanlike, to attachment points on nearby ground, rock, root, branch, or leaf surfaces. Much of the web consists of fine, closely spaced threads, but in places cables of co-

hering threads are apparent. In the 10 species whose webs have been observed, the approximate area of the dominant plane covered by an adult female's capture web ranges from 150 to 3600 cm<sup>2</sup>. Some webs, particularly the larger ones, contain vertical threads connecting the capture sheets to structures above (figs. 8, 217, 441). The smaller capture webs of juveniles or of adults of *L. grabensis* and *Andethelinae* species are typically simpler (less three-dimensional) than larger webs, and may consist of little more than a single roughly horizontal sheet (figs. 4, 307, 308). Although web size is at least roughly correlated with spider size, webs of *Andethelinae* species appear to be smaller in proportion to body size than are those of other genera, a feature that may be causally related to the proportionally shorter spinnerets and/or slower prey capture approaches of *Andethelinae* species. The considerable amount of debris found in many ischnotheline webs and the presence of sym-

bionts in some suggest that an ischnotheline spider typically resides for many months in a given web.

The capture web is somewhat adhesive and entangles some kinds of prey at least temporarily. Prey remains found in the webs suggest that ambulatory invertebrates, primarily ants and beetles, make up the great majority of prey captured. Prey capture occurs during day and night, but the spiders tend to rest deeper in the retreat and respond less quickly to prey during the day than at night. The prey capture approach is typically a series of short rapid advances alternating with pauses, during which vibration information is gathered from the prey (figs. 1, 4, 308, 442). During the capture, the anterior legs and pedipalps typically reach over and beyond the prey and pull it under the chelicerae for the downward strike, although immobilization wrapping has been observed in some individuals of *I. caudata*.

**Symbionts:** Invertebrate symbionts have been found in more than 20% of the observed adult female webs of *I. digitata* (Kraus, 1955; Platnick and Shadab, 1978), *I. longicauda* (Alayón, 1992), *I. reggae* (Coyle and Meigs, 1989, 1990), *I. xera* (Coyle and Meigs, 1989, 1990), *Ischnothele goloboffi*, and *T. striatipes* (Coyle and Meigs, 1992). Such symbionts are much less common in *I. caudata* and *I. annulata* webs, appear to be absent from *Andechele* webs, and have not been recorded from the webs of other ischnothelines. These guests are typically other spiders and/or insects and they may function as kleptoparasites, predatory or scavenging commensals, or even predators of host spiderlings. The most common symbionts are tiny mysmenid spiders of the genera *Mysmenopsis* and *Kilia*, which complete their entire life cycle in the host web and behave as kleptoparasites and commensals, pilfering portions of the host's prey and consuming minute insects that are trapped in the web but ignored by the host (fig. 2). To date, seven *Ischnothele* species have been found to harbor an overall total of five species of *Mysmenopsis* kleptoparasites. Some of these kleptoparasites may be so dependent on the host that they may coevolve and speciate with the host (Coyle and Meigs, 1990). *Thelechoris striatipes* webs,

which are larger than those of nearly all other ischnothelines, harbor the most symbionts.

**Reproduction and Life Cycle:** Data are inadequate to indicate whether seasonal patterns exist in mating and oviposition. The courtship and mating behaviors of *T. striatipes* have been described by Coyle and O'Shields (1990), and descriptions of the courtship and mating behavior of seven other ischnotheline species are being prepared (Coyle, in prep.). The male generates taxon-specific web vibrations during courtship, clasps the base of the female's first legs with his tibia I mating apophyses (fig. 3), and lifts her cephalothorax while performing alternate insertions of his palpal organs.

Ischnotheline eggs are deposited in a flattened spheroid mass that is enclosed in a hammock-shaped egg sac constructed in the wall of the retreat (fig. 420). Observed clutch size varies from 42 to 500, with smaller-bodied species (e.g., *I. caudata* and *L. grabensis*) having smaller average clutch sizes than larger species (e.g., *I. guianensis* and *T. striatipes*). My own and other observations of early postembryonic development of *I. guianensis* (Galiano, 1972), *I. reggae* and *I. xera* (Coyle and Meigs, 1990), and *T. striatipes* (Holm, 1954) indicate the following pattern: the first postembryonic cuticle is shed when the eggs hatch a week or two after oviposition; the unpigmented and nearly immobile second instar lasts about a week; and the third-instar spiderlings, fully equipped for independent life, emerge from the egg sac but remain in the maternal web for varying periods before dispersing. Data from *I. guianensis* and *T. striatipes* indicate that a female may produce two or more clutches over the course of a few months and that some spiderlings from an early clutch may still be in the mother's web when spiderlings emerge from a newer clutch. Jantschke and Nentwig's (1987) observations of extensive maternal care in *I. caudata* indicate that at least this ischnotheline species is subsocial (as defined by Wilson [1971] and others).

The wide range of sizes present in a natural population at any given time and the duration and number of juvenile and adult instars observed for lab-reared individuals indicate that, as is customary for mygalomorph spi-

ders, newly hatched ischnothelines require more than a year to develop to adults and that adult females (but not males) can continue to molt and grow for more than a year.

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#### METHODS AND ABBREVIATIONS

The quantitative characters used in this study are abbreviated and defined as follows (in alphabetical order):

AMD – transverse diameter of left anterior median eye pupil

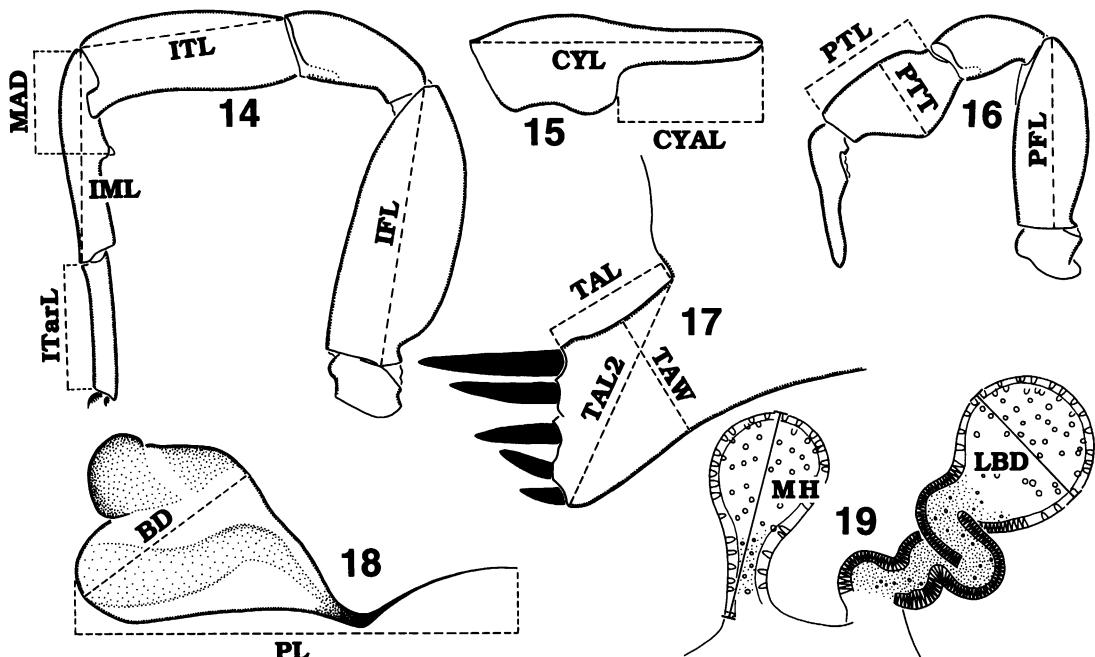
AMS – minimum distance between anterior median eye pupils

BD – maximum diameter of palpal bulb, with palpal organ positioned for a retrolateral and slightly ventral view with the bulb and embolus tip in the horizontal plane (fig. 18)  
 CAS – number of spines on cymbial apophysis (except for those at the extreme tip of the apophysis)  
 CDP, CDR – number of cheliceral denticles adjacent to prolateral and retrolateral rows of teeth, respectively  
 CL – carapace length  
 CS – length of longest carapace edge seta above coxa III  
 CTP, CTR – number of cheliceral teeth in prolateral and retrolateral rows, respectively  
 CW – carapace width  
 CYAL – length of male cymbial apophysis from apex of prolateral cymbial lobe to tip of apophysis along line parallel to CYL (fig. 15)  
 CYL – length of male cymbium (including apophysis) in prolateral view (fig. 15)  
 EL – length of embolus in ventral view with embolus in horizontal plane (*Thelechoris* only)  
 IFL, ITL, IML, ITarL – lengths of leg I femur, tibia, metatarsus, and tarsus, respectively (fig. 14)  
 IMD – maximum diameter of male metatarsus I in retrolateral view along line perpendicular to IML  
 ITarS – number of spines on female tarsus I  
 IFT – maximum diameter of female femur I in retrolateral view along line perpendicular to IFL  
 ITT – maximum diameter of male tibia I in retrolateral view along line perpendicular to ITL  
 ITTP – diameter of male tibia I at one-fourth of distance from proximal to distal end; measured in retrolateral view along line perpendicular to ITL  
 LBD – maximum diameter of bulb of lateral spermatheca (fig. 19)  
 LH – height of lateral spermatheca, measured from base of stalk to end of bulb  
 LSL1, LSL2, LSL3 – lengths of each posterior lateral spinneret article (basal, middle, and terminal article, respectively) measured along midventral line  
 MBD – maximum diameter of bulb of median spermatheca  
 MC – number of cuspules on ventral surface of maxilla  
 MH – height of median spermatheca, measured from basalmost pore at base of stalk to end of bulb (fig. 19)  
 MAD – distance along IML line from proximal end of male metatarsus I to intersection with perpendicular line passing through the apex of tallest part of metatarsal apophysis in retrolateral view (fig. 14)

OL – distance of anterior edge of ocular protuberance from anterior edge of carapace; this may be positive (if ocular protuberance extends beyond carapace edge), zero, or negative (if ocular protuberance lies wholly behind anterior edge of carapace)  
 OQW – ocular quadrangle width  
 PFL, PTL – lengths of male palpal femur and tibia, respectively (fig. 16)  
 PL – length of palpal organ when positioned as described for BD measurement (fig. 18)  
 PTarS – number of spines on tarsus of female pedipalp  
 PTT – maximum diameter of male palpal tibia in retrolateral view along line perpendicular to PTL (fig. 16)  
 SL, SW – length and width, respectively, of sternum; for SL, the anterior point of measurement is on the line passing through the anteriomost points of sternum on each side of labium  
 TAL – distance from distodorsal angle of male tibia I mating apophysis to base of apophysis in retrolateral view (fig. 17)  
 TAL2 – distance from distoventral angle of male tibia I mating apophysis to base of apophysis in retrolateral view (fig. 17)  
 TAS – number of spines on male tibia I mating apophysis  
 TAW – midpoint diameter of male tibia I mating apophysis in retrolateral view (fig. 17)  
 TSP, TSR – number of spines on prolateral and retrolateral surfaces, respectively, of male tarsus I

All appendage characters were measured from the left appendage (unless missing, damaged, or not fully regenerated). All carapace and eye measurements were performed in dorsal view with lateral borders of the carapace in the horizontal plane. The lengths of each leg article and of the palpal femur and tibia were measured in retrolateral view and equal the distance from the proximal point of articulation to the most distodorsal point of the article (in the case of IFL, the distal point of measurement is the tip of the condyle, which is sometimes slightly proximal of the distalmost point of the article).

Most measurements were performed with a Wild M-5 stereomicroscope with 20 $\times$  eyepiece lenses and an eyepiece micrometer scale. LSL1, LSL2, and LSL3 measurements are accurate to 0.076 mm; BD, CYAL, CYL, OL, PFL, PL, PTL, PTT, SL, and SW to 0.018 mm; AMD, AMS, OQW, TAL, TAL2, and TAW to 0.009 mm; all other measurements



Figs. 14–19. Measurement characters (defined in text); illustrated on *Ischnothelus caudatus* structures. 14. Male leg I, retrolateral view. 15. Cymbium, prolateral view. 16. Male pedipalp, retrolateral view. 17. Male tibia I mating apophysis, retrolateral view. 18. Palpal organ, retrolateral-ventral view. 19. Right spermathecae.

(except LBD, LH, MBD, and MH) to 0.038 mm. LBD, LH, MBD, and MH measurements were obtained with a Wild M-20 compound microscope at 100 $\times$  magnification and are accurate to 0.006 mm. All measurements are in mm.

Spermathecae were examined by removing the portion of the body wall to which they are attached, clearing in 85% lactic acid, teasing off any over- or underlying nontransparent tissues, placing the preparation dorsal side up in lactic acid under a coverslip on a glass slide, and viewing through a compound light microscope at 100–400 $\times$ . Spermathecae were then photographed or drawn using a drawing tube.

Each species description is a composite of all adult specimens examined; these sample sizes are given in tables 5 and 6. The quantitative character values recorded for these samples (tables 5, 6) and for the type specimens alone (table 7) are an integral part of each description. If the type specimen possesses distinctive traits, these are noted. My drawings attempt to accurately portray ana-

tomical form and spine patterns; representative bristles are also usually included, but lesser setae are seldom included. All leg and pedipalp figures are drawn from left-hand appendages. Unless otherwise noted, colors are described from specimens in alcohol, illuminated by a tungsten bulb, and viewed through a microscope; live ischnothelines usually appear markedly darker and often exhibit a silvery pubescence not evident in alcohol. Descriptions of characters studied with the scanning electron microscope are based on the examination of one male and one female of each of the following species: *I. reggae*, *I. xera*, *I. guianensis*, *A. huanca*, *L. grbensis*, and *T. striatipes*. When using the key, it is important to remember that any ranges of quantitative character values given are ranges for the sample examined in this study, some of which are quite small.

Characters used in this study were selected from a larger set of traits on the basis of their utility in distinguishing populations and groups of species. One potentially useful trait that I failed to detect early is the relative size

of the female genital lip, which is distinctively large in some species (*Lathrothele jezequelii* and *Indothele rothi*) and difficult or impos-

sible to quantify after the spermathecae are examined. Future studies should record genital lip dimensions.

## RELATIONSHIPS

### TAXONOMIC HISTORY OF THE ISCHNOTHELINAE

The subfamily Ischnothelinae was erected by F. O. P.-Cambridge (1897) to include two diplurid genera, *Ischnothelie* and *Euagrus*. For the next several decades this subfamily was not recognized by other authors (Pocock, 1903; Benoit, 1964, 1965), who instead included *Ischnothelie*, *Euagrus*, and their putative relatives in the diplurid subfamily Macrothelinae, which had been erected by Simon (1892). In the late 1970s and early 1980s, Raven undertook a series of revisions of diplurid and hexathelid genera and a cladistic analysis of mygalomorph spiders that led him to remove many taxa from the Dipluridae. After suggesting that the Macrothelinae was paraphyletic (Raven and Platnick, 1978), he erected the family Hexathelidae to contain certain of the macrotheline and other diplurid genera with numerous labial cuspules (Raven, 1980). At the same time, he reinstated the Ischnothelinae to include diplurid genera of the traditional Macrothelinae that lack labial cuspules and that differ from the Diplurinae by having only one row (rather than two rows) of teeth on the superior tarsal claws. For the next few years, Raven's (1981, 1983a, 1983b, 1984, 1985b) Ischnothelinae was composed of two tribes, Ischnothelini (*Ischnothelie*, *Thelechoris*, and *Lathrothele*) and Euagrini (*Euagrus*, *Phyxioschema*, *Allothele*, and five Australian genera). Then, in his ground-breaking analysis of mygalomorph relationships, he further restricted the Dipluridae by removing the short-spinnereted diplurines from the family, restricted the Ischnothelinae to the three genera in his tribe Ischnothelini, and elevated the tribe Euagrini to the subfamily Euagrinae (Raven, 1985a). In that paper, Raven indicated that a revision of the ischnothelines was needed to test the hypothesis that *Thelechoris* and *Lathrothele* were really separate genera and to resolve the *Ischnothelie*-*Lathrothele*-*Thelechoris* trichotomy.

### MONOPHYLY OF THE ISCHNOTHELINAE

Six putative synapomorphies provide evidence that the Ischnothelinae as defined herein is a monophyletic group. Raven (1985a) proposed four ischnotheline synapomorphies: (1) elongate terminal cymbial apophysis (fig. 60) (vs. no apophysis), (2) two rows of cheliceral teeth (fig. 122) (vs. one row), (3) collariform trichobothrial bases (figs. 43–46) (vs. corrugiform bases), and (4) terminal article of posterior lateral spinnerets (PLS) pseudosegmented (figs. 153, 154) (vs. integral). The first two of these synapomorphies are especially strong. The very long cymbial apophysis is unique among diplurids (perhaps even among all mygalomorphs), and no other diplurids have two rows of cheliceral teeth. The diplurid genus *Microhexura* also has collariform trichobothrial bases (fig. 47) (although this collar, unlike that of the ischnothelines, has parallel ridges and lobed ends), and outgroup comparison (with the Hexathelidae) indicates that the collariform state may actually be plesiomorphic in diplurids. Pseudosegmented terminal PLS articles have been found in a few other diplurids (*Phyxioschema*, several species of *Phyxioschema*'s sister genus *Euagrus*, and one species of *Linothele*) and in the mecicobothriids; however, as Raven (1985a) suggested, this trait probably arose independently in these taxa.

Another putative ischnotheline synapomorphy, fused spigots (the absence of a deep groove separating the spigot shaft from its swollen base) (figs. 48, 49, 51, 52), was first observed in a species of *Ischnothelie* by Palmer (1990, from Goloboff, 1993). Other diplurids and the one examined hexathelid genus have articulated spigots (with a deep groove separating the shaft from its base). My scanning electron microscope observations reveal fused spigots in the other ischnotheline genera, although in *Andethele huanca* a shallow to moderately deep groove may be present (fig. 50). Another possible synapomorphy

is the clearly procurved transverse fovea possessed by all ischnotheline species (figs. 153, 250, 283, 341, 415). This state is distinctively different from the recurved fovea of diplurines and the wide range of fovea types in other diplurids (absent in *Carrai*, longitudinal in *Microhexura*, rounded and pitlike to a broad and narrow but never procurved transverse groove in nearly all the rest). Only in a few species of *Euagrus* is the steep front wall of the fovea occasionally procurved. Only 2 (*Atrax* and *Hadronyche*) of the 10 genera of hexathelines have a procurved fovea (Raven, 1985a; Gray, 1988).

#### SISTER GROUP OF THE ISCHNOTHELIINAE

It is not clear what taxon is the sister group of the ischnothelines. The first explicit and argued ischnotheline sister group hypothesis (Raven, 1985a) postulated that the diplurines (*Diplura*, *Trechona*, and *Linothele*) are that sister group. Raven presented three synapomorphies in support of this hypothesis: (1) male tarsi pseudosegmented (vs. integral), (2) male tibia I with a single distal spur (vs. spur absent), and (3) tarsal organ centrally raised (vs. concave). Synapomorphy 1 may be valid since hexathelid males apparently all have integral tarsi (Raven, 1985a). However, it should be noted that at least eight ischnotheline species in three genera have integral tarsi, and that the presence of both states in each of at least four mygalomorph families (Antrodiaetidae, Dipluridae, Theraphosidae, and Nemesiidae) (Goloboff, 1993) suggests that this character may be especially plastic. Synapomorphy 2 rests on even weaker ground since the single distal spur of diplurines (a large spine attached to a small protuberance) is very different in form from, and consequently may not be homologous to, the tibia I mating claspers of ischnothelines (a much larger apophysis with at least a few spines or without spines) (figs. 56, 226, 280, 336, 374) and since the diplurine state is similar to that of some hexathelids (see Raven, 1980). Raven (1985a) showed that the centrally raised tarsal organ (synapomorphy 3) is also found in euagrines, and Goloboff (1993), who discussed difficulties in defining and scoring this character state, concluded that hexathelids and diplurines share the same state. Further

cause to reject Raven's (1985a) hypothesis that the diplurines are the sister group of the ischnothelines comes from Goloboff's (1993) cladistic analysis, which indicates that the sister group of the ischnothelines may be Goloboff's Bipectina, a large taxon consisting of the Diplurinae and the Rastelloidina plus Crassitarsae.

Ischnothelines share with *Euagrus* and at least most other euagrines a number of character states not found in diplurines (see Goloboff [1993] for descriptions of most of these states): (1) inferior tarsal claw dentate (vs. edentate), (2) superior tarsal claws with one row of teeth (vs. two rows), (3) no scopula on tarsi I and II (vs. scopula present), (4) tarsal trichobothria row straight (vs. zigzag), (5) two (or more) plus two (or more) spermathecal arrangement (vs. one plus one), (6) spigot shaft surface scalelike (vs. almost smooth), and (7) foveal bristles present (vs. absent). However, all of these states appear to be plesiomorphic (using hexathelids as the outgroup). Similar numbers of symplesiomorphies exist between ischnothelines and other nondiplurine diplurid taxa (*Microhexura*, *Chilehexops*, and the Masteriinae). Goloboff's (1993) analysis indicates that *Euagrus* and/or *Chilehexops* are sister groups of the Ischnothelinae plus Bipectina.

In summary, no strong synapomorphies have been found to support a sister group relationship between the ischnothelines and any other diplurid taxon. Goloboff (1993) concludes that the Dipluridae, as currently recognized, is not monophyletic and may need to be further restricted to include only the diplurine genera (*Diplura*, *Trechona*, and *Linothele*). In Goloboff's (1993) preferred phylogeny, "the non-diplurine diplurids form a gray area between the four-spinnereted taxa and the more plesiomorphic, six-spinnereted hexathelids and mecicothriids."

#### CLADISTIC ANALYSIS OF ISCHNOTHELINE SPECIES RELATIONSHIPS

**Selection of Outgroup:** Uncertainty about the sister group of the Ischnothelinae makes it difficult to select an appropriate outgroup for this cladistic analysis. The best way to solve this problem—a detailed cladistic analysis of all dipluroid genera—is beyond the

scope of this paper, but should be feasible once the diplurine genera are revised. Considering the current state of knowledge, I think that the euagrine genera *Euagrus* and *Allothele* together comprise the most informative working outgroup for the following reasons: (1) Much more is known about character state distribution in these genera (Coyle, 1984, 1988) than in diplurine genera. (2) The large number of apparently plesiomorphic states shared by *Euagrus* and ischnothelines suggests that *Euagrus* may be a relatively informative guide to ischnotheline ancestral states. (3) Unusually small body size and the apparent absence of close relatives suggest that diplurid taxa such as *Microhexura* and *Chilehexops* may have evolved too many specializations to be informative outgroups. (4) Goloboff's (1993) Bipectina is not now a useful outgroup because relationships within this large group are poorly known and many of its characters are highly modified (Goloboff, personal commun.). Consequently, I decided to perform two analyses, the first with euagrines (*Euagrus* plus *Allothele*) as the outgroup and the second with euagrines and diplurines (*Diplura* plus *Linothele*) as two separate outgroups.

**Characters and Data Matrix:** Of the first 39 characters used in this analysis, 25 are male characters (1–25), 13 are female characters (26–38), and 1 is an ecological character (39). The four meristic, one measurement, and six ratio characters used were selected from the much larger set of quantitative characters surveyed in this study because they are more informative and less subjective than others; these selected characters distinguish clusters of species with nonoverlapping values or with mean values significantly different ( $P < 0.05$ ) from other such clusters (see, for example, fig. 20). The descriptive statistics for all but one of these characters are presented in tables 5 and 6. All 14 characters with more than two states were ordered except for characters 3, 7, 8, and 10, which were treated as unordered because they have discrete and distinctive states without evidence favoring a particular transformation series. Characters 40–44, putative ischnotheline synapomorphies, were used only for the second analysis to maintain the two outgroups.

In the character descriptions that follow,

only representative figures (rather than all applicable ones) are cited.

**Character 1.** Spines on tibia I mating apophysis. 0 = absent (figs. 226, 280); 1 = present (fig. 56).

**Character 2.** Position of tibia I mating apophysis. 0 = subterminal (fig. 280); 1 = terminal (figs. 56, 226).

**Character 3.** Shape of tibia I mating apophysis. 0 = truncate (fig. 56); 1 = gradually tapers to a point (fig. 280); 2 = two protuberances (a distal semiquadratus and a subdistal pointed one) (fig. 226).

**Character 4.** Shape of dorsal portion of tibia I. 0 = not swollen or very weakly swollen (fig. 56); 1 = strongly swollen (fig. 280).

**Character 5.** Longitudinal ventral keel at distal end of metatarsus I. 0 = absent (figs. 90, 94); 1 = present (figs. 56, 57).

**Character 6.** Apophysis on ventral surface of metatarsus I. 0 = present (fig. 56); 1 = absent (fig. 336).

**Character 7.** Form of retrolateral prominence of metatarsus I apophysis. 0 = short, strong, and blunt (fig. 56); 1 = short, weak, and pointed (fig. 320); 2 = long and keel-like (figs. 226, 227).

**Character 8.** Form of retrolateral keel of metatarsus I apophysis. 0 = thick and ridge-like (figs. 226, 227); 1 = low and proximally thin (figs. 347, 348); 2 = tall and strong (figs. 280, 281).

**Character 9.** Prolateral prominence of metatarsus I apophysis. 0 = present (figs. 56, 57); 1 = absent (figs. 90, 94).

**Character 10.** Form of prolateral prominence of metatarsus I apophysis. 0 = small sharp point (fig. 56); 1 = long thick ridge (figs. 242, 243); 2 = keel (fig. 281).

**Character 11.** Mean number of spines on prolateral surface of tarsus I. 0 = 0.0–0.2; 1 = 1.3–3.0; 2 = 18–27.

**Character 12.** Mean number of spines on retrolateral surface of tarsus I. 0 = 0.0–0.5; 1 = 1.8–2.7.

**Character 13.** Mean of ITarL(100)/CL. 0 = 30–45; 1 = 55–72.

**Character 14.** Tarsus I form. 0 = not pseudosegmented (rigid, integral); 1 = pseudosegmented (sclerotized cuticle interrupted by transverse weakly sclerotized or unsclerotized areas, which make tarsus at least slightly flexible).

**Character 15.** Spines on prolateral surface

of palpal patella. 0 = no spines (only bristles present); 1 = two slender-tipped spines; 2 = two truncate broad-tipped spines (fig. 63).

Character 16. Shape of palpal tibia (in lateral view). 0 = proximal half strongly swollen ventrally (fig. 118); 1 = proximal half not strongly swollen ventrally (figs. 60, 78).

Character 17. Bristles on tip of cymbium. 0 = absent (only setae); 1 = weak bristles (slightly thicker than surrounding setae); 2 = strong bristles (nearly spinelike) (figs. 95, 118).

Character 18. Mean of CAS. 0 = 0–1.5; 1 = 2.8–6.1 (fig. 95); 2 = 11.3–12.0 (figs. 405–407).

Character 19. Mean of PL(100)/BD. 0 = 150–175; 1 = 222–282; 2 = 309–435.

Character 20. Transition from bulb to embolus. 0 = gradual (fig. 96); 1 = fairly rapid (figs. 32, 86, 88); 2 = rapid (figs. 34, 119, 121); 3 = very abrupt (figs. 36, 408, 409).

Character 21. Serrations on embolus. 0 = absent (figs. 34, 96); 1 = present (figs. 33, 86, 88).

Character 22. Keels on embolus. 0 = absent (figs. 34, 39); 1 = edges almost keellike (weakly flattened) (figs. 32, 86, 88); 2 = one or two thin keels (figs. 61, 62, 79).

Character 23. Embolus cross section. 0 = not flattened; 1 = flattened (figs. 37, 408).

Character 24. Form of embolus tip. 0 = sharp tip extends beyond opening (figs. 37, 38, 380); 1 = no such extension.

Character 25. Embolus curvature near tip (in retrolateral view, slightly ventral aspect). 0 = downward (fig. 96); 1 = upward (figs. 231, 279).

Character 26. Mean of SW(100)/SL. 0 = 81–93 (fig. 155); 1 = 97–99 (fig. 417).

Character 27. Mean of AMD(100)/CL. 0 = 3.3–5.0 (fig. 153); 1 = 1.7–2.2 (fig. 250).

Character 28. Position of ocular lobe. 0 = anterior edge well behind anterior edge of carapace (mean OL = –0.14 to –0.06) (figs. 250, 251); 1 = anterior edge nearly even with, or projecting in front of, anterior edge of carapace (mean OL = –0.02 to 0.08) (figs. 283, 284).

Character 29. Mean of CS(100)/CW (fig. 20). 0 = 5.2–8.1; 1 = 11.2–18.3 (fig. 283).

Character 30. Mean of LSL3(100)/CL. 0 = 79–123 (fig. 154); 1 = 53–59 (fig. 251).

Character 31. Number of spermathecae per side. 0 = one (fig. 335); 1 = two (fig. 123); 2 = three (occasionally two, and third stalk

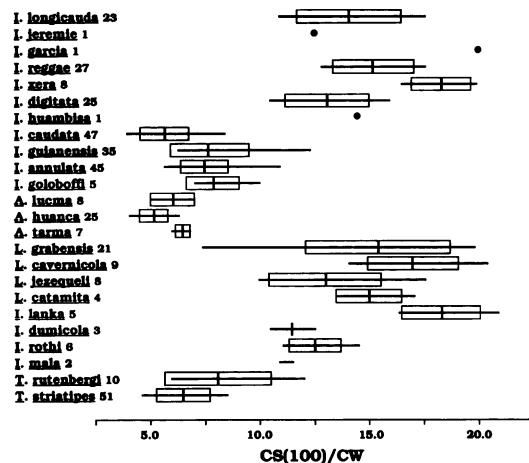


Fig. 20. Values of CS(100)/CW (character 29) for samples of females of all ischnotheline species. Sample size beside species name. Horizontal bar represents range, vertical bar the mean, and box the standard deviation (if sample size greater than 3).

without bulb) (figs. 72, 81); 3 = four to six (fig. 102).

Character 32. Shapes of spermathecal stalks. 0 = not coiled (figs. 64, 82); 1 = one stalk coiled (figs. 125, 126); 2 = both median and lateral stalks coiled (figs. 382–387).

Character 33. Degree to which terminal ends (usually bulbs) of spermathecae are sclerotized. 0 = unsclerotized (fig. 64); 1 = weakly to moderately sclerotized (figs. 234–240); 2 = heavily sclerotized (figs. 87, 89).

Character 34. Lengths of the spermathecal stalks. 0 = all very short (vestigial) (figs. 87, 89); 1 = short to long (figs. 64, 84).

Character 35. Relative lengths of spermathecal stalks. 0 = lateral much longer than medial (figs. 124–131); 1 = all roughly same length (figs. 82, 85).

Character 36. Distance between right and left spermathecae. 0 = small (figs. 72, 81); 1 = large (figs. 329, 335).

Character 37. Sclerotization of spermathecal stalks. 0 = absent (fig. 101); 1 = one or more stalks sclerotized (fig. 125).

Character 38. Base of spermathecal stalk abruptly upturned dorsally to form a lip. 0 = absent (fig. 64); 1 = present (fig. 355).

Character 39. Climate. 0 = warm (low elevation and latitude); 1 = cool (high elevation and/or latitude).

TABLE 1  
Data Matrix for Ischnotheline Species and Outgroups  
(? = no information available; - = not applicable)

Taxa	123456789	1 0123456789	2 0123456789	3 0123456789	4 01234
<i>Ischnotheli</i>					
<i>longicauda</i>	1100100-0	0111121000	1020100001	0200110100	00000
<i>jeremie</i>	1100100-0	0?1??21000	1020100001	0200110100	00000
<i>garcia</i>	???????????	???????????	????????0001	0200110100	?0000
<i>reggae</i>	1000100-0	0011111000	1110100001	0202010100	00000
<i>xera</i>	1000100-0	0111111000	1110100001	0202010100	00000
<i>digitata</i>	1100000-1	-110101211	0000100011	0300110000	00000
<i>huambisa</i>	???????????	???????????	????????0011	0200110000	?0000
<i>caudata</i>	1100000-0	0210000211	2000100000	0110100100	00000
<i>guianensis</i>	1100000-0	0210000211	2000100000	0110100100	00000
<i>annulata</i>	1100000-0	0210000211	2000100000	0110100100	00000
<i>goloboffi</i>	1100000-0	0110100211	0000100000	0120100100	00000
<i>Andetheli</i>					
<i>lucma</i>	012000200	1110001111	0000110100	1101110101	00000
<i>huanca</i>	012000200	1110001111	0000110100	1101110101	00000
<i>tarma</i>	012000200	1110001111	0000110100	1101110101	00000
<i>Lathrotheli</i>					
<i>grabensis</i>	001100220	2000101012	0000110011	0100110100	00000
<i>cavernicola</i>	001100220	2000101012	0000110011	0100110100	00000
<i>jezequeli</i>	0010001-1	-000101012	0000110011	0100111100	00000
<i>catamita</i>	???????????	???????????	????????0011	000-1-00	?0000
<i>Indothele</i>					
<i>lanka</i>	001001---	-000101011	0000110011	0110110110	00000
<i>dumicola</i>	001000211	-000?-1011	0000110011	0100110010	00000
<i>rothi</i>	???????????	???????????	????????0011	0100110010	?0000
<i>mala</i>	???????????	???????????	????????0011	0100110010	?0000
<i>Thelechoris</i>					
<i>rutenbergi</i>	011001---	-00000102?	3001001010	0120110100	00000
<i>striatipes</i>	011001---	-00000102?	3001001010	0120110100	00000
<i>Euagrus &amp; Allothele</i>	---001---	-110001001 212	0000100000 1	1100000100 111 1	11111
<i>Diplura &amp; Linothele</i>	1100000-1	-001101001	0000110001 1 2	1000110000 1 11 3	11111

Character 40. Cymbial apophysis. 0 = elongate; 1 = extremely short or absent.

Character 41. Number of rows of teeth on chelicerae. 0 = two; 1 = one.

Character 42. Trichobothrial base form. 0 = collariform; 1 = corrugiform.

Character 43. Spigot base form. 0 = fused; 1 = articulated.

Character 44. Fovea shape. 0 = procurved; 1 = otherwise.

The data matrix for the 24 ischnotheline species and the outgroups is presented in ta-

ble 1. When scoring character states for the euagrine outgroup (*Euagrus* plus *Allothele*), I was able, for most characters, to score every species in both genera using data from Coyle (1984, 1988). If more than one state was found in these two genera, I either scored the state hypothesized to be ancestral on the basis of published cladograms (Coyle, 1984, 1988) or, in the absence of such a hypothesis, all of the states present. Because data are not available in Coyle's revisions about characters 11-14 for *Euagrus* and characters 11-15 for *Allo-*

*thele*, I observed males and females of *Euagrus mexicanus*, *E. chisoseus*, *E. carlos*, and *Allothele caffer* to score the outgroup for these characters. Diplurine outgroup states were recorded from three *Diplura* adults representing two or three species (a male from Bon Jesus, Rio Grande do Sul, Brazil; a male of a different species from Kaw Mountains, French Guiana; a female from Mont Saul, French Guiana) and five *Linothele* adults representing three or four species (a male and female from San Pedro, S. N. de Santa Marta, Colombia; a male of a different species from H. Pittier National Park, Aragua, Venezuela; a female from Pakitzá, Madre de Dios, Peru; a female paratype of *L. megatheloides*). If more than one state occurred for a given character in this diplurine sample, I scored the outgroup as having all observed states.

**Search for Parsimonious Trees:** The branch and bound algorithm of PAUP version 3.1 (Swofford, 1993) was used to search for parsimonious cladograms. Both PAUP and MacClade version 3.0 (Maddison and Maddison, 1992) were used to study character evolution. Initially, all characters were weighted "equally" (PAUP's default setting). Two analyses (or sets of searches) of ischnotheline species interrelationships were performed: in the first, *Euagrus* plus *Allothele* constituted the outgroup and characters 1–39 were used; in the second, another outgroup, consisting of *Diplura* plus *Linothele*, and characters 40–44 were added.

In the first analysis, the first search found 36 shortest trees, each with a treelength of 85, a consistency index (CI) of 0.75, and a retention index (RI) of 0.88. Successive searches were performed using PAUP's a posteriori character weighting algorithm. Reweighting was based on both the rescaled CI and CI and on both the best fit and mean fit options. In each case, this process produced 18 equally shortest trees (CI = 0.87, RI = 0.94), all members of the original set of 36. Cladogram A (fig. 21) is the one tree (from among these 18) that I think, from the following considerations, is the strongest hypothesis. The 18 trees differ only in the position of *Ischnothele garcia* in clade 5 and the resolution of clade 19. Examination of these 18 trees, their strict consensus, and their majority rule consensus shows that clade 19 is

an unresolvable trichotomy and that, among the various resolutions of clade 5, *I. gacia* is the sister of *I. digitata* plus *I. huambisa* (clade 10) in only 3 trees, *I. gacia* forms a clade with *I. longicauda* and *I. jeremie* twice as commonly (in 6 of the trees) as with any other taxa, and *I. longicauda* and *I. jeremie* are sister species (clade 8) in 12 of the 18 trees. Table 2 gives the unambiguous character changes (synapomorphies) supporting the branches of this preferred tree. Clades 3 and 15–19 (the *Lathrothele* and *Indothele* clades) are each supported by only one synapomorphy; all others (except clade 7) are supported by two or more. Table 3 presents the tree's character indices for all homoplastic characters; four characters (6, 9, 14, and 32) exhibit especially high degrees of homoplasy.

The three polytomies (clades 2, 12, and 19) in cladogram A (fig. 21) are difficult to resolve. For each of these trichotomies I screened all observed characters to find characters with states shared by two of the three species and distinct (with significantly different means if the character is continuously variable) from the state in the third species. Most of these characters, because their usefulness is restricted to the clade in question, are not in the set of 44 used in the overall analysis. In clade 2 (the three *Andethelae* species) I found 11 such characters. Seven of these characters involve states shared by *A. huanca* and *A. tarma*: high PTT(100)/PTL values (table 5), high CYAL(100)/CL values (table 5), low PL(100)/BD values (table 5), embolus base not so inflated (figs. 249, 270 vs. 231), sharper tip on subdistal mating apophysis of tibia I (figs. 244–247, 267, 268 vs. 228–230), spermathecae less well sclerotized (figs. 252–260, 271–277 vs. 234–240), and median spermathecal bulbs better developed (figs. 252–260, 271–277 vs. 234–240). The other four characters involve states shared by *A. huanca* and *A. lucma*: dorsal shoulder of distal mating apophysis of tibia I not a sharp corner (figs. 228–230, 244–247 vs. 267, 268), branch at base of lateral spermatheca absent (figs. 234–240, 252–260 vs. 271–277), high AMD(100)/CL values (table 6), and high SW(100)/SL values (table 6). Outgroup comparison to the rest of the ischnothelines indicates that some of these shared

## Cladogram A

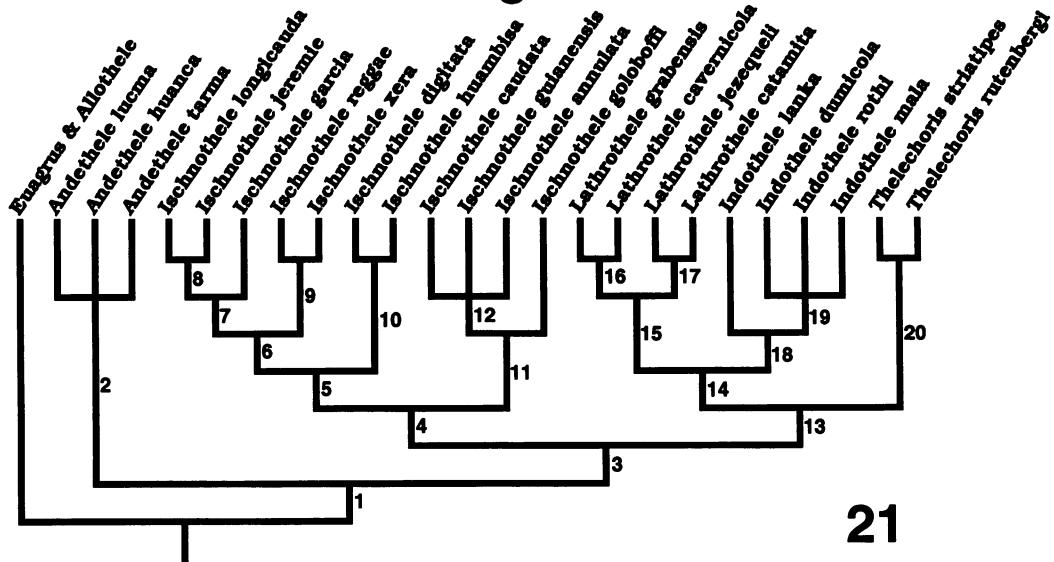


TABLE 2  
Unambiguous Character Changes  
(Synapomorphies) Supporting Clades in  
Cladogram A

(Character numbers are followed by state changes  
enclosed in parentheses.)

Clade	Character changes
2	25 (0 > 1), 17 (0/2 > 1)
3	30 (1 > 0)
4	1 (0 > 1), 7 (2 > 0)
5	29 (0 > 1), 31 (1 > 2)
6	5 (0 > 1), 13 (0 > 1), 15 (0 > 1), 17 (1/2 > 0), 18 (1 > 0), 19 (1 > 0), 20 (0 > 1), 22 (0 > 1)
8	15 (1 > 2), 22 (1 > 2)
9	2 (1 > 0), 21 (0 > 1), 33 (0 > 2), 34 (1 > 0)
10	28 (0 > 1), 37 (1 > 0)
11	16 (1 > 0), 32 (0 > 1), 35 (1 > 0)
12	11 (1 > 2), 20 (0 > 2)
13	11 (1 > 0), 12 (1 > 0), 17 (1 > 0), 28 (0 > 1)
14	2 (1 > 0), 25 (0 > 1), 29 (0 > 1)
15	19 (1 > 2)
16	4 (0 > 1)
17	36 (0 > 1)
18	38 (0 > 1)
19	37 (1 > 0)
20	6 (0 > 1), 18 (1 > 2), 20 (0 > 3), 23 (0 > 1), 24 (1 > 0), 26 (0 > 1), 32 (0 > 2)

TABLE 3  
Indices for Characters Exhibiting Homoplasy in  
the Preferred Cladograms  
(CI = consistency index; RI = retention index)

Char-	Cladogram A (fig. 21)		Cladogram B (fig. 22)	
	Char-	CI	RI	CI
2	0.50	0.83	0.50	0.83
6	0.33	0.33	0.33	0.33
9	0.33	0.00	0.25	0.00
11	0.67	0.89	0.50	0.80
12			0.50	0.86
13			0.50	0.67
14	0.33	0.75	0.25	0.63
17	0.67	0.82	0.80	0.91
20	0.50	0.77	0.63	0.77
25	0.50	0.86	0.33	0.75
28	0.50	0.91	0.50	0.91
29	0.50	0.89	0.25	0.67
30			0.50	0.75
31			0.86	0.83
32	0.40	0.63	0.40	0.63
33	0.75	0.80	0.75	0.80
37	0.50	0.75	0.67	0.75

states are plesiomorphic and others are of indeterminate polarity; none are clearly apomorphic.

In clade 12 (*Ischnothele caudata*, *I. guianensis*, and *I. annulata*) I found 16 characters with states shared by two species. Six of these states are shared by *I. guianensis* and *I. caudata*: high OQW(100)/CL values (table 6), presence of continuous longitudinal pectinate band of white hairs on abdominal dorsum (figs. 135–137, 156–159 vs. 200–202), low number of ITarS on female (table 6), high AMD(100)/CL values (table 6), eye tubercle farther back from carapace edge (OL, table 6), and ventral swelling of male palpal tibia not greatly protruding (figs. 118, 120, 147 vs. 182). Using *I. goloboffi* as the outgroup, only the first state is apomorphic, the second is indeterminate, and the rest are plesiomorphic. Eight states are shared by *I. guianensis* and *I. annulata*: low TAL1(100)/CL values (table 5), low MKP(100)/ML values (table 5), low CDR/CL values (table 6), high CS(100)/CL values (table 6), high CYAL(100)/CL val-

ues (table 5), high PFL(100)/CL values (table 5), absence of a median shoulder at the base of the lateral spermatheca (figs. 160–171, 187–199 vs. 124–133), and high MH/LBD values (fig. 110). The first state is apomorphic, the second is indeterminate, and the rest are plesiomorphic. Only one state, high PTT(100)/PTL values (table 5), is shared by *I. caudata* and *I. annulata*; this is apparently apomorphic. These observations provide only weak evidence that either *I. guianensis* plus *I. caudata* or *I. guianensis* plus *I. annulata* are the most probable sister groupings in this clade.

In clade 19 (*Indothele dumicola*, *I. rothi*, and *I. mala*) I found only five characters with shared states, including three putative synapomorphies (using *Indothele lanka* as the outgroup), for the three possible species pairings. Two of these synapomorphies, low AMD(100)/CL values (table 6) and a more strongly upturned dorsal lip at the bases of the spermathecal stalks (figs. 355–358, 362–365 vs. 369, 370), support the sister-group relationship of *I. dumicola* plus *I. rothi*. The third, low ITL(100)/CL values (table 6), supports the sister-group relationship of *I. dumicola* plus *I. mala*.

In the second analysis, which used both the euagrine and diplurine outgroups, the first search found 237 shortest trees, each with a treelength of 106, a CI of 0.72, and an RI of 0.84. PAUP's *a posteriori* character reweighting (run with the same options as in the first analysis) produced 15 equally shortest trees (CI = 0.86, RI = 0.92), all members of the original set of 237. Cladogram B (fig. 22) is the one tree (from among these 15) that I think, from the following considerations, is the strongest hypothesis. The 15 trees differ only in the resolutions of clade 12 and the position of *Ischnothele garcia*. Examination of these trees, their strict consensus, and their majority rule consensus reveals that clade 12 is an unresolvable trichotomy and that *I. gacia* is sister to *I. digitata* plus *i. huambisa* (clade 8) in 3 of the 15 trees, a branch within clade 2 on the other 12 trees, and allied with *I. longicauda* and *I. jeremie* (as the sister of these two together and as a trichotomy) in 6 of these 12 trees. *Ischnothele longicauda* and *I. jeremie* (clade 4) are sister species in 12 of the 15 shortest trees. Table 4 gives the unambiguous character changes (synapomorphies) supporting the branches of this preferred tree. Clades 6, 7, and 14–19 (the *Lathrothele* and *Indothele* clades) are each supported by only one putative synapomorphy; all others (except clade 3) are supported by two or more. Table 3 presents the tree's character indices for homoplastic characters; six characters (6, 9, 14, 25, 29, and 32), the first three and last of which were highly homoplastic in cladogram A, exhibit especially high degrees of homoplasy in cladogram B.

The three polytomies (clades 10, 12, and 19) in cladogram B (fig. 22) are the same as those in cladogram A (fig. 21), and two of them (the *Ischnothele* and *Indothele* trichotomies, clades 10 and 19) are just as difficult to resolve in this context because their sister groups are unchanged. However, the *Andethele* clade (12), which has a different, more restricted, sister group in this cladogram than in cladogram A, is easier to resolve in cladogram B because 2 [high PTT(100)/PTL values (table 5) and low PL(100)/BD values (table 5)] of the 11 shared character states are apomorphic and thereby strengthen support for the sister group relationship of *A. tarma* and *A. huanca*.

TABLE 4  
Unambiguous Character Changes  
(Synapomorphies) Supporting Clades in  
Cladogram B  
(Character numbers are followed by state changes  
enclosed in parentheses.)

Clade	Character changes
2	5 (1 > 0), 15 (0 > 1), 19 (1 > 0), 20 (0 > 1), 22 (0 > 1), 31 (1 > 2)
4	15 (1 > 2), 22 (1 > 2)
5	2 (1 > 0), 21 (0 > 1), 33 (0 > 2), 34 (1 > 0)
6	18 (0 > 1)
7	17 (0/1 > 2)
8	28 (0 > 1), 31 (1 > 2), 37 (1 > 0)
9	16 (1 > 0), 32 (0 > 1), 35 (1 > 0)
10	11 (1 > 2), 14 (1 > 0), 20 (0 > 2)
11	1 (1 > 0), 7 (0 > 2)
12	27 (0 > 1), 30 (1 > 0), 33 (0 > 1), 39 (0 > 1)
13	11 (1 > 0), 12 (1 > 0), 28 (0 > 1)
14	2 (1 > 0)
15	19 (1 > 2)
16	4 (0 > 1)
17	36 (0 > 1)
18	38 (0 > 1)
19	37 (1 > 0)
20	6 (0 > 1), 18 (1 > 2), 20 (0 > 3), 23 (0 > 1), 24 (1 > 0), 26 (0 > 1), 32 (0 > 2)

There are only three differences in the form of the two phylogenies (cladograms A and B) generated by these two analyses: (1) The *Andethele* clade is the sister group of all other ischnothelines in cladogram A (fig. 21), but is the sister group of the more restricted clade 13, the Old World genera (*Thelechoris*, *Indothele*, and *Lathrothele*), in cladogram B (fig. 22). (2) *Ischnothele* is monophyletic in cladogram A, but paraphyletic in cladogram B. (3) *Ischnothele digitata* plus *i. huambisa* is the sister group of one *Ischnothele* clade (6) in cladogram A, but sister of the other *Ischnothele* clade (9) in cladogram B. Both cladograms provide particularly strong support for the monophyly of the following five "major" (with three or more species) clades: the Greater Antilles *Ischnothele* clade (clade 6 in cladogram A and clade 2 in cladogram B), the *Ischnothele goloboffi* clade (clade 11 in A and clade 9 in B), the *Ischnothele caudata* clade (clade 12 in A and clade 10 in B), the *Andethele* clade (clade 2 in A and clade 12 in B), and the Old World clade (clade 13). For the reasons given above under "Selection of Out-

group," I suspect that cladogram A (fig. 21), the phylogeny produced by using only *Euagrus* plus *Allothele* as the outgroup, is closer to the "truth." It is unfortunate that the males of five species (*I. garcia*, *I. huambisa*, *L. catamita*, *I. rothi*, and *I. mala*) are unknown; the paucity of character information for these

species makes their phylogenetic positions especially tenuous. When males of these species are discovered and dipluroid relationships are better resolved, more rigorous testing of ischnotheline phylogenies will be possible.

## BIOGEOGRAPHY

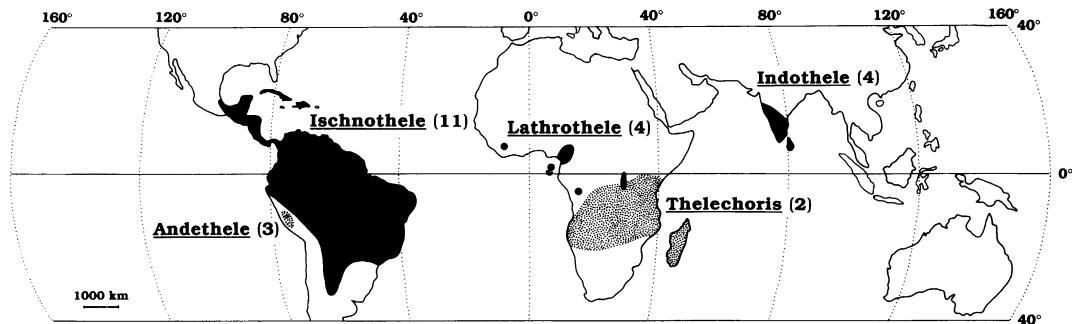
Although not particularly speciose, the Ischnothelinae is a widespread group, occurring throughout the New World Tropics (14 species) and in Africa (5 species), Madagascar (1 species), India (3 species), and Sri Lanka (1 species) (fig. 23). The greatest concentrations of species are in Peru (6 species), a country known for high species diversity and endemism (Silva, 1992), and the Greater Antilles (5 species). Most ischnotheline species exhibit high endemism; only five species—*Ischnothele caudata*, *I. guianensis*, and *I. annulata* in South America (map 2), and *Lathrothele grabensis* and *Thelechoris striatipes* in Africa (map 4)—are relatively widespread. No genus is found on more than one continent and its adjacent islands. Allopatry is the rule throughout the subfamily; only two species (*Ischnothele digitata* and *I. caudata*) are clearly sympatric. These traits (occurrence on three continents, high specific and generic endemism, and allopatry) make the subfamily potentially very useful for testing biogeographic hypotheses.

The only published hypothesis about the biogeographic history of the ischnothelines is one proposed by Pocock (1903) in his classic paper on the geographic distribution of mygalomorphs. He postulated that ischnothelines originated in the Old World and spread westward from India to Madagascar to Africa and thence to South America, and he suggested that all this may have taken place during the Tertiary. Now that testable cladograms (figs. 21, 22) of ischnothelines exist, they can be used to test biogeographic hypotheses (Platnick, 1981). Not only do we know much more now than Pocock knew about the relationships and distribution (fig. 23, maps 1–5) of ischnotheline taxa, but we now have a new heuristic methodology—cladistic biogeography (Nelson and Platnick, 1981)—and knowledge of the mechanics and history of

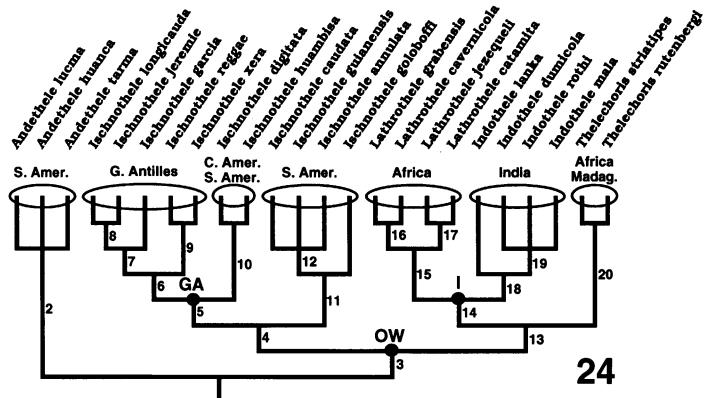
drifting fragments of the earth's crust to improve our understanding of why taxa are distributed in certain areas and not others.

Area cladograms (figs. 24, 25) constructed from cladograms A and B both suggest that continental drift has played a key role in generating the major ischnotheline clades. The area cladograms are consistent with the hypotheses that (1) the subfamily originated before South America and Africa separated (at about 125 Ma [Briggs, 1987; Donnelly, 1988]), (2) this separation gave birth to the Old World clade (OW event in figs. 24, 25), and (3) a later separation of India from Africa—perhaps after a secondary contact 70–80 Ma (Briggs, 1987)—gave rise to *Indothele*, the Indian clade (I event in figs. 24, 25). Area cladogram A (fig. 24) differs from area cladogram B (fig. 25) in two key biogeographic implications: it indicates an earlier origin for the Peruvian montane endemic *Andethele* than does cladogram B and a later origin (GA event in figs. 24, 25) for the Greater Antilles clade of *Ischnothele* than does cladogram B.

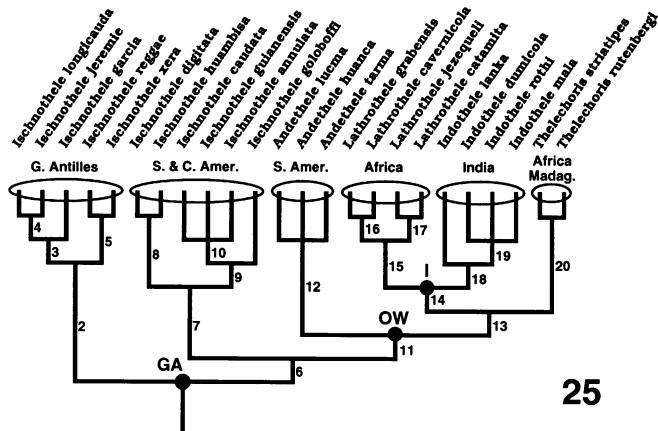
The Greater Antilles *Ischnothele* clade is of particular interest because of its promise for testing hypotheses about the biogeography of the Caribbean, a region that has challenged many biogeographers (Liebherr, 1988a). The hypothesized relationship of *I. garcia* (Hispaniola) is frustratingly tenuous and will probably remain so until a male is discovered. Nevertheless, the area cladogram of the Greater Antilles clade is generally consistent with hypotheses and distribution patterns presented by Rosen (1985), Liebherr (1988b), and others. These patterns fit the geological evidence that during much of the Tertiary the Greater Antilles consisted of "about a dozen blocks that have at different times been juxtaposed and wrenched apart" and have therefore fostered the vicariant origin of taxa (Donnelly, 1988). In particular,



23



24



25

Figs. 23–25. Distribution and area cladograms of the Ischnothelinae. 23. Approximate known distribution of ischnotheline genera. Number of species in parentheses. 24, 25. Area cladograms of cladograms A and B, respectively. OW, GA, and I represent events that gave rise to the Old World, Greater Antillean, and Indian clades, respectively.

the convincing sister relationship of *I. longicauda* (Cuba) with *I. jeremie* (Hispaniola) supports the hypothesis that part of Cuba split off from Hispaniola (Hedges, 1982; Rosen, 1985). I suspect that the population of *I. lon-*

*gicauda* on Andros Island (map 1), which was submerged in the Pliocene, reached that island recently during a Pleistocene glacial when lowered sea levels enlarged Andros Island and reduced the water gap between it and Cuba

to a few kilometers (Browne et al., 1993). Given enough time, the reduced gene flow resulting from the greatly widened water gap may generate another species. The close similarity of the two allopatric Jamaican species, *I. reggae* and *I. xera*, suggests that speciation can occur within individual Caribbean islands; geologic evidence indicates that Jamaica has been intact and reasonably isolated from other islands following a period (40–20 Ma) of submergence (Buskirk, 1985). This same geologic evidence also suggests that the ancestor of this species pair reached Jamaica by dispersal across water.

The mode and time of origin of the Greater Antilles clade are unclear. The key geologic event, emergence of the Greater Antilles, is thought to have occurred at about 80 Ma (Donnelly, 1988). How did the ancestor reach these emerging islands? Perhaps it arrived directly from South America over land connections, which some geologic evidence suggests may have existed when the Greater Antilles emerged (Donnelly, 1988). Area cladogram A (fig. 24), which requires that the Greater Antilles clade originated after Africa separated from South America, and therefore long after North America and incipient Central America had separated from South America at about 170 Ma (Donnelly, 1988), is consistent with this scenario. The existence of a Central American species (*I. digitata*) in the sister clade of the Greater Antilles clade, however, points also to a possible origin of this clade indirectly from South America by way of a land route that may have linked northwestern South America to the emerging Greater Antilles via a Central American connection in the early Tertiary (Donnelly, 1988). Area cladogram B (fig. 25), which requires that the Greater Antilles clade originated before Africa and South America separated, suggests that the ancestor was present on continental fragments formed even earlier when North and South America separated, fragments that eventually contributed to Central America and the Greater Antilles (Donnelly, 1988).

The *Ischnothelus goloboffi* clade (clade 11 in

fig. 24 and clade 9 in fig. 25) includes three very widespread allopatric (parapatric?) sister species (*I. caudata*, *I. guianensis*, and *I. annulata*) that evidently arose in South America. Perhaps these very successful species have such similar niche requirements that they cannot coexist in sympatry. Presumably, *I. caudata*, like many other South American organisms (Raven and Axelrod, 1975; Marshall et al., 1982), extended its range north into Central America after the emergence of the Panamanian land bridge 3–5 Ma.

Because few specimens of *Indothele* species and *Lathrothele catamita* were available for study, and especially since the males of three of these species are unknown, the relationships and therefore biogeographic history within the Old World ischnotheline clade are less well known than for *Ischnothelus*. Although the cladistic analysis indicates a close relationship between *L. catamita*, from the west African islands of São Tome and Príncipe, and mainland *L. jezequelei* (map 4), the distinctive spermathecal morphology of the former suggests that its lineage has long been separate from that of any mainland *Lathrothele* lineage. This hypothesis is consistent with the occurrence of many other endemic animal and plant species on these relatively old volcanic islands, which have apparently long been isolated from the mainland (Brown, 1967). *Indothele lanka*, from Sri Lanka (map 5), is another island endemic distinctly different in spermathecal form from its sister group on the Indian mainland.

I suspect, as the cladograms suggest, that the species of *Thelechoris* on Madagascar, *T. rutenbergi*, was relatively recently derived from the African species, *T. striatipes*, by dispersal across the considerable water gap between Africa and Madagascar. The extreme similarity of these species and the long age of separation of these two plates, probably 150 Ma (Rabinowitz et al., 1983), rules out a vicariant explanation. The population of *T. striatipes* on Nossi Bé, just offshore of Madagascar (map 4), is presumably the result of an even more recent dispersal, perhaps by boat.

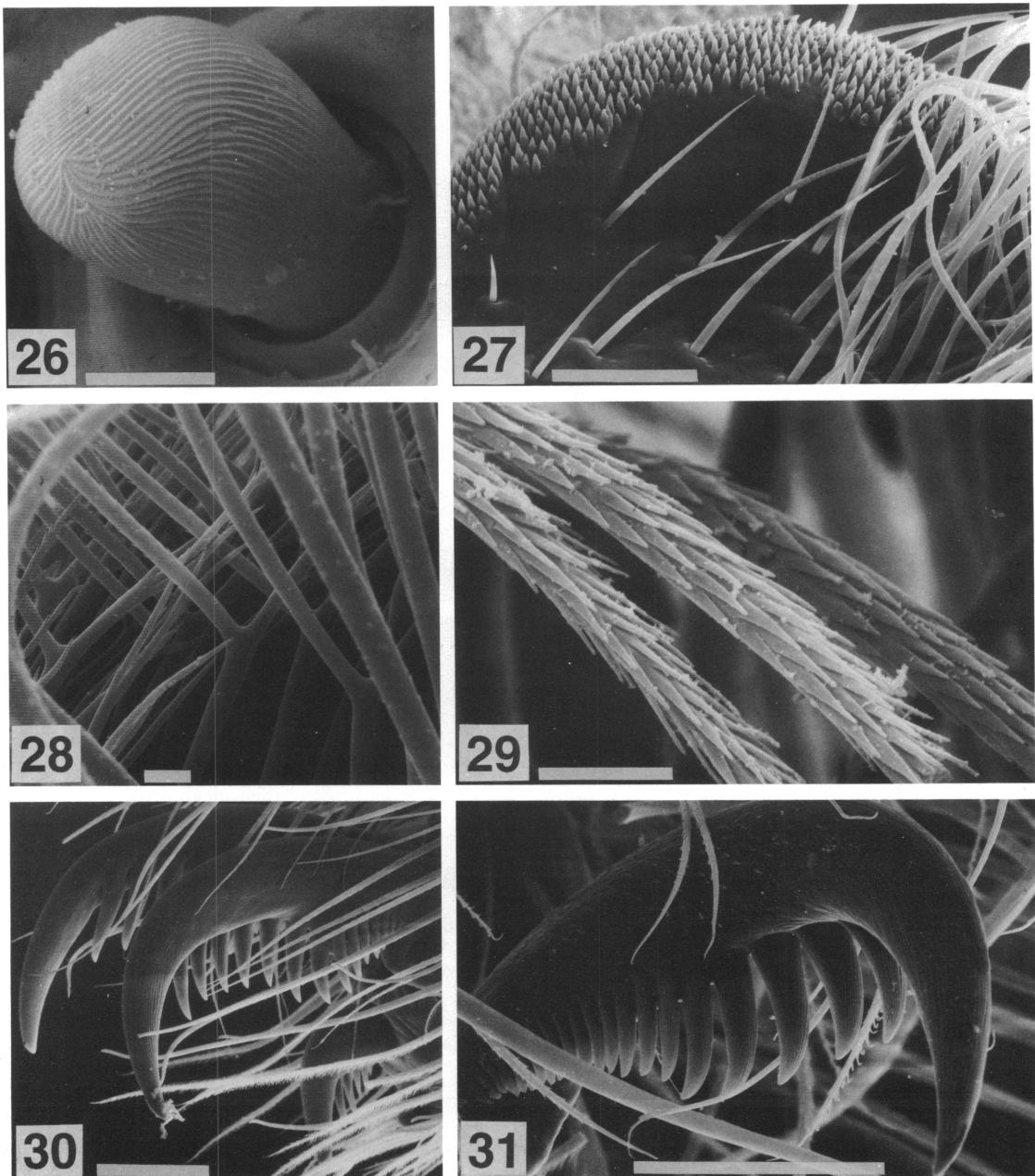
## ISCHNOTHELINAE F. O. P.-CAMBRIDGE

Ischnothelinae F. O. P.-Cambridge, 1897: 36. — Bonnet, 1957: 2308. — Raven, 1980: 251; 1981: 225; 1983a: 346; 1983b: 552; 1984: 4; 1985a: 76; 1985b: 15.

**DIAGNOSIS:** Ischnothelines differ from all other diplurids in having an elongate cymbial apophysis (figs. 60, 147), two rows of cheliceral teeth (fig. 122), and a clearly procurved transverse fovea (figs. 153, 250). Collariform trichobothrial bases (figs. 43–46), fused silk spigots (figs. 48–52), and elongate, tapering, pseudosegmented apical PLS articles (figs. 154, 251) also distinguish ischnothelines from most other diplurids (for exceptions see discussion of ischnotheline monophyly in “Relationships” section).

**DESCRIPTION:** Body size small to medium (CL = 2.2–9.2) (figs. 153, 154, 250, 251, 283, 284, 341, 342, 415, 416). Pars cephalica usually elevated slightly to moderately, but occasionally not at all, above pars thoracica; pars thoracica slopes downward to posterior margin. Fovea a deep procurved transverse groove. One pair (occasionally more) of elongate, erect foveal bristles (just in front of fovea). Eight eyes forming compact quadrangle, 1.7–2.5 times wider than long, and elevated on ocular prominence; anterior eye row straight or slightly procurved; posterior row straight or slightly recurved; central part of ocular prominence projects forward in front of ALEs, sometimes beyond anterior edge of carapace. Sternum width about 80–100% of length (figs. 155, 417); posterior three pairs of sigilla marginal, small, and circular to oval; pair of labiosternal sigilla larger. Labium much wider than long, steeply inclined from plane of sternum, and without cuspules. Chelicerae with two subequal rows of teeth (fig. 122); usually a few or more denticles along prolateral side of proximal half of retrolateral row; no rastellum; many long down-curved bristles on dorsal and frontal surfaces of chelicerae. Maxillae ventrally with many (22–258) cuspules concentrated in proximal-medial quadrant (figs. 26, 155, 417); maxillary lobe short and approximately triangular; serrula of sharp conical teeth in a broad band that tapers at both ends (fig. 27). Prolateral

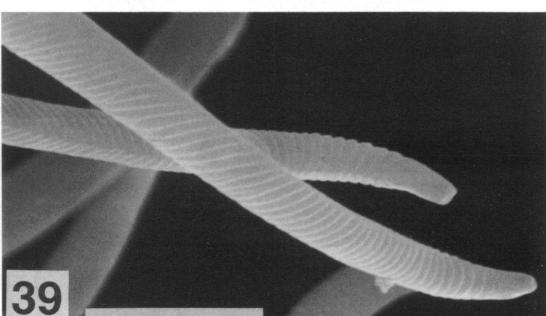
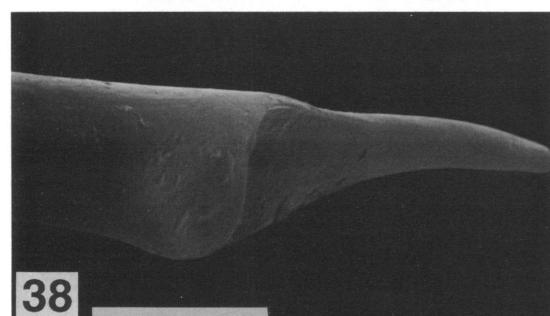
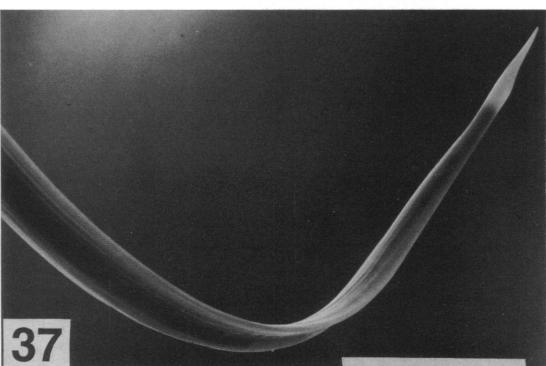
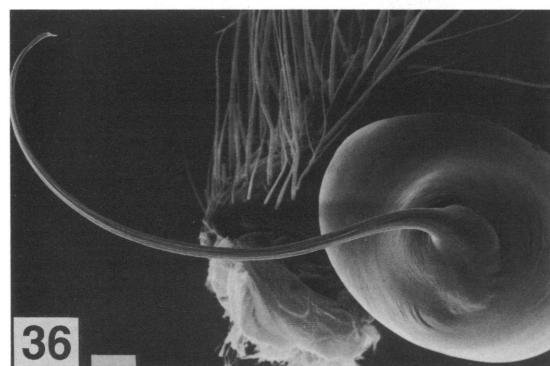
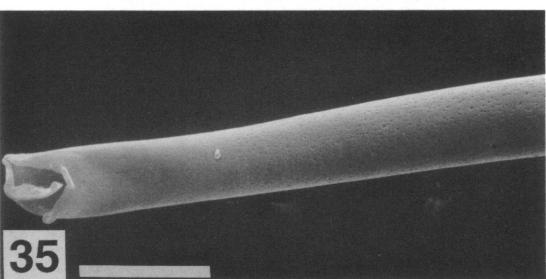
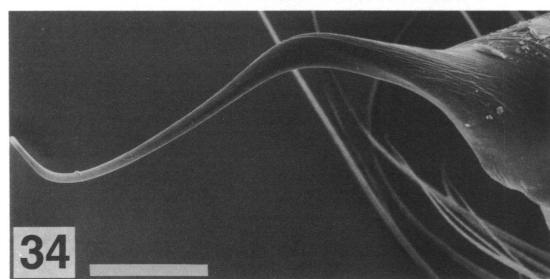
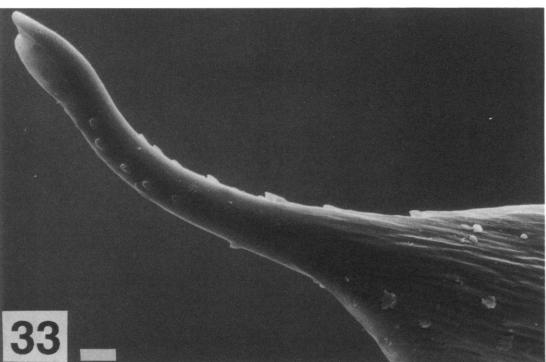
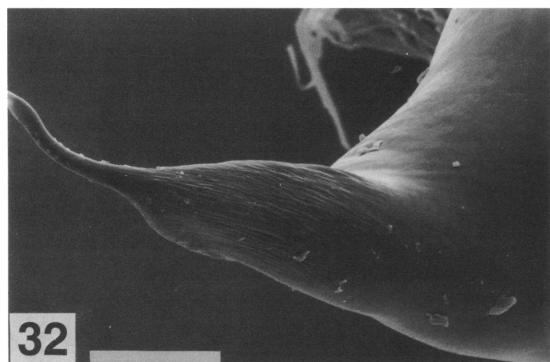
face of maxillae with long flexible hairs covered with long microspines distally (fig. 29); hairs in center of field typically bifurcate (fig. 28). Palpal tarsi of female with 5–27 spines on ventral aspect of prolateral and retrolateral surface; claw with single row of few to many teeth. Male palpal tibia generally swollen, varies from semicylindrical to prominent ventral swelling proximally (figs. 60, 95, 182, 312). Cymbial apophysis at least slightly longer than rest of cymbium (figs. 60, 95, 312); 0–24 spines on prolateral and retrolateral surfaces; apophysis tip with chemoreceptor (?) hairs (fig. 39) and with or without stout bristles. Palpal bulb more or less pyriform (figs. 61, 96, 119, 279, 378); embolus short to long, with or without pores near tip (figs. 32–38). Leg tarsi with three claws (figs. 30, 31); single row of many teeth on each superior claw; row of few to several teeth on inferior claw. Female tarsi integral; male tarsi integral or pseudosegmented. Female tarsus I with 0–17 spines on ventral aspect of prolateral and retrolateral surface; male tarsus I with 0–38 prolateral spines, 0–5 retrolateral spines (figs. 112, 113). Male tarsi sparsely scopulate; female tarsi with only a few scopular hairs. Tarsal organ a low mound with concentric ridges surrounding a central depression with a small protrusion in its center (figs. 40–42). No metatarsal preening combs. Two slightly diagonal rows of trichobothria dorsally and proximally on each tibia, single longer row dorsally on each metatarsus and tarsus; trichobothrium bases collariform (with crescent-shaped hood) (figs. 43–46). Male leg I usually with distal ventral tibial apophysis and ventral metatarsal process that together function as mating clasper (figs. 90, 226). Four spinnerets (figs. 153, 154, 324); median pair relatively short, slender, and unsegmented; lateral pair much longer than carapace. Proximal and middle articles of lateral spinnerets subequal; apical article tapered, pseudosegmented, flexible, and 1–1.8 times combined length of first two articles. Only one type of spigot on all spinnerets (figs. 48–55); base inflated, sometimes wrinkled; shaft usually fused to base with only a very shallow groove between the two parts; shaft long, slender,



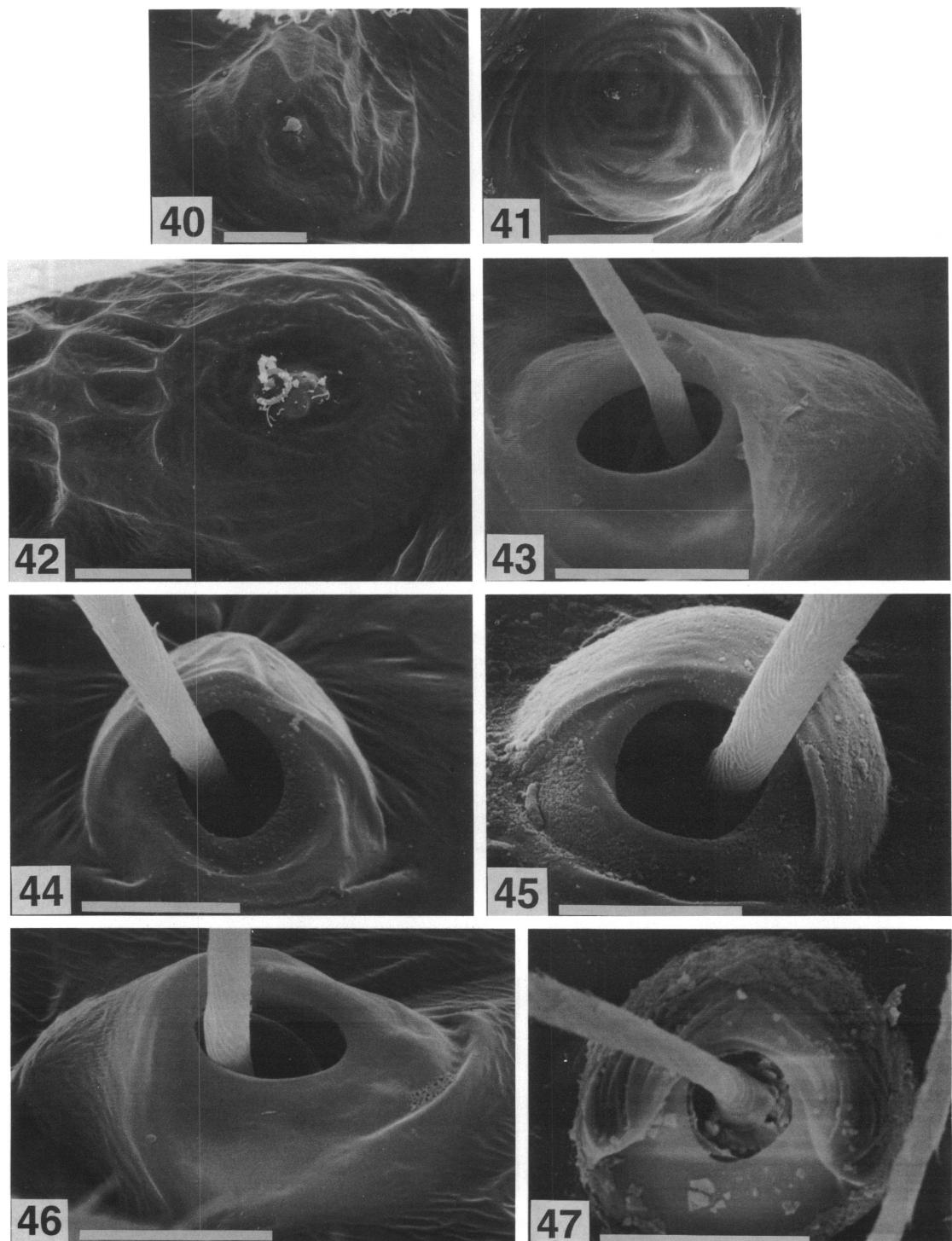
Figs. 26–31. SEM views of *Ischnothelidae* and *Thelechoris*. 26. Maxillary cuspule of *I. reggae* female (scale bar 10  $\mu\text{m}$ ). 27. Serrula of *I. guianensis* female (scale bar 100  $\mu\text{m}$ ). 28, 29. Maxillary hairs of *I. reggae* female (scale bars 10  $\mu\text{m}$ ). 28. Proximal portions. 29. Distal portions. 30, 31. Female leg I tarsal claws (scale bars 100  $\mu\text{m}$ ). 30. *I. reggae*, all claws. 31. *T. striatipes*, superior (lateral) claw.

and gently curved distally, with surface of overlapping scalelike folds sculpted with parallel longitudinal folds. Thin setae often on

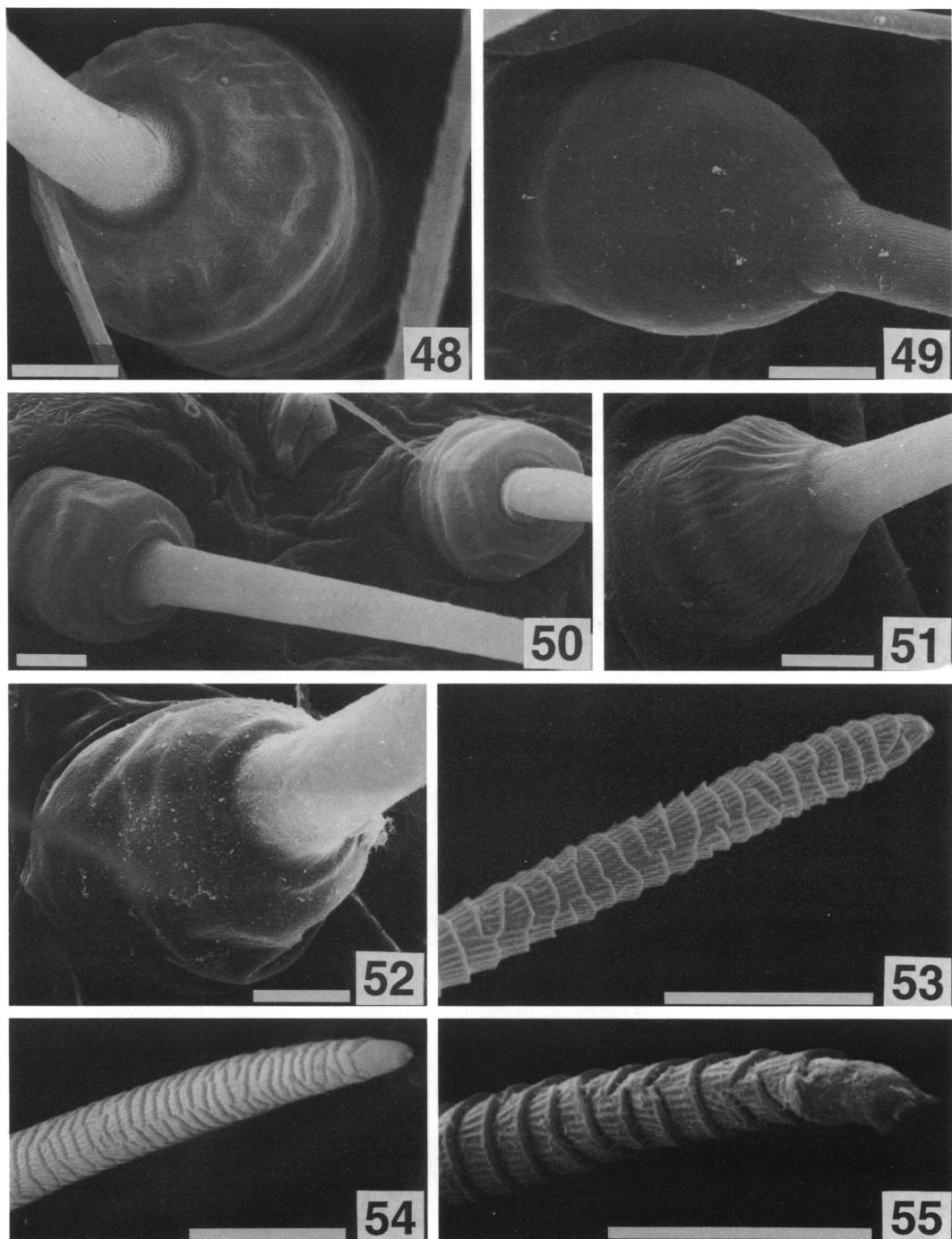
wall (especially dorsal) of bursa copulatrix (figs. 329, 335). Spermathecae usually paired (two on each side), but sometimes three or



Figs. 32-39. SEM views of *Ischnothelae* and *Thelechoris*. 32-38. Embolus. 32, 33. *I. xera*. 34. *I. caudata*. 35. *I. annulata*, tip. 36-38. *T. striatipes*; three views including tip. 39. Chemoreceptor (?) hairs at tip of cymbial apophysis of *T. striatipes*. Scale bars: 100  $\mu\text{m}$  for figs. 32, 34, 36, 37; 10  $\mu\text{m}$  for figs. 33, 35, 38, 39.



Figs. 40-47. SEM views. 40-42. Tarsal organ on leg I of female. 40. *Ischnothel guianensis*. 41. *Lathrothele grabensis*. 42. *Thelechoris striatipes*. 43-47. Trichobothrium bases on tarsus I of female. 43. *Ischnothel reggae*. 44. *I. guianensis*. 45. *L. grabensis*. 46. *T. striatipes*. 47. *Microhexura montivaga*. All scale bars 10  $\mu$ m.



Figs. 48-55. SEM views of spigots on posterior lateral spinnerets of female. 48-52. Spigot bases. 48. *Ischnothele reggae*. 49. *Ischnothele guianensis*. 50. *Andethene huanca*. 51. *Lathrothele grabensis*. 52. *Thelechoris striatipes*. 53-55. Spigot tips. 53. *I. reggae*. 54. *L. grabensis*. 55. *T. striatipes*. All scale bars 10 µm.

more per side or rarely only one per side (figs. 72, 81, 102, 123, 233, 335).

**GENERA INCLUDED:** *Ischnothele*, *Andethele*, *Lathrothele*, *Indothele*, and *Thelechoris*.

**DISTRIBUTION:** Antilles and Central America (*Ischnothele*), South America (*Ischnothele*, *Andethele*), Africa (*Lathrothele*, *Thelechoris*), Madagascar (*Thelechoris*), and India and Sri Lanka (*Indothele*) (fig. 23).

**MISPLACED SPECIES:** Mello-Leitão (1923) transferred the Brazilian species *Macrothele annectens* Bertkau (1880) to *Ischnothele*. Two character states described by Bertkau (only one row of cheliceral teeth and two rows of teeth on the lateral tarsal claws) clearly show that it is not an ischnotheline.

*Ischnothele simplicata* Saito (1933), described from Formosa, was later transferred to *Macrothele* (Platnick, 1993). The type specimen was lost during World War II (T. Yaginuma, personal commun.), but two character states described by Saito (1933) confirm that the specimen was not an ischnotheline; there was only one row of cheliceral teeth and the apical article of the posterior lateral spinnerets was much shorter than the combined length of the first two articles.

*Ischnothele strandi* Spassky (1937), from south central Asia, was reported to lack maxillary cuspules and therefore is clearly not an ischnotheline. This species is apparently a junior synonym of the diplurid, *Phyioschae-ma raddei* Simon (Kharitonov, 1969; Platnick, 1989).

Bonnet (1957) transferred the Venezuelan species *Schismatothele lineata* Karsch (1879) to *Ischnothele* without comment. Raven (1985a) examined the type and transferred it to the theraphosid genus *Holothele* Karsch (1879). The type, which I also examined, is obviously not a diplurid; the lateral spinnerets are short and claw tufts and scopulae are present on all tarsi.

The following three character states described and/or illustrated by Tikader (1968) clearly show that *Ischnothele indicola* Tikader from India is not an ischnotheline: (1) only one row of cheliceral teeth, (2) posterior lateral spinnerets shorter than the carapace, and (3) no cymbial apophysis.

Wunderlich (1988) tentatively identified a fossil Hispaniolan spider from Dominican

amber as a juvenile female *Ischnothele*. Apparently no important diagnostic ischnotheline characters were observable, so his description revealed no character states that would allow either acceptance or rejection of his identification. However, Wunderlich's drawings (figs. 8, 9) reveal that the carapace and the palpal claw are both much more elongate than those of any known ischnothelines.

*Thelechoris australis* Purcell (1903) is a species of *Allothele* (Coyle, 1984).

#### KEY TO GENERA AND SPECIES OF THE SUBFAMILY ISCHNOTHELINAE

##### Males

1. Spines present on tibia I mating apophysis (figs. 56, 75, 90) ..... 2 (*Ischnothele*)  
No spines on tibia I mating apophysis (figs. 226, 280, 374) ..... 10
2. Longitudinal ventral keel at distal end of metatarsus I (figs. 56, 57, 75, 76); 2 spines on prolateral surface of palpal patella; no bristles or spines on tip of cymbial apophysis; tarsus I long [ITarL(100)/CL = 46–77]; bulb broad and embolus short [PL(100)/BD = 150–183] (figs. 61, 79, 86, 88) ..... 3  
No distal ventral keel on metatarsus I; no spines on prolateral surface of palpal patella; strong bristles on tip of cymbial apophysis (figs. 95, 118); tarsus not as long [ITarL(100)/CL = 29–43]; palpal organ more elongate [PL(100)/BD = 195–291] (figs. 96, 119) ..... 6
3. 2 truncate broad-tipped spines on prolateral surface of palpal patella (fig. 63); embolus with 1 or 2 thin keels and no serrations (figs. 61, 79) ..... 4  
2 slender-tipped spines on prolateral surface of palpal patella; embolus with serrations and without thin keel (figs. 86, 88) ..... 5
4. 2 keels on embolus; embolus tip short, conical, and with a relatively large opening (figs. 61, 62); tibia I mating apophysis spines not extremely short (figs. 58, 59) .....  
..... *Ischnothele longicauda*  
1 keel on embolus; embolus tip long, curved, and tapered to a sharp point (fig. 79); tibia I mating apophysis spines extremely short (fig. 77) ..... *Ischnothele jeremie*
5. Tibia I mating apophysis short and wide [TAW(100)/TAL = 116–242] (fig. 13 in Coyle and Meigs, 1990); 0 or 1 spine on

- prolateral surface of tarsus I; both spines on prolateral surface of palpal patella are slender and taper gradually (fig. 25 in Coyle and Meigs, 1990) ..... *Ischnothele reggae*
- Tibia I mating apophysis long and narrow [TAW(100)/TAL = 45–64] (figs. 15, 17 in Coyle and Meigs, 1990); 2 or 3 spines on prolateral surface of tarsus I; at least the proximal spine on prolateral surface of palpal patella is especially stout and tapers suddenly to an extremely thin deciduous tip (fig. 26 in Coyle and Meigs, 1990) ..... *Ischnothele xera*
6. Palpal tibia with moderate proximal ventral swelling with a flat profile (fig. 95) [PTT(100)/PTL = 42–46]; tibia I mating apophysis relatively broad and its dorsal profile especially short (figs. 90–93) [TAW(100)/TAL = 364–567] ..... *Ischnothele digitata*
- Palpal tibia with large, rounded, ventral swelling proximally (figs. 118, 120) [PTT(100)/PTL = 50–78]; tibia I mating apophysis proportionally narrower and dorsal profile longer (figs. 114, 180) [TAW(100)/TAL = 62–262] ..... 7
7. Only 2–4 spines on prolateral surface of tarsus I (fig. 219); embolus base narrows gradually (fig. 222); palpal organ elongate [PL(100)/BD = 261–264] ..... *Ischnothele goloboffi*
- Many (4–38) spines on prolateral surface of tarsus I (figs. 113, 141); embolus base narrows rapidly (figs. 119, 148, 183–186); palpal organ rarely as elongate [PL(100)/BD = 195–267] ..... 8
8. Cymbial apophysis proportionally short (fig. 118); metatarsus I keel relatively far from proximal end of metatarsus (fig. 112) [CYAL(100)/MKD = 60–79; CYAL(100)/CL = 17–23] ..... *Ischnothele caudata*
- Cymbial apophysis proportionally long (fig. 147); metatarsus I keel relatively close to proximal end of metatarsus (fig. 141) [CYAL(100)/MKD = 78–119; CYAL(100)/CL = 20–30] ..... 9
9. Tibia I mating apophysis relatively long (figs. 142–146); metatarsus I keel relatively close to proximal end of metatarsus (fig. 140); AMEs relatively large; ventral swelling of palpal tibia moderately strong (fig. 147) [TAL2(100)/MKD = 40–49; TAL2(100)/PTT = 44–56; AMD(100)/MKD = 18–22] ..... *Ischnothele guianensis*
- Tibia I mating apophysis relatively short (figs. 178–181); metatarsus I keel relatively far from proximal end of metatarsus (fig. 177); AMEs relatively small; ventral swelling of palpal tibia very strong (fig. 182) ..... [TAL2(100)/MKD = 27–39; TAL2(100)/PTT = 31–43; AMD(100)/MKD = 13–18] ..... *Ischnothele annulata*
10. Tibia I mating apophysis consists of a distal semiquadratus and a subdistal pointed protuberance (figs. 226, 241, 265); metatarsus I proportionally short [IML(100)/CL = 43–46] (fig. 226); metatarsus I with long, double, ventral keel in middle of article (fig. 227) ..... 11 (*Andethele*)
- Tibia I mating apophysis single and tapering to a point (figs. 280, 320); metatarsus I not especially short [IML(100)/CL = 49–74]; metatarsus I ventral keel not double or, if double, is proximal (figs. 281, 309) ..... 13
11. Palpal tibia elongate [PTT(100)/PTL = 39–42] (fig. 232); cymbial apophysis proportionally short [CYAL(100)/CL = 17–19; CYAL(100)/PTL = 46–50]; embolus base inflated (fig. 231) ..... *Andethele lucma*
- Palpal tibia relatively short and thick [PTT(100)/PTL = 47–56] (figs. 248, 269); cymbial apophysis not as short [CYAL(100)/CL = 22–24; CYAL(100)/PTL = 63–69]; embolus base not inflated (figs. 249, 270) ..... 12
12. Metatarsus I proportionally thick [IMD(100)/IML = 37–39] (fig. 241); dorsal shoulder of distal process of tibia I mating apophysis gently rounded (figs. 244–247); subdistal process of tibia I mating apophysis reduced ..... *Andethele huanca*
- Metatarsus I not so thick [IMD(100)/IML = 34] (fig. 265); dorsal shoulder of distal process of tibia I mating apophysis a sharp corner (figs. 267, 268); subdistal process of tibia I mating apophysis larger ..... *Andethele tarma*
13. Palpal bulb large (BD = 0.67–0.96) and narrows very abruptly at base of embolus (figs. 36, 378, 379); embolus flattened and with sharp tip projecting beyond opening (figs. 37, 38, 380) ..... 14 (*Thelechoris*)
- Palpal bulb small (BD = 0.22–0.43) and narrows gradually to embolus (figs. 311, 351); embolus not noticeably flattened and with no extension at tip beyond opening ..... 15
14. Palpal and leg I tibiae relatively thin and leg I articles relatively long [PTT(100)/IML = 18.5–19.4; ITT(100)/IML = 19.8–21.0] ..... *Thelechoris rutenbergi*
- Palpal and leg I tibiae relatively thicker and leg I articles relatively shorter [PTT(100)/IML = 20.6–26.0; ITT(100)/IML = 20.9–25.7] ..... *Thelechoris striatipes*
15. Metatarsus I mating apophysis either absent or single, long, and in middle of article (figs. 347–349) [MAD(100)/IML = 52; PL(100)/

- BD = 240–285]; India or Sri Lanka ..... 16 (*Indothele*)
- Metatarsus I mating apophysis either double (figs. 281, 309) or single and proximal (fig. 320) [MAD(100)/IML = 36–43; PL(100)/BD = 277–483]; Africa .. 17 (*Lathrothele*)
16. Metatarsus I without keel (fig. 336); relatively long legs [IML(100)/CL = 63–69]; elongate palpal tibia (fig. 339) [PTT(100)/PTL = 37–38]; Sri Lanka ..... *Indothele lanka*
- Metatarsus I with keel (fig. 347); legs proportionally shorter [IML(100)/CL = 53]; relatively thick palpal tibia (fig. 350) [PTT(100)/PTL = 55]; India ..... *Indothele dumicola*
17. Metatarsus I with one small mating keel (fig. 320); tibia I mating apophysis small and with tip curved upward (fig. 320) (TAL = 0.26–0.28) ..... *Lathrothele jezequelii*
- Metatarsus I with large double mating keel (figs. 281, 309); tibia I mating apophysis large and tip not bent (figs. 280, 310) (TAL = 0.50–0.83) ..... 18
18. Tibia I relatively thin proximally and with prominent dorsal hump distally (fig. 310); palpal tibia relatively long [PTT(100)/PTL = 36–39] (fig. 312) ..... *Lathrothele cavernicola*
- Tibia I as thick proximally as distally (fig. 280); palpal tibia relatively shorter and thicker [PTT(100)/PTL = 38–50] (fig. 278) ..... *Lathrothele grabensis*
- Females
- 2 spermathecae on each side with long coiled stalks (figs. 386, 387, 427–436); carapace and sternum relatively broad [SW(100)/SL = 92–104] ..... 2 (*Thelechoris*)
  - Never with 2 spermathecae on each side both having long and coiled stalks; carapace and sternum rarely relatively broad [SW(100)/SL = 78–96] ..... 3
  - OQW(100)/LSL2 = 59–72; Madagascar ..... *Thelechoris rutenbergi*  
OQW(100)/LSL2 = 69–95; Africa and Nossi Bé ..... *Thelechoris striatipes*
  - Proportionally small anterior median eyes [AMD(100)/CL = 1.5–3.0]; relatively short appendages [ITL(100)/CL = 38–42; LSL3 (100)/CL = 42–73]; mountains (over 2300 m elevation) of Peru ..... 4 (*Andethele*)
  - Proportionally large anterior median eyes [AMD(100)/CL = 2.6–5.4]; relatively longer appendages [ITL(100)/CL = 40–57; LSL3(100)/CL = 65–132]; absent from high elevations of Peru ..... 6
  - Short spermathecal branch just lateral to base of lateral spermatheca (figs. 271–277) ..... *Andethele tarma*
  - No such lateral branch (figs. 233–240, 252–260) ..... 5
  - Spermathecae usually well sclerotized (figs. 234–240); median spermatheca usually lacks bulb or has a rudimentary one; retrolateral cheliceral denticles relatively numerous [CDR(100)/CL = 415–853] ..... *Andethele lucma*
  - Spermathecae usually less heavily sclerotized (figs. 252–260); median spermatheca usually has well-developed bulb; retrolateral cheliceral denticles relatively less numerous [CDR(100)/CL = 265–564] ..... *Andethele huanca*
  - Usually more than 2 spines on tarsus I (ITarS = 0–17) or 3 spermathecae per side; tropical America ..... 7 (*Ischnothelae*)
  - Rarely more than 2 spines on tarsus I (ITars = 0–5); only 1 or 2 spermathecae per side; Old World tropics ..... 17
  - 4 or more weakly sclerotized spermathecae per side (figs. 100–104); Mexico to Honduras ..... *Ischnothelae digitata*
  - 2 or 3 spermathecae per side ..... 8
  - Anterior edge of ocular lobe nearly even with anterior edge of carapace; ITarS = 0; 3 unsclerotized spermathecae (figs. 105, 106); CDR(100)/CL = 533; known only from 1 female from northern Peru ..... *Ischnothelae huambisa*
  - Anterior edge of ocular lobe behind anterior edge of carapace; ITarS almost never less than 2; some spermathecae at least weakly sclerotized; CDR(100)/CL = 0–536 ..... 9
  - Carapace edge setae relatively long [CS(100)/CW = 10.9–20.0]; spermathecal stalks straight to sinuous but not coiled (figs. 64–72, 82, 85, 87, 89); usually 3 (occasionally 2) spermathecae per side; Greater Antilles ..... 10
  - Carapace edge setae relatively short [CS(100)/CW = 4.0–12.3]; 1 or both spermathecal stalks on each side coiled (figs. 125, 163, 223); only 2 spermathecae per side; Central or South America ..... 14
  - Spermathecal bulbs unsclerotized; spermathecal stalks moderately long (figs. 64–72, 82, 85) ..... 11
  - Spermathecal bulbs moderately to heavily sclerotized; spermathecal stalks very short or vestigial (figs. 87, 89); Jamaica ..... 13
  - The 2 primary (median) spermathecae with short stalks emerging from a common heavily sclerotized trunk (figs. 64–72); Cuba and Andros Island ..... *Ischnothelae longicauda*

- Spermathecal stalks moderately long and do not share a common trunk (figs. 82, 85); Hispaniola ..... 12
12. 3 spermathecae per side; stalks emerge from unsclerotized base (figs. 81, 82); 1 pair foveal bristles; many retrolateral cheliceral denticles ( $CDR = 20$ ) ..... *Ischnothele jeremie*  
2 spermathecae per side; stalks emerge from heavily sclerotized base with a median shoulderlike sclerotized protuberance at base of median stalk (figs. 84, 85); fewer retrolateral cheliceral denticles ( $CDR = 5-8$ ) ..... *Ischnothele garcia*
13.  $OQW(100)/LSL3 = 23-32$ ; 9-12 retrolateral cheliceral teeth; dorsal coloration dark (fig. 4 in Coyle and Meigs, 1990) ..... *Ischnothele reggae*  
 $OQW(100)/LSL3 = 18-24$ ; 7-9 retrolateral cheliceral teeth; dorsal coloration usually lighter (fig. 6 in Coyle and Meigs, 1990) .. *Ischnothele xera*
14. Stalk of median spermatheca sinuous to looped (figs. 223-225); relatively long legs [ $ITL(100)/CL = 47-50$ ] ..... *Ischnothele goloboffi*  
Stalk of median spermatheca straight to bent (figs. 123-133, 160-171, 187-199); proportionally shorter legs [ $ITL(100)/CL = 40-49$ ] ..... 15
15. Median shoulder at base of lateral spermatheca (figs. 123-133); median spermatheca relatively short and bulb of lateral spermatheca relatively broad ( $MH/LBD = 1.09-1.83$ ) ..... *Ischnothele caudata*  
No median shoulder at base of lateral spermatheca (figs. 160-171, 187-199); median spermatheca relatively long and bulb of lateral spermatheca relatively narrow ( $MH/LBD = 1.75-3.00$ ) ..... 16
16. Proportionally large anterior median eyes [ $AMD(100)/CL = 3.6-4.9$ ] and ocular quadrangle [ $OQW(100)/CL = 24-29$ ] ..... *Ischnothele guianensis*  
Proportionally smaller anterior median eyes [ $AMD(100)/CL = 2.6-3.7$ ] and ocular quadrangle [ $OQW(100)/CL = 19-25$ ] ..... *Ischnothele annulata*
17. Low number of retrolateral cheliceral denticles ( $CDR = 3-11$ ) [ $CDR(100)/CL = 55-332$ ]; base of spermathecal stalk upturned dorsally to form a lip (figs. 343-345, 355-358, 362-365, 369, 370); India or Sri Lanka ..... 18 (*Indothele*)  
High number of retrolateral cheliceral denticles ( $CDR = 12-62$ ) [ $CDR(100)/CL = 476-1576$ ]; base of spermathecal stalk not upturned dorsally to form a lip (figs. 287-302,
- 313-316, 325-327, 331-335); Africa ..... 21 (*Lathrothele*)
18. Spermathecal stalks long and well sclerotized (figs. 343-346); relatively long carapace edge setae [ $CS(100)/CW = 16.4-20.9$ ] (fig. 341); proportionally wide ocular quadrangle [ $OQW(100)/CL = 28$ ]; Sri Lanka ..... *Indothele lanka*  
Spermathecal stalks short and lightly sclerotized or unsclerotized (figs. 355-358, 362-365, 369, 370); relatively shorter carapace edge setae [ $CS(100)/CW = 10.5-14.5$ ] (fig. 361); proportionally narrower ocular quadrangle [ $OQW(100)/CL = 25-27$ ]; India .. ..... 19
19. Median spermatheca longer and its bulb wider than lateral spermatheca (figs. 362-366); proportionally longer leg I [ $ITL(100)/CL = 47-52$ ]; relatively low number of retrolateral cheliceral denticles [ $CDR(100)/CL = 55-182$ ] ..... *Indothele rothi*  
Median spermatheca about same length and width as lateral spermatheca (figs. 355-359, 369, 370); proportionally shorter leg I [ $ITL(100)/CL = 42-45$ ]; relatively high number of retrolateral cheliceral denticles [ $CDR(100)/CL = 202-333$ ] ..... 20
20. Spermathecae very short, wide, weakly sclerotized, and pocketlike (figs. 369, 370); anterior median eyes relatively large [ $AMD(100)/CL = 4.2-4.5$ ] ..... *Indothele mala*  
Spermathecae with longer stalks that are narrower than the bulbs (figs. 355-359); anterior median eyes proportionally smaller [ $AMD(100)/CL = 3.3-3.9$ ] ..... *Indothele dumicola*
21. Only 1 spermatheca per side, consisting of broad heavily sclerotized chamber at end of long thin-walled unsclerotized stalk (figs. 331-335);  $CDR/MC = 1.1-1.5$ ;  $LSL3(100)/CL = 100-130$ ; São Tomé and Príncipe .. ..... *Lathrothele catamita*  
2 spermathecae per side, without broad, sclerotized terminal chambers (figs. 287-302, 313-316, 325-327);  $CDR/MC = 0.2-0.7$ ;  $LSL3(100)/CL = 65-100$ ; mainland Africa ..... 22
22. Right and left pair of spermathecae far apart (fig. 329); large genital plate extends back to posterior book lungs (fig. 324); small body ( $CL = 2.2-3.0$ ) ..... *Lathrothele jezequelii*  
Right and left pair of spermathecae close together (figs. 290, 298, 316); genital plate does not extend back to posterior book lungs; larger body ( $CL = 3.0-6.3$ ) ..... 23
23. Relatively large number of retrolateral cheliceral denticles [ $CDR(100)/CL = 1001-1258$ ];

off-white abdominal chevrons prominent in alcohol (fig. 317) . . . . .		denticles [CDR(100)/CL = 476–853]; off- white abdominal chevrons absent or faint in alcohol (fig. 283) . . . . .
..... <i>Lathrothele cavernicola</i>		
Proportionally fewer retrolateral cheliceral		..... <i>Lathrothele grabensis</i>

TABLE 5  
Quantitative Character Values for Adult Males of Ischnotheline Species

(Character abbreviations are defined in Methods section of text. Range, mean, and standard deviation given. \*Values of each ratio character have been multiplied by 100. \*\*EL for *Thelechoris* only.)

	N	TAS	TSP	TSR	CAS	CL	CW	AMD	AMS
<i>Ischnothelinae</i>									
<i>longicauda</i>	2	3-8	2	1-4	0	5.51-5.74	4.93-5.12	0.24-0.25	0.12-0.13
<i>jeremie</i>	1	3			0	4.35	3.85		
<i>reggae</i>	7	6-9 7.6±1.4	0-1 0.1±0.4	1-2 1.9±0.4	0	3.47-4.08 3.69±0.19	3.20-3.77 3.37±0.19	0.19-0.23 0.21±0.02	0.11-0.19 0.14±0.03
<i>xera</i>	4	4-7 5.5±1.3	2-3 2.5±0.6	2 2.0±0.0	0-2 1.5±0.9	3.54-4.20 3.86±0.37	3.12-3.73 3.43±0.33	0.17-0.19 0.18±0.01	0.10-0.15 0.13±0.02
<i>digitata</i>	15	5-12 9.1±1.6	0-3 1.9±0.7	2-4 2.2±0.6	3-9 6.1±1.1	4.43-6.54 5.43±0.58	4.04-5.74 4.84±0.54	0.20-0.30 0.25±0.03	0.09-0.33 0.18±0.06
<i>caudata</i>	57	3-6 4.2±0.6	4-29 18.5±5.1	1-4 2.3±0.7	2-5 2.8±0.7	2.35-4.47 3.35±0.48	2.08-4.08 2.95±0.43	0.11-0.18 0.15±0.02	0.05-0.19 0.11±0.02
<i>guianensis</i>	43	3-7 4.9±0.9	11-29 21.9±5.1	2-5 2.3±0.6	1-5 2.8±0.8	2.31-5.58 4.31±0.84	2.08-5.00 3.85±0.74	0.13-0.27 0.20±0.03	0.08-0.20 0.15±0.03
<i>annulata</i>	44	3-8 4.9±1.0	10-38 26.5±6.1	2-5 2.5±0.8	2-7 3.6±1.2	3.04-6.70 4.76±0.82	2.66-5.85 4.16±0.74	0.14-0.25 0.19±0.03	0.11-0.31 0.16±0.03
<i>goloboffi</i>	3	5-7 6.0	2-4 3.0	2-3 2.7	3-4 3.7	4.00-4.39 4.18	3.66-3.93 3.80	0.19 0.19	0.09-0.11 0.11
<i>Andethelinae</i>									
<i>lucma</i>	4	0	1-3 2.0±0.8	2	3-4 3.8±0.4	4.04-4.35 4.19±0.17	3.35-3.70 3.51±0.17	0.07-0.12 0.10±0.03	0.08-0.12 0.10±0.02
<i>huanca</i>	10	0	0-2 1.3±0.7	1-2 1.8±0.4	3-4 3.7±0.5	3.54-3.97 3.76±0.14	3.04-3.39 3.21±0.12	0.08-0.11 0.09±0.01	0.08-0.12 0.10±0.01
<i>tarma</i>	2	0	1-2	2-3	3-4	3.93-4.00	3.39-3.43	0.07-0.08	0.10-0.12
<i>Lathrothelinae</i>									
<i>grabensis</i>	13	0	0-1 0.1±0.3	0-1 0.3±0.5	3-6 4.2±0.7	3.16-4.77 3.74±0.42	2.73-4.35 3.30±0.42	0.10-0.20 0.15±0.02	0.12-0.19 0.14±0.02
<i>cavernicola</i>	4	0	0	0	4-5 4.3±0.4	3.54-4.54 4.03±0.51	3.23-4.16 3.68±0.44	0.11-0.19 0.15±0.03	0.14-0.26 0.18±0.06
<i>jezequelii</i>	2	0	0	0	5-8	2.54-2.77	2.23-2.39	0.11-0.12	0.10-0.11
<i>Indothelinae</i>									
<i>lanka</i>	2	0	0	0	3-6	3.77	3.39	0.26	0.11
<i>dumicola</i>	1	0	0	0	4	3.00	2.58	0.13	0.09
<i>Thelechoris</i>									
<i>rutenbergi</i>	3	0	0	0	11-12 11.3	5.24-6.47 5.74	5.04-6.39 5.65	0.26-0.28 0.27	0.17-0.19 0.18
<i>striatipes</i>	59	0	0	0-4 0.5±0.7	6-24 12.0±2.9	4.31-7.35 5.45±0.63	4.12-7.39 5.28±0.67	0.21-0.30 0.25±0.03	0.15-0.39 0.22±0.05

TABLE 5—(Continued)

	IFL	ITL	ITT	IML	MAD	ITarL	TAL
<i>Ischnothelie</i>							
<i>longicauda</i>	4.58-5.20	3.58-4.12	1.00-1.08	3.08-4.04	1.08-1.23	2.66-3.50	0.37-0.46
<i>jeremie</i>	3.58	2.93	0.92	2.58	1.04		0.44
<i>reggae</i>	3.08-3.77 3.34±0.23	2.58-3.04 2.74±0.15	0.69-0.81 0.73±0.04	2.58-3.00 2.76±0.13	1.04-1.19 1.09±0.05	2.39-2.93 2.62±0.18	0.09-0.18 0.14±0.03
<i>xera</i>	3.16-3.70 3.44±0.30	2.46-2.93 2.71±0.21	0.62-0.85 0.74±0.10	2.66-3.04 2.82±0.20	0.92-1.16 1.04±0.11	2.16-2.89 2.57±0.33	0.26-0.41 0.35±0.07
<i>digitata</i>	3.77-5.39 4.50±0.47	2.66-3.66 3.18±0.30		2.66-3.77 3.20±0.32	1.15-1.69 1.42±0.17	1.73-2.43 2.05±0.21	0.09-0.11 0.10
<i>caudata</i>	1.81-3.40 2.52±0.35	1.33-2.39 1.80±0.23		1.42-2.65 1.95±0.26	0.68-1.24 0.92±0.12	0.89-1.48 1.13±0.13	0.11-0.29 0.19±0.03
<i>guianensis</i>	2.00-4.58 3.50±0.64	1.46-3.23 2.50±0.44		1.46-3.23 2.51±0.45	0.65-1.31 1.04±0.17	1.00-1.92 1.56±0.25	0.09-0.23 0.16±0.03
<i>annulata</i>	2.50-5.08 3.67±0.56	1.89-3.47 2.60±0.35		1.89-3.77 2.71±0.39	0.81-1.58 1.20±0.18	1.31-2.39 1.75±0.23	0.12-0.22 0.17±0.03
<i>goloboffi</i>	3.20-3.27 3.23	2.39-2.43 2.41	0.81-0.92 0.86	2.46-2.70 2.60	1.16-1.19 1.17	1.66-1.73 1.69	0.19-0.22 0.20
<i>Andethelie</i>							
<i>lucma</i>	2.89-3.15 3.04±0.11	2.11-2.33 2.21±0.11		1.74-1.96 1.86±0.09	0.93-1.00 0.95±0.04	1.22-1.41 1.32±0.08	
<i>huanca</i>	2.55-2.78 2.66±0.08	2.04-2.18 2.11±0.05		1.59-1.72 1.66±0.05	0.81-0.93 0.87±0.03	1.09-1.17 1.13±0.03	
<i>tarma</i>	2.81-2.96	2.11-2.28		1.74-1.81	0.96	1.18-1.24	
<i>Lathrothelie</i>							
<i>grabensis</i>	2.39-3.89 2.84±0.37	1.89-2.89 2.22±0.25	0.85-1.19 1.00±0.12	1.62-2.81 2.05±0.29	0.65-1.00 0.80±0.09	1.27-2.00 1.61±0.17	0.50-0.83 0.60±0.08
<i>cavemicola</i>	3.08-3.85 3.46±0.38	2.27-2.85 2.57±0.27	0.92-1.16 1.04±0.11	2.08-2.66 2.38±0.27	0.85-1.04 0.94±0.09	1.54-1.93 1.73±0.18	0.59-0.81 0.72±0.12
<i>jezequelii</i>	2.00-2.16	1.42-1.54	0.50-0.54	1.66-1.73	0.65-0.69	1.12-1.16	0.26-0.28
<i>Indothelie</i>							
<i>lanka</i>	3.47-3.58	2.70-2.77	0.58-0.62	2.39-2.62		1.66-1.77	0.50
<i>dumicola</i>	2.23	1.66	0.58	1.58	0.81	1.04	0.29
<i>Thelechoris</i>							
<i>rutenbergi</i>	4.66-5.35 4.90	3.20-3.66 3.39	0.77-0.92 0.83	3.89-4.39 4.07		1.85-2.00 1.90	0.41-0.44 0.43
<i>striatipes</i>	3.54-5.81 4.50±0.48	2.46-3.85 3.03±0.31	0.62-1.08 0.84±0.09	2.96-4.50 3.59±0.35		1.50-2.08 1.77±0.13	0.32-0.57 0.46±0.05

TABLE 5—(Continued)

	TAW	PFL	PTL	PTT	CYL	CYAL	BD
<i>Ischnothelae</i>							
<i>longicauda</i>	0.25-0.27	2.96-3.11	2.00-2.17	1.02-1.04	2.05-2.33	1.11-1.39	0.68-0.76
<i>jeremie</i>	0.17	2.29	1.59	0.67	1.63	1.00	0.52
<i>reggae</i>	0.20-0.27 0.23±0.02	2.11-2.44 2.20±0.11	1.59-1.81 1.65±0.07	0.67-0.78 0.70±0.04	1.48-1.74 1.61±0.09	0.81-1.02 0.94±0.07	0.46-0.56 0.49±0.03
<i>xera</i>	0.17-0.19 0.17±0.01	2.07-2.48 2.28±0.22	1.48-1.74 1.61±0.13	0.57-0.70 0.64±0.06	1.44-1.85 1.64±0.18	0.83-1.11 0.99±0.13	0.44-0.52 0.48±0.03
<i>digitata</i>	0.40-0.57 0.49	2.70-3.68 3.14±0.30	1.92-2.55 2.20±0.18	0.81-1.11 0.97±0.09	1.81-2.48 2.16±0.20	1.17-1.55 1.33±0.12	0.54-0.72 0.63±0.05
<i>caudata</i>	0.13-0.24 0.19±0.03	1.20-2.26 1.65±0.21	0.81-1.42 1.09±0.13	0.55-1.00 0.77±0.10	0.85-1.46 1.18±0.13	0.46-0.81 0.64±0.07	0.28-0.54 0.41±0.05
<i>guianensis</i>	0.13-0.37 0.27±0.06	1.39-3.02 2.35±0.41	1.00-2.00 1.59±0.26	0.54-1.15 0.92±0.17	1.07-2.31 1.84±0.32	0.65-1.44 1.14±0.20	0.37-0.74 0.59±0.09
<i>annulata</i>	0.16-0.37 0.26±0.05	1.76-3.44 2.53±0.38	1.28-2.18 1.67±0.22	0.81-1.61 1.10±0.16	1.33-2.68 1.90±0.28	0.78-1.59 1.13±0.17	0.46-0.87 0.61±0.08
<i>goloboffi</i>	0.30-0.32 0.31	2.18-2.26 2.22	1.44-1.52 1.48	0.81-0.85 0.83	1.59-1.65 1.61	0.91-0.96 0.94	0.52-0.54 0.52
<i>Andethele</i>							
<i>lucma</i>		2.04-2.15 2.11±0.05	1.54-1.67 1.61±0.05	0.63-0.70 0.65±0.04	1.28-1.37 1.33±0.05	0.72-0.83 0.77±0.05	0.39-0.41 0.39±0.01
<i>huanca</i>		1.68-1.85 1.77±0.06	1.26-1.37 1.30±0.04	0.59-0.69 0.64±0.03	1.30-1.43 1.36±0.04	0.83-0.89 0.87±0.02	0.41-0.46 0.44±0.02
<i>tarma</i>		1.81-1.92	1.30-1.41	0.70-0.72	1.41-1.43	0.89	0.43-0.44
<i>Lathrothele</i>							
<i>grabensis</i>	0.28-0.56 0.43±0.08	1.59-2.55 1.87±0.24	1.13-1.78 1.36±0.16	0.52-0.67 0.60±0.05	1.35-1.91 1.55±0.15	0.81-1.26 0.98±0.12	0.32-0.43 0.36±0.03
<i>cavemicola</i>	0.44-0.54 0.51±0.05	1.89-2.33 2.11±0.22	1.39-1.68 1.55±0.14	0.50-0.65 0.58±0.07	1.54-1.72 1.62±0.09	1.00-1.11 1.06±0.06	0.33-0.41 0.37±0.04
<i>jezequelii</i>	0.32-0.35	1.37-1.44	0.91-0.98	0.41-0.44	1.26-1.35	0.94-1.02	0.22-0.26
<i>Indothele</i>							
<i>lanka</i>	0.10-0.13	2.18-2.28	1.52-1.55	0.56-0.59	1.59-1.63	1.04-1.07	0.37
<i>dumicola</i>		1.54	1.02	0.56	1.06	0.65	0.37
<i>Thelechoris</i>							
<i>rutenbergi</i>		3.20-3.74 3.39	1.89-2.18 2.03	0.72-0.85 0.77	2.55-2.85 2.68	1.76-1.98 1.88	0.78-0.83 0.81
<i>striatipes</i>		2.65-4.05 3.18±0.32	1.61-2.33 1.89±0.17	0.67-1.00 0.82±0.07	2.16-3.22 2.61±0.20	1.46-2.18 1.79±0.14	0.67-0.96 0.80±0.07

TABLE 5—(Continued)

	PL(EL)**	CW/CL*	AMD/CL*	ITT/ITL*	TAW/TAL*	TAL/CL*
<i>Ischnothelie</i>						
<i>longicauda</i>	1.05-1.17	89-90	4.4	26.2-28.0	54-73	6.4-8.4
<i>jeremie</i>	0.78	89		31.6	38	10.2
<i>reggae</i>	0.78-0.93 0.84±0.05	89-93 91.3±1.1	5.1-6.4 5.6±0.5	25.4-27.9 26.5±0.8	116-242 172±54	2.7-4.9 3.8±0.9
<i>xera</i>	0.76-0.89 0.83±0.06	88-89 88.8±0.5	4.4-5.0 4.7±0.2	25.0-29.7 27.2±2.0	45-64 52±9	7.3-9.8 8.9±1.1
<i>digitata</i>	1.48-2.04 1.76±0.16	87-92 89.0±1.8	3.4-5.0 4.5±0.4		364-567 483±106	1.5-2.2 1.8±0.4
<i>caudata</i>	0.63-1.20 0.91±0.11	83-93 88.0±2.2	3.7-6.0 4.4±0.4		62-146 103±16	3.8-8.7 5.5±0.9
<i>guianensis</i>	0.76-1.70 1.36±0.25	85-92 88.9±1.5	4.1-5.6 4.8±0.3		94-262 171±39	2.5-6.9 3.7±0.8
<i>annulata</i>	1.11-2.11 1.45±0.22	81-92 87.2±2.1	3.3-4.7 4.0±0.3		106-258 155±35	2.2-4.6 3.7±0.6
<i>goloboffi</i>	1.35-1.41 1.38	90-92 90.8	4.2-4.6 4.4	33.9-38.1 35.6	133-165 151	4.4-5.5 4.9
<i>Andethelie</i>						
<i>lucma</i>	1.04-1.15 1.10±0.05	83-86 83.9±1.3	1.6-3.0 2.4±0.6			
<i>huanca</i>	0.96-1.06 1.01±0.03	82-88 85.3±1.8	2.1-2.8 2.5±0.2			
<i>tama</i>	1.04-1.07	86	1.8-2.1			
<i>Lathrothelie</i>						
<i>grabensis</i>	0.98-1.39 1.12±0.11	85-93 88.1±2.2	3.2-4.4 4.1±0.4	41-57 44.8±3.9	56-86 71.1±8.7	14.5-17.9 16.1±1.0
<i>cavemicola</i>	1.17-1.41 1.28±0.11	90-93 91.2±1.3	2.4-4.3 3.8±0.9	40-41 40.4±0.5	66-75 70.5±4.5	16.7-22.3 18.8±3.0
<i>jezequelei</i>	1.00-1.07	86-88	4.0-4.7	35	121-127	10.0-10.2
<i>Indothelie</i>						
<i>lanka</i>	1.04-1.06	90	6.9	21-22	20-26	13.2
<i>dumicola</i>	0.89	86	4.3	35		9.5
<i>Thelechoris</i>						
<i>rutenbergi</i>	1.35-1.57 1.44	96-100 98.3	4.3-5.2 4.7	24-25 24.6		6.8-8.4 7.5
<i>striatipes</i>	1.15-1.65 1.42±0.11	93-101 96.8±2.0	3.7-5.6 4.6±0.4	25-30 27.5±1.3		6.5-10.9 8.5±1.1

TABLE 5—(Continued)

	IML/CL*	MAD/IML*	IML/ITL*	ITarL/CL*	PTT/PTL*	CYAL/CL*	PL/BD*
<i>Ischnothelae</i>							
<i>longicauda</i>	54-73	31-35	86-98	46-64	48-51	19.3-25.2	154
<i>jeremie</i>	59	40	88		42	23.0	150
<i>reggae</i>	73-78 74.8±1.6	39-40 39.7±0.3	99-104 100.7±2.6	68-77 71.2±2.9	41-44 42.2±1.3	22.3-27.1 25.6±1.6	167-177 171±4
<i>xera</i>	70-75 73.2±2.2	35-38 36.8±1.6	102-108 104.0±2.7	61-70 66.5±3.9	38-41 39.6±1.4	23.5-27.2 25.7±1.6	164-183 175±9
<i>digitata</i>	57-61 59.0±1.2	42-46 44.2±1.2	99-103 100.6±1.4	35-40 37.7±1.3	42-46 44.1±1.4	22.3-26.4 24.6±1.1	263-291 280±8
<i>caudata</i>	53-66 58.2±2.5	45-52 47.3±1.6	104-113 108.6±2.1	29-38 33.8±1.9	63-78 70.5±3.4	16.6-22.7 19.2±1.3	204-239 222±9
<i>guianensis</i>	53-63 58.0±2.1	38-45 41.6±1.6	95-106 100.3±2.1	33-43 36.4±2.2	50-65 58.0±2.6	22.4-30.1 26.4±1.6	195-254 231±11
<i>annulata</i>	54-62 58.0±2.5	40-47 44.3±1.5	97-110 104.4±2.9	34-43 37.5±2.7	57-74 65.9±3.6	20.3-29.2 23.9±2.2	211-267 237±11
<i>goloboffi</i>	59-65 62.0	44-47 45.1	103-111 107.4	40-42 40.5	54-59 56.3	21.9-22.7 22.4	261-264 262
<i>Andethelae</i>							
<i>lucma</i>	43-46 44.4±1.7	47-54 51.1±2.9	82-89 84.3±3.0	30-33 31.5±1.1	39-42 40.5±1.5	17.8-19.1 18.3±0.6	267-286 278±8
<i>huanca</i>	43-46 44.1±1.3	50-54 52.2±1.5	76-82 78.6±1.8	29-31 30.0±1.0	47-53 49.4±2.0	21.9-23.5 23.1±0.6	224-255 234±10
<i>tarma</i>	43-46	53-55	80-83	30-32	50-56	22.2-22.6	233-252
<i>Lathrothelae</i>							
<i>grabensis</i>	49-59 54.8±2.6	36-43 39.0±2.2	79-100 92.1±5.1	38-48 43.2±2.2	38-50 44.3±3.2	24.3-27.5 26.1±1.0	277-365 309±24
<i>cavernicola</i>	58-61 59.0±1.4	39-41 39.7±0.7	92-93 92.4±0.8	42-44 43.0±1.0	36-39 37.7±1.2	24.4-28.2 26.3±1.7	343-367 351±11
<i>jezequelei</i>	63-65	40	113-116	40-46	45	36.7-37.1	386-483
<i>Indothelae</i>							
<i>lanka</i>	63-69		89-94	44-47	37-38	27.5-28.4	280-285
<i>dumicola</i>	53	52	95	35	55	21.6	240
<i>Thelechoris</i>							
<i>rutenbergi</i>	68-74 71.1		119-122 120.1	31-35 33.3	37-39 37.8	30.6-34.3 32.8	
<i>striatipes</i>	59-71 66.1±2.7		113-124 118.4±2.2	28-37 32.7±2.0	38-49 43.2±2.3	28.9-37.6 33.0±1.9	

TABLE 6

## Quantitative Character Values for Adult Females of Ischnotheline Species

(Character abbreviations are defined in Methods section of text. Range, mean, and standard deviation given. \*Values of each ratio character have been multiplied by 100.)

	N	CTP	CDP	CTR	CDR	PTarS	ITarS	MC	CL
<i>Ischnothelie longicauda</i>	23	6-12 8.1±1.3	0-2 0.3±0.6	8-9 8.4±0.5	2-26 15.6±6.0	7-16 11.6±2.0	4-7 5.7±1.0	61-154 107±26	3.53-7.56 6.06±1.14
<i>jeremie</i>	1	10	0	12	20	8	2	70	3.73
<i>garcia</i>	1	8	1	9	5	11	5	82	4.89
<i>reggae</i>	27	6-12 8.8±1.5	0-3 0.6±0.8	9-12 10.0±0.9	8-18 13.1±2.9	6-16 10.8±2.2	2-7 4.3±1.0	72-136 100±19	4.14-7.49 5.45±0.82
<i>xera</i>	8	8-10 9.3±0.7	0-4 0.9±1.4	7-9 8.4±0.7	10-16 13.8±2.5	9-13 10.9±1.6	5-11 6.3±2.1	44-91 63±19	3.12-5.97 4.86±1.02
<i>digitata</i>	25	6-10 8.0±1.3	0-3 0.8±1.0	6-10 8.7±1.0	2-14 7.7±3.2	5-18 12.3±2.9	3-8 4.9±1.3	74-215 110±36	4.45-9.20 5.74±1.06
<i>huambisa</i>	1	10	5	14	16	10	0	44	3.00
<i>caudata</i>	47	5-11 7.2±1.2	0-5 0.6±0.9	6-11 8.2±0.9	4-22 10.6±3.7	7-19 10.5±2.5	0-7 4.0±1.1	31-107 61±17	2.39-5.97 4.10±0.72
<i>guianensis</i>	35	6-12 8.2±1.3	0-3 1.1±1.0	7-10 8.4±0.8	4-11 7.1±2.0	7-16 11.4±2.0	2-7 4.5±1.1	33-140 98±23	3.04-7.11 5.53±1.00
<i>annulata</i>	45	5-8 6.7±0.9	0-2 0.3±0.6	6-10 7.7±1.0	0-11 4.4±2.8	9-23 13.9±3.7	4-17 7.3±3.4	65-166 107±25	3.88-7.14 5.89±0.76
<i>goloboffi</i>	5	8-9 8.2±0.4	0-1 0.6±0.5	7-11 9.8±1.6	4-5 4.4±0.5	9-11 9.4±0.9	4 4.0±0.0	36-55 45±8	4.20-4.62 4.40±0.20
<i>Andethelie lucma</i>	8	6-11 7.5±1.6	0-1 0.6±0.5	4-8 5.5±1.6	20-41 27.3±7.5	8-13 9.5±2.0	4-8 4.5±1.4	30-76 47±15	3.95-5.93 4.64±0.73
<i>huanca</i>	25	4-7 4.8±0.7	0	4-8 6.2±0.8	12-33 20.3±4.6	6-24 10.7±3.4	0-9 4.0±1.6	26-97 63±15	3.00-5.85 4.77±0.74
<i>tarma</i>	7	5-8 6.3±1.0	0-1 0.1±0.4	4-7 6.1±1.1	17-21 18.7±1.3	6-9 8.1±1.2	2-5 3.7±1.1	75-175 106±33	4.79-6.46 5.68±0.66
<i>Lathrothelie grabensis</i>	21	5-10 7.8±1.1	0-3 0.4±0.8	8-11 9.8±0.9	21-46 32.4±6.9	8-16 10.3±2.1	0-5 1.7±1.6	77-168 115±29	3.31-6.31 5.04±0.69
<i>cavernicola</i>	9	7-9 8.0±0.5	0-1 0.3±0.5	8-11 9.9±1.1	46-62 51.8±5.1	8-10 8.6±0.7	0-1 0.1±0.3	93-155 123±21	3.97-5.16 4.63±0.35
<i>jezequeili</i>	8	7-9 7.9±0.6	0-1 0.3±0.5	7-10 8.4±1.1	12-20 16.4±2.9	7-11 8.6±1.3	0 0	22-69 34±16	2.16-3.00 2.60±0.30
<i>catamita</i>	4	9-12 10.5±1.7	0	9-11 10.3±1.0	31-54 42.3±9.9	6-8 7.5±1.0	0 0	22-40 31±9	3.04-3.43 3.22±0.19
<i>Indothelie lanka</i>	5	7-10 8.6±1.1	0-1 0.4±0.5	8-11 10.0±1.2	8-11 9.6±1.5	6-9 7.8±1.3	0-2 0.8±0.8	70-127 108±22	3.81-5.24 4.80±0.58
<i>dumicola</i>	3	9-10 9.7	0-3 1.0	9-10 9.7	8-11 9.7	7-8 7.3	0 0	48-89 70	3.31-3.97 3.73
<i>rothi</i>	6	7-11 8.7±1.4	0	10-12 10.5±0.8	3-7 5.3±1.4	6-10 8.3±1.6	0 0	68-143 103±27	3.85-5.47 4.89±0.60
<i>mala</i>	2	7-9	0-2	9	7-11	8-9	0	50-97	2.89-4.24
<i>Thelechoris rutenbergi</i>	10	6-7 6.4±0.5	0	6-11 8.7±1.6	1-10 5.9±2.6	14-20 17.3±1.9	0-2 1.0±0.7	50-221 149±43	5.54-7.47 6.16±0.69
<i>striatipes</i>	51	5-8 6.0±0.6	0-6 0.1±0.8	7-11 8.5±1.0	1-16 6.4±2.7	12-27 16.8±3.5	0-4 0.6±0.8	58-258 157±49	3.89-7.24 5.55±0.73

TABLE 6—(Continued)

	CW	CS	AMD	AMS	OQW	OL	SL	SW
<i>Ischnothelie</i>								
<i>longicauda</i>	3.04-6.61 5.18±1.01	0.39-0.96 0.76±0.20	0.15-0.27 0.22±0.03	0.11-0.21 0.18±0.03	0.92-1.59 1.35±0.20	-0.15-0.06 -0.09±0.03	1.92-4.07 3.20±0.62	1.68-3.58 2.75±0.54
<i>jeremie</i>	3.08	0.39	0.13	0.11	0.81	-0.06	2.04	1.78
<i>garcia</i>	4.24	0.85	0.20	0.15	1.11	-0.09	2.65	2.28
<i>reggae</i>	3.53-6.42 4.78±0.69	0.54-1.08 0.77±0.21	0.18-0.31 0.23±0.03	0.13-0.24 0.17±0.03	1.13-1.83 1.41±0.18	-0.11-0.04 -0.07±0.03	2.15-3.80 2.87±0.39	1.93-3.39 2.51±0.32
<i>xera</i>	2.74-5.13 4.14±0.85	0.54-0.96 0.80±0.15	0.13-0.22 0.19±0.03	0.09-0.18 0.15±0.03	0.80-1.35 1.12±0.20	-0.13-0.06 -0.10±0.03	1.72-3.05 2.58±0.50	1.46-2.59 2.20±0.40
<i>digitata</i>	3.88-8.06 5.11±0.91	0.46-1.00 0.65±0.18	0.18-0.27 0.22±0.03	0.14-0.35 0.21±0.05	1.14-1.87 1.40±0.18	-0.04-0.06 0.00±0.03	2.34-4.93 3.02±0.58	2.06-4.31 2.65±0.48
<i>huambisa</i>	2.66	0.39	0.15	0.09	0.85	0.00	1.63	1.52
<i>caudata</i>	2.23-5.24 3.59±0.63	0.15-0.31 0.22±0.05	0.10-0.20 0.16±0.02	0.10-0.18 0.13±0.02	0.72-1.32 0.99±0.13	-0.15-0.00 -0.06±0.03	1.39-3.27 2.27±0.37	1.33-2.77 1.97±0.32
<i>guianensis</i>	2.62±6.35 4.86±0.91	0.19-0.73 0.34±0.15	0.15-0.28 0.23±0.03	0.12-0.30 0.19±0.04	0.87-1.75 1.40±0.21	-0.11-0.02 -0.06±0.03	1.64-3.92 2.99±0.53	1.48-3.21 2.53±0.42
<i>annulata</i>	3.42-6.50 5.15±0.68	0.23-0.65 0.38±0.08	0.13-0.24 0.20±0.02	0.13-0.26 0.18±0.03	0.94-1.50 1.26±0.12	-0.24-0.04 -0.13±0.05	2.17-3.94 3.22±0.42	1.90-3.29 2.77±0.34
<i>goloboffi</i>	3.70-4.20 3.91±0.21	0.27-0.39 0.31±0.05	0.17-0.19 0.17±0.01	0.09-0.11 0.11±0.01	0.90-1.02 0.97±0.05	-0.07-0.06 -0.07±0.01	2.33-2.66 2.49±0.15	2.00-2.26 2.15±0.11
<i>Andethelie</i>								
<i>lucma</i>	3.34-5.05 3.86±0.65	0.19-0.27 0.22±0.04	0.07-0.12 0.10±0.02	0.08-0.14 0.11±0.02	0.80-1.06 0.90±0.11	-0.19-0.11 -0.14±0.03	2.15-3.34 2.52±0.42	1.90-2.90 2.22±0.35
<i>huanca</i>	2.43-4.83 3.93±0.60	0.12-0.23 0.20±0.04	0.06-0.13 0.10±0.01	0.09-0.17 0.13±0.02	0.64-1.21 0.97±0.15	-0.20-0.04 -0.12±0.05	1.64-3.12 2.59±0.39	1.50-2.77 2.20±0.32
<i>tama</i>	3.99-5.24 4.70±0.51	0.27-0.35 0.31±0.04	0.08-0.15 0.10±0.03	0.13-0.17 0.15±0.02	0.92-1.19 1.06±0.12	-0.19-0.07 -0.12±0.04	2.65-3.36 3.02±0.29	2.17-2.83 2.47±0.26
<i>Lathrothelie</i>								
<i>grabensis</i>	2.77-5.54 4.31±0.64	0.27-0.96 0.67±0.20	0.15-0.28 0.20±0.03	0.12-0.20 0.16±0.02	0.91-1.66 1.27±0.18	0.00-0.11 0.06±0.04	1.92-3.44 2.72±0.36	1.61-2.85 2.29±0.28
<i>cavernicola</i>	3.54-4.39 4.10±0.28	0.50-0.85 0.70±0.11	0.13-0.19 0.16±0.02	0.15-0.27 0.20±0.04	1.09-1.35 1.26±0.08	0.06-0.11 0.08±0.02	2.04-2.70 2.50±0.20	1.94-2.37 2.20±0.14
<i>jezequelei</i>	1.89-2.62 2.26±0.27	0.19-0.46 0.30±0.09	0.09-0.13 0.11±0.01	0.09-0.13 0.11±0.01	0.57-0.78 0.68±0.07	0.02-0.07 0.04±0.02	1.26-1.70 1.49±0.17	1.13-1.52 1.34±0.14
<i>catamita</i>	2.66-3.08 2.82±0.19	0.39-0.46 0.42±0.04	0.14-0.17 0.15±0.01	0.09-0.13 0.11±0.02	0.78-0.94 0.87±0.07	0.02-0.06 0.03±0.02	1.70-1.92 1.80±0.10	1.55-1.67 1.60±0.05
<i>Indothelie</i>								
<i>lanka</i>	3.31-4.62 4.16±0.53	0.69-0.85 0.76±0.07	0.20-0.26 0.24±0.02	0.12-0.19 0.17±0.03	1.07-1.48 1.35±0.16	0.00-0.06 0.03±0.02	2.15-2.78 2.59±0.26	1.85-2.48 2.26±0.27
<i>dumicola</i>	2.77-3.43 3.17	0.35-0.39 0.36	0.13-0.14 0.13	0.09-0.11 0.10	0.82-0.98 0.92	-0.04-0.00 -0.02	2.04-2.33 2.21	1.63-1.92 1.83
<i>rothi</i>	3.47-4.77 4.36±0.51	0.39-0.69 0.55±0.10	0.15-0.19 0.18±0.02	0.15-0.22 0.19±0.03	1.04-1.44 1.30±0.16	-0.04-0.06 0.02±0.04	2.22-3.15 2.80±0.34	1.94-2.66 2.39±0.26
<i>mala</i>	2.46-3.70	0.27-0.42	0.13-0.18	0.09-0.11	0.78-1.04	-0.02-0.00	1.74-2.52	1.52-2.09
<i>Thelechoris</i>								
<i>rutenbergi</i>	5.24-7.20 5.96±0.71	0.35-0.85 0.52±0.20	0.22-0.29 0.25±0.02	0.19-0.29 0.23±0.03	1.38-1.79 1.54±0.14	0.00-0.04 0.02±0.02	2.85-4.11 3.27±0.41	2.78-4.11 3.25±0.44
<i>striatipes</i>	3.70-7.05 5.35±0.76	0.23-0.50 0.34±0.07	0.18-0.28 0.23±0.03	0.16-0.32 0.22±0.04	1.08-1.91 1.45±0.18	-0.02-0.07 0.03±0.03	2.15-3.96 3.03±0.40	2.15-3.81 2.95±0.41

TABLE 6—(Continued)

	IFL	ITL	IML	ITarL	LSL1	LSL2	LSL3
<i>Ischnothelie</i>							
<i>longicauda</i>	2.66-5.85 4.43±0.88	1.79-4.08 3.00±0.60	1.86-4.16 3.11±0.60	1.14-2.39 1.79±0.33	1.67-3.50 2.47±0.44	1.44-3.04 2.28±0.41	4.48-8.74 7.42±1.29
<i>jeremie</i>	2.58	1.69	1.81	1.16	1.39	1.23	
<i>garcia</i>	3.70	2.62	2.81	1.66	2.00	1.85	6.00
<i>reggae</i>	3.23-5.74 4.17±0.59	2.28-4.03 2.93±0.41	2.39-4.10 3.03±0.42	1.48-2.36 1.87±0.23	1.44-2.96 2.06±0.32	1.29-2.89 1.84±0.32	3.95-8.13 5.44±1.08
<i>xera</i>	2.32-4.26 3.55±0.72	1.60-3.08 2.52±0.54	1.75-3.27 2.69±0.57	1.10-2.01 1.65±0.33	1.60-2.36 1.98±0.25	1.37-2.28 1.90±0.30	3.72-6.69 5.90±1.12
<i>digitata</i>	3.15-6.12 4.03±0.75	2.05-4.10 2.63±0.50	2.17-4.18 2.73±0.50	1.29-2.05 1.53±0.21	1.75-3.65 2.26±0.42	1.44-3.27 1.96±0.37	4.26-9.12 5.88±1.21
<i>huambisa</i>	2.16	1.54	1.54	0.85	1.31	1.16	2.85
<i>caudata</i>	1.81-3.99 2.81±0.46	1.16-2.55 1.83±0.29	1.23-2.70 1.98±0.31	0.73-1.44 1.10±0.15	1.00-2.28 1.57±0.29	0.77-2.20 1.43±0.28	2.08-6.99 4.05±0.94
<i>guianensis</i>	2.13-5.21 3.94±0.71	1.37-3.34 2.55±0.47	1.44-3.42 2.61±0.48	0.91-1.82 1.44±0.20	1.14-2.96 2.06±0.37	0.99-2.66 1.75±0.34	2.81-8.13 5.23±1.24
<i>annulata</i>	2.51-4.83 4.02±0.52	1.56-3.04 2.54±0.34	1.67-3.23 2.65±0.34	1.06-1.82 1.53±0.17	1.44-2.58 2.08±0.28	1.29-2.58 1.93±0.30	3.72-8.06 5.80±1.16
<i>goloboffi</i>	2.93-3.23 3.04±0.13	2.00-2.23 2.12±0.09	2.16-2.39 2.24±0.09	1.23-1.39 1.29±0.06	1.62-1.85 1.71±0.10	1.46-1.62 1.54±0.08	4.24-4.70 4.50±0.20
<i>Andethelie</i>							
<i>lucma</i>	2.58-3.88 2.98±0.48	1.60-2.51 1.87±0.33	1.52-2.43 1.78±0.34	0.99-1.60 1.17±0.22	1.14-1.90 1.36±0.28	0.91-1.67 1.16±0.25	1.90-4.33 2.62±0.79
<i>huanca</i>	1.86-3.61 2.98±0.43	1.14-2.28 1.89±0.28	1.06-2.05 1.71±0.24	0.76-1.33 1.13±0.14	0.99-1.75 1.38±0.21	0.68-1.44 1.18±0.19	1.44-3.42 2.50±0.51
<i>tarma</i>	3.04-4.14 3.60±0.43	1.90-2.66 2.28±0.29	1.71-2.32 2.01±0.22	1.10-1.48 1.29±0.13	1.37-2.13 1.69±0.30	1.29-1.75 1.50±0.18	2.43-4.71 3.37±0.74
<i>Lathrothele</i>							
<i>grabensis</i>	2.27-4.54 3.58±0.56	1.54-3.23 2.42±0.40	1.62-3.31 2.54±0.40	1.08-1.77 1.49±0.17	1.08-2.31 1.79±0.28	0.92-1.93 1.49±0.26	2.16-5.54 3.92±0.94
<i>cavemicola</i>	3.08-3.93 3.55±0.25	2.12-2.73 2.49±0.18	2.16-2.77 2.52±0.19	1.39-1.66 1.51±0.09	1.46-1.93 1.75±0.15	1.31-1.93 1.52±0.20	3.39-4.62 4.00±0.43
<i>jezequelii</i>	1.54-2.12 1.85±0.20	1.04-1.42 1.24±0.14	1.16-1.62 1.38±0.17	0.73-0.96 0.86±0.08	0.92-1.31 1.11±0.14	0.85-1.16 0.96±0.12	2.08-2.93 2.38±0.32
<i>catamita</i>	2.27-2.62 2.44±0.17	1.54-1.89 1.67±0.16	1.69-2.04 1.84±0.17	1.00-1.23 1.11±0.11	1.39-1.69 1.52±0.16	1.31-1.69 1.50±0.18	3.08-4.47 3.73±0.72
<i>Indothele</i>							
<i>lanka</i>	2.81-3.77 3.47±0.39	2.00-2.58 2.39±0.23	1.96-2.62 2.39±0.25	1.16-1.46 1.36±0.12	1.62-2.16 1.99±0.21	1.54-2.08 1.88±0.22	4.47-5.31 4.89±0.36
<i>dumicola</i>	2.19-2.54 2.40	1.42-1.66 1.58	1.46-1.66 1.59	0.85-0.96 0.92	1.31-1.62 1.51	1.16-1.46 1.34	2.70-3.70 3.29
<i>rothi</i>	2.85-3.81 3.48±0.37	2.00-2.70 2.44±0.26	2.04-2.77 2.49±0.26	1.12-1.50 1.33±0.15	1.46-2.23 1.94±0.29	1.16-1.77 1.60±0.23	3.08-4.70 3.98±0.54
<i>mala</i>	1.96-2.85	1.31-1.85	1.31-1.89	0.85-1.08	1.23-1.62	1.08-1.46	2.54-3.54
<i>Thelechoris</i>							
<i>rutenbergi</i>	3.67-5.20 4.37±0.54	2.23-3.39 2.85±0.37	2.39-3.58 2.98±0.38	1.35-1.69 1.50±0.13	2.08-3.31 2.58±0.38	2.08-2.85 2.34±0.26	5.24-9.63 6.89±1.34
<i>striatipes</i>	2.62-5.12 3.83±0.51	1.62-3.23 2.46±0.33	1.69-3.35 2.58±0.36	1.04-1.66 1.35±0.14	1.62-2.93 2.24±0.30	1.31-2.23 1.86±0.25	3.08-8.47 5.75±1.17

TABLE 6—(Continued)

	CDR/CL*	CS/CW*	AMD/CL*	OQW/CL*	SW/SL*	ITL/CL*	LSL3/CL*	
<i>Ischnothelie</i> <i>longicauda</i>	33-414	10.9-17.6	2.9-4.6	21-26	80-92	45-55	102-130	
	263±94	14.1±2.4	3.6±0.4	22.7±1.6	86.0±3.4	50.2±2.9	118±10	
<i>jeremie</i>	536	12.5	3.5	22	86	45		
<i>garcia</i>	102	20.0	4.2	23	86	54	123	
<i>reggae</i>	120-410	12.8-17.6	3.7-4.6	24-27	82-91	51-56	81-111	
	244±69	15.2±1.9	4.3±0.3	25.9±0.9	86.6±2.0	52.7±1.3	97±9	
<i>xera</i>	192-434	16.5-19.9	3.3-4.2	21-26	82-90	49-55	101-132	
	292±73	18.3±1.4	3.9±0.3	23.3±1.3	85.3±2.4	51.8±2.2	119±13	
<i>digitata</i>	33-281	10.5-15.9	2.8-4.5	20-27	83-93	44-50	74-124	
	143±73	13.1±1.9	3.9±0.4	24.6±1.5	87.7±2.6	46.2±1.3	103±12	
<i>huambisa</i>	533	14.5	4.9	28	93	51	95	
<i>caudata</i>	120-435	4.0-8.4	3.0-4.5	20-30	81-96	40-48	71-126	
	260±82	5.7±1.1	3.8±0.3	24.3±1.5	87.2±2.7	44.7±1.9	99±13	
<i>guianensis</i>	63-329	6.3-12.3	3.6-4.9	24-29	80-90	43-49	66-120	
	132±49	7.7±1.8	4.1±0.4	25.5±1.3	85.0±2.3	46.2±1.4	94±12	
<i>annulata</i>	0-174	5.7-10.9	2.6-3.7	19-25	81-92	40-47	70-123	
	76±49	7.5±1.1	3.3±0.3	21.6±1.2	86.3±2.2	43.1±1.5	99±12	
<i>goloboffi</i>	87-119	7.1-10.0	3.6-4.1	21-23	85-89	47-50	101-105	
	100±13	7.9±1.2	3.9±0.2	22.1±0.9	86.5±2.0	48.1±1.0	102±1	
<i>Andethelie</i>								
	<i>lucma</i>	415-853	5.1-7.0	1.8-2.4	18-21	83-92	39-42	46-73
		591±146	6.1±1.0	2.2±0.2	19.5±0.9	88.1±2.8	40.1±1.1	56±8
<i>huanca</i>	265-564	4.1-6.3	1.9-3.0	18-22	81-91	38-42	42-62	
	432±94	5.2±0.6	2.2±0.2	20.3±1.1	85.7±2.7	39.7±0.9	53±6	
<i>tarma</i>	279-422	6.1-6.8	1.5-2.3	18-20	78-87	39-41	52-73	
	334±53	6.5±0.3	1.7±0.3	18.7±0.6	81.6±2.9	40.1±0.7	59±9	
<i>Lathrothelie</i> <i>grabensis</i>	476-853	7.4-19.8	3.3-4.7	23-29	79-88	43-57	65-96	
	644±111	15.4±3.3	3.9±0.4	25.3±1.8	84.1±2.4	48.0±3.7	79±11	
<i>cavernicola</i>	1001-1258	14.1-20.4	2.6-4.4	26-28	86-96	53-55	73-97	
	1121±101	17.0±2.1	3.5±0.6	27.3±0.7	88.5±2.7	53.8±0.6	87±7	
<i>jezequeli</i>	537-742	10.0-17.6	4.0-5.1	25-28	87-93	47-49	72-100	
	629±78	13.0±2.6	4.4±0.4	26.2±0.7	89.7±1.8	47.8±0.6	92±10	
<i>catamita</i>	1019-1576	13.5-17.1	4.2-4.9	26-28	86-92	50-55	100-130	
	1305±236	15.0±1.5	4.6±0.3	26.9±1.0	88.8±3.0	51.7±2.3	116±16	
<i>Indothelie</i>								
	<i>lanka</i>	153-230	16.4-20.9	4.4-5.4	28	84-90	48-53	89-102
		201±30	18.3±1.8	5.0±0.3	28.0±0.3	87.3±2.5	50.1±1.8	97±6
<i>dumicola</i>	202-332	10.5-12.5	3.3-3.9	25	80-85	42-43	81-93	
	263	11.4	3.6	24.7	82.6	42.3	88	
<i>rathi</i>	55-182	11.1-14.5	3.2-4.1	25-27	82-90	47-52	74-91	
	113±43	12.5±1.2	3.6±0.3	26.2±1.1	85.6±2.9	50.0±2.2	81±6	
<i>mala</i>	243-260	10.9-11.5	4.2-4.5	25-27	83-87	44-45	84-88	
<i>Thelechoris</i> <i>rutenbergi</i>	14-162	6.0-12.0	3.7-4.3	24-27	97-103	40-49	93-136	
	96±41	8.1±2.4	4.0±0.2	25.1±0.9	99.6±1.7	46.2±2.6	114±14	
<i>striatipes</i>	20-297	4.7-8.5	3.3-4.7	24-29	92-104	41-48	79-130	
	117±52	6.5±1.2	4.1±0.3	26.6±1.1	97.1±2.8	44.4±1.8	104±13	

TABLE 7  
Quantitative Character Values for Type Specimens of Ischnotheline Species

(Holotypes and lectotypes only. Character abbreviations are defined in Methods section of text. For the first four male characters, values are given for both left and right appendages. \*EL for *Thelechoris* types only.)

	TAS	TSP	TSR	CAS	CL	CW	AMD	AMS	IFL	ITL	IT
<i>Ischnothelie jeremie</i>	3, 3			0, 0	4.35	3.85			3.58	2.93	0.92
<i>Ischnothelie reggae</i>	9, 7	0, 0	1, 0	0, 0	3.73	3.43	0.20	0.12	3.35	2.73	0.73
<i>Ischnothelie xera</i>	4, 4	3, 3	2, 2	2, 2	4.16	3.70	0.19	0.12	3.70	2.85	0.85
<i>Ischnothelie digitata</i>	10, 11	2, 2	2, 2	4, 3	5.85	5.39	0.28	0.20	4.89	3.50	
<i>Entomothele pusilla</i>	4, 4	, 18	, 2	2, 3	2.81	2.54	0.11	0.11	2.23	1.66	
<i>Ischnothelie cranwelli</i>	5, 5	31, 34	2, 4	, 3	6.31	5.66	0.23	0.18	4.85	3.27	
<i>Ischnothelie goloboffi</i>	5, 5	3, 2	3, 2	3, 3	4.00	3.66	0.19	0.09	3.23	2.43	0.85
<i>Andethelie lucma</i>	0, 0	2, 2	2, 2	4, 4	4.04	3.39	0.12	0.10	3.05	2.11	
<i>Andethelie huanca</i>	0, 0	2, 2	2, 2	3, 3	3.97	3.31	0.09	0.12	2.78	2.11	
<i>Andethelie tarma</i>	0, 0	1, 1	2, 2	3, 3	4.00	3.43	0.07	0.10	2.81	2.11	
<i>Lathrothele grabensis</i>	0, 0	0, 0	0, 0	4, 3	4.04	3.46	0.17	0.15	3.12	2.46	1.15
<i>Lathrothele cavernicola</i>	0, 0	0, 0	0, 0	4, 4	4.39	3.93	0.19	0.17	3.70	2.73	1.12
<i>Lathrothele jezequelii</i>	0, 0	0, 0	0, 0	5, 8	2.77	2.39	0.11	0.11	2.16	1.54	0.54
<i>Indothele lanka</i>	0, 0	0, 0	0, 0	3, 4	3.77	3.39	0.26	0.11	3.46	2.69	0.58
<i>Indothele dumicola</i>	0, 0	0, 0	0, 0	4, 4	3.00	2.58	0.13	0.09	2.23	1.66	0.58
<i>Thelechoris striatipes</i>	0, 0	0, 0	0, 0	9, 8	6.16	6.24	0.28	0.18	5.04	3.43	0.92
<i>Ischnothelie gracilis</i>	0, 0	0, 0	0, 0	12,	6.51	6.39	0.26	0.28	5.39	3.54	1.00
<i>Ischnothelie mashonica</i>	0, 0	0, 0	0, 0	11, 10	4.81	4.47	0.22	0.19	3.97	2.62	0.73
	CTP	CDP	CTR	CDR	PTarS	ITarS	MC	CL	CW	CS	AMD
<i>Ischnothelie longicauda</i>	8	0	8	26	13	5	154	6.55	5.74	0.92	0.26
<i>Ischnothelie gacia</i>	8	1	9	5	11	5	82	4.89	4.24	0.85	0.20
<i>Ischnothelie huambisa</i>	10	5	14	16	10	0	44	3.00	2.66	0.39	0.15
<i>Ischnothelie caudata</i>	9	0	8	9	9	4	55	4.56	3.99	0.27	0.19
<i>Ischnothelie siemensi</i>	9	0	10	7	15	7	118	6.76	5.93	0.73	0.26
<i>Ischnothelie annulata</i>	6	1	9	7	10	5	104	6.00	5.24	0.46	0.19
<i>Ischnothelie catamita</i>	12	0	10	54	6	0	38	3.43	3.08	0.46	0.17
<i>Indothele rothi</i>	8	0	11	5	10	0	112	5.31	4.77	0.58	0.19
<i>Indothele mala</i>	7	2	9	11	8	0	97	4.24	3.70	0.42	0.18
<i>Thelechoris rutenbergi</i>	6	0	11	10	18	1	221	7.47	7.20	0.54	0.28
<i>Thelechoris karschi</i>	9	0	9	8	18	0	119	4.39	4.00	0.27	0.19

TABLE 7—(Continued)

	IML	MAD	ITarL	TAL	TAW	PFL	PTL	PTT	CYL	CYAL	BD	PL(EL)*
<i>Ischnothelie jeremie</i>	2.58	1.04		0.45	0.17	2.29	1.59	0.67	1.63	1.00	0.52	0.78
<i>Ischnothelie reggae</i>	2.73	1.08	2.54	0.12	0.23	2.16	1.63	0.67	1.55	0.94	0.48	0.83
<i>Ischnothelie xera</i>	2.93	1.12	2.77	0.41	0.19	2.48	1.70	0.70	1.72	1.07	0.48	0.87
<i>Ischnothelie digitata</i>	3.54	1.62	2.31			3.40	2.37	1.07	2.37	1.48	0.65	1.89
<i>Entomothele pusilla</i>	1.81	0.85	1.04			1.52	1.00	0.69	1.17	0.61	0.37	0.85
<i>Ischnothelie cranwelli</i>	3.39	1.58	2.16	0.19	0.35	3.26	2.04	1.29	2.26	1.33	0.68	1.63
<i>Ischnothelie goloboffi</i>	2.62	1.15	1.69	0.22	0.30	2.18	1.44	0.85	1.59	0.91	0.52	1.35
<i>Andethele lucma</i>	1.87	1.00	1.30			2.11	1.61	0.65	1.31	0.74	0.39	1.07
<i>Andethele huanca</i>	1.72	0.85	1.15			1.85	1.35	0.67	1.42	0.89	0.44	1.05
<i>Andethele tarma</i>	1.74	0.96	1.18			1.81	1.30	0.72	1.41	0.89	0.44	1.04
<i>Lathrothele grabensis</i>	2.23	0.81	1.73	0.65	0.52	2.04	1.44	0.67	1.70	1.09	0.39	1.28
<i>Lathrothele cavernicola</i>	2.54	1.00	1.85	0.76	0.54	2.28	1.63	0.63	1.72	1.11	0.39	1.33
<i>Lathrothele jezequeli</i>	1.73	0.69	1.12	0.28	0.35	1.44	0.98	0.44	1.35	1.02	0.22	1.07
<i>Indothele lanka</i>	2.39		1.66	0.50	0.13	2.18	1.52	0.56	1.63	1.07	0.37	1.05
<i>Indothele dumicola</i>	1.58	0.81	1.04	0.29		1.54	1.02	0.56	1.05	0.65	0.37	0.89
<i>Thelechoris striatipes</i>	4.00		1.85	0.41		3.59	2.07	0.89	2.63	1.85	0.87	1.41
<i>Ischnothelie gracilis</i>	4.24		2.00	0.43		3.77	2.18	0.89	2.92	2.04	0.94	1.52
<i>Ischnothelie mashonica</i>	3.12		1.62	0.42		2.78	1.67	0.70	2.22	1.50	0.67	
	AMS	OQW	OL	SL	SW	IFL	ITL	IML	ITarL	LSL1	LSL2	LSL3
<i>Ischnothelie longicauda</i>	0.20	1.41	-0.07	3.52	3.03	5.16	3.58	3.81	2.27	2.62	2.39	8.47
<i>Ischnothelie gacia</i>	0.15	1.11	-0.06	2.65	2.28	3.70	2.61	2.81	1.66	2.00	1.85	6.01
<i>Ischnothelie huambisa</i>	0.09	0.85	0.00	1.63	1.52	2.16	1.54	1.54	0.85	1.31	1.16	2.85
<i>Ischnothelie caudata</i>	0.14	1.08	-0.06	2.52	2.19	2.96	1.86	1.98	1.03	1.60	1.52	
<i>Ischnothelie siemensi</i>	0.23	1.67	-0.11	3.72	3.12	4.79	3.15	3.19	1.67	2.66	2.20	6.00
<i>Ischnothelie annulata</i>	0.21	1.30	-0.15	3.34	2.88	4.22	2.58	2.96	1.67	2.05	1.82	5.09
<i>Ischnothelie catamita</i>	0.13	0.94	0.04	1.92	1.67	2.62	1.89	2.04	1.23	1.69	1.69	4.47
<i>Indothele rothi</i>	0.19	1.44	0.06	3.03	2.52	3.70	2.58	2.62	1.39	2.08	1.69	3.93
<i>Indothele mala</i>	0.11	1.04	-0.02	2.52	2.09	2.85	1.85	1.87	1.08	1.62	1.46	3.54
<i>Thelechoris rutenbergi</i>	0.29	1.78	0.04	4.11	4.11	5.16	3.39	3.58	1.69	2.93	2.70	
<i>Thelechoris karschi</i>	0.19	1.18	0.04	2.28	2.18	2.85	1.77	1.85	1.00	1.77	1.54	4.00

## ISCHNOTHELE Ausserer

*Ischnothele* Ausserer, 1875: 163 (type species by monotypy *Ischnothele caudata* Ausserer). — Bonnet, 1957: 2306. — Brignoli, 1983: 125. — Raven, 1985a: 77. — Platnick, 1989: 80; 1993: 90.

*Entomothele* Simon, 1889a: 235 (type species by original designation *Mygale guianensis* Walckenaer). First synonymized by Simon, 1903: 968.

**DIAGNOSIS:** Three putative synapomorphies distinguish *Ischnothele* males from all other ischnotheline males: (1) the presence of spines on the tibia I mating apophysis (fig. 56), (2) this apophysis single and truncate (rather than double or pointed), and (3) a short, strong, and blunt retrolateral prominence on the metatarsus I mating apophysis (figs. 56, 57). *Ischnothele* females are not as distinctive, but they have proportionally longer appendages [ITL(100)/CL = 40–56 vs. 38–42] and proportionally larger AMEs [AMD(100)/CL = 2.6–4.9 vs. 1.5–3.0] than nearly all *Andethele* females, their median spermathecae are never as strongly coiled and long and their sternum is rarely as broad [SW(100)/SL = 80–96 vs. 92–104] as in *Thelechoris* females, and, unlike the Old World genera *Lathrothele* and *Indothele* (which rarely have more than two spines on tarsus I [ITarS = 0–5] and never have more than two spermathecae per side), *Ischnothele* females nearly always have more than two spines on tarsus I (ITarS = 0–17) and, if they do not, are likely to have more than two spermathecae per side.

**DESCRIPTION:** Body size small to medium (CL = 2.3–9.2) (figs. 153, 154). Carapace with moderately dense covering of thin recumbent to semirecumbent hairs; usually 2 (one pair) and rarely 3 foveal bristles except for *I. garcia*, which has 8 (4 pairs); semierect setae on lateral edges of carapace vary from thin and short to long and strong. Pars cephalica slightly to moderately elevated above pars thoracica (fig. 154). Sternum not quite as wide as long (fig. 155). Palpal tarsus of female with 5–23 spines. Male palpal tibia (figs. 60, 78, 95, 120, 147, 182, 221) slightly to strongly swollen ventrally and proximally; erect ventral bristles of varying lengths and positions.

Cymbial apophysis with 0–9 spines; very tip with or without cluster of stout bristles. Palpal organ highly variable. Male tarsi integral or pseudosegmented; tarsus I with 1–43 (males) or 0–17 (females) spines. Male tibia I cylindrical, with truncate mating apophysis ventrally at distal end armed with 3–12 spines (figs. 56, 75, 90, 111, 140, 177, 218); metatarsus I with a ventral apophysis with a short, strong, and blunt retrolateral prominence. Spermathecal morphology diverse.

**REMARKS:** Whether *Ischnothele*, as constituted herein, is monophyletic, as indicated by cladogram A (fig. 21), or paraphyletic, as indicated by cladogram B (fig. 222), will be determined only by further research. In cladogram A, my preferred working hypothesis, a monophyletic *Ischnothele* is supported by the three putative synapomorphies cited in the diagnosis above. Both cladistic analyses support the existence of three monophyletic species groups of *Ischnothele*, the Greater Antilles group (*I. longicauda*, *I. jermie*, *I. garcia*, *I. reggae*, and *I. xera*), the South American *goloboffi* group (*I. goloboffi*, *I. caudata*, *I. guianensis*, and *I. annulata*), and a group composed of the two remaining species, *I. digitata* and *I. huambisa*.

**DISTRIBUTION:** Tropical South America, Central America, and the Antilles.

*Ischnothele longicauda* Franganillo

Figures 56–74; Map 1

*Ischnothele longicauda* Franganillo, 1930: 47, figs. 1, 2 (female lectotype, here designated, and female paralectotype from Loma del Gato, Sierra Maestra, Cuba, in Cuban Academy of Sciences, Habana, examined). — Franganillo, 1935: 23; 1936: 17, figs. 2, 3. — Alayón, 1992: 1, figs. 1–3. *Ischnothele guyanensis* (misidentification): Banks, 1906: 186.

**DIAGNOSIS:** Males of *I. longicauda* are distinct from those of all other *Ischnothele* species (except closely related *I. jermie*) by virtue of the very thin keels on the embolus (figs. 61, 62) and the peculiar pair of terminally broad, flattened, and truncate spines on the prolaternal face of the palpal patella (fig. 63). Females are distinguished from those of all other *Ischnothele* species by the heavily scler-

otized broad trunk shared by the two primary spermathecae on each side (figs. 64–72). See the *I. jeremie* diagnosis for character states that distinguish *I. longicauda* males from *I. jeremie* males.

**MALES:** Table 5. Palpal organ (figs. 60–62) with relatively short embolus with 2 rather broad, thin, transparent to translucent keels, one dorsal and one ventral, extending almost to the truncate tip of the embolus; ventral keel bent prolaterally. Cymbium (fig. 60) without spines; no stout bristles on tip. Proximal half of palpal tibia (fig. 60) swollen, with dense group of sharp-tipped bristles on the ventral-retrolateral aspect of that swelling. Pair of spines on prolateral surface of palpal patella are truncate, flattened, and broadened at tip in dorsal and ventral view (fig. 63). Tibia I apophysis (figs. 56, 58, 59) rather long and subcylindrical with relatively short spines on tip. Metatarsus I (figs. 56, 57) with strong midventral keel on distal one-third to one-fourth, and ventral apophysis at about one-third distance from proximal to distal end; apophysis with robust and angular retrolateral prominence and triangular, sharp, ventrally directed prolateral prominence. Tarsus I flexible. One pair of weak foveal bristles. Carapace and appendages light yellow-tan to darker orange-tan; abdominal dorsum medium gray-brown to darker purple-brown with very faint chevron pattern of paired, thin, pale lines.

**FEMALES:** Tables 6 and 7. Spermathecae (figs. 64–72) on each side consist of (1) a heavily sclerotized, rather broad, median trunk that bifurcates into 2 stalks, each with a large oval to elongate bulb and (2) a heavily sclerotized lateral trunk that has either a single stalk with well-developed bulb or reduced bulb or no bulb. One pair of long foveal bristles. Carapace pale orange-tan to light reddish brown; chelicerae darker; pedipalps and legs like carapace or darker orange-tan to chestnut brown; abdomen pale brown to medium purple-brown, often with very faint chevron pattern as in male.

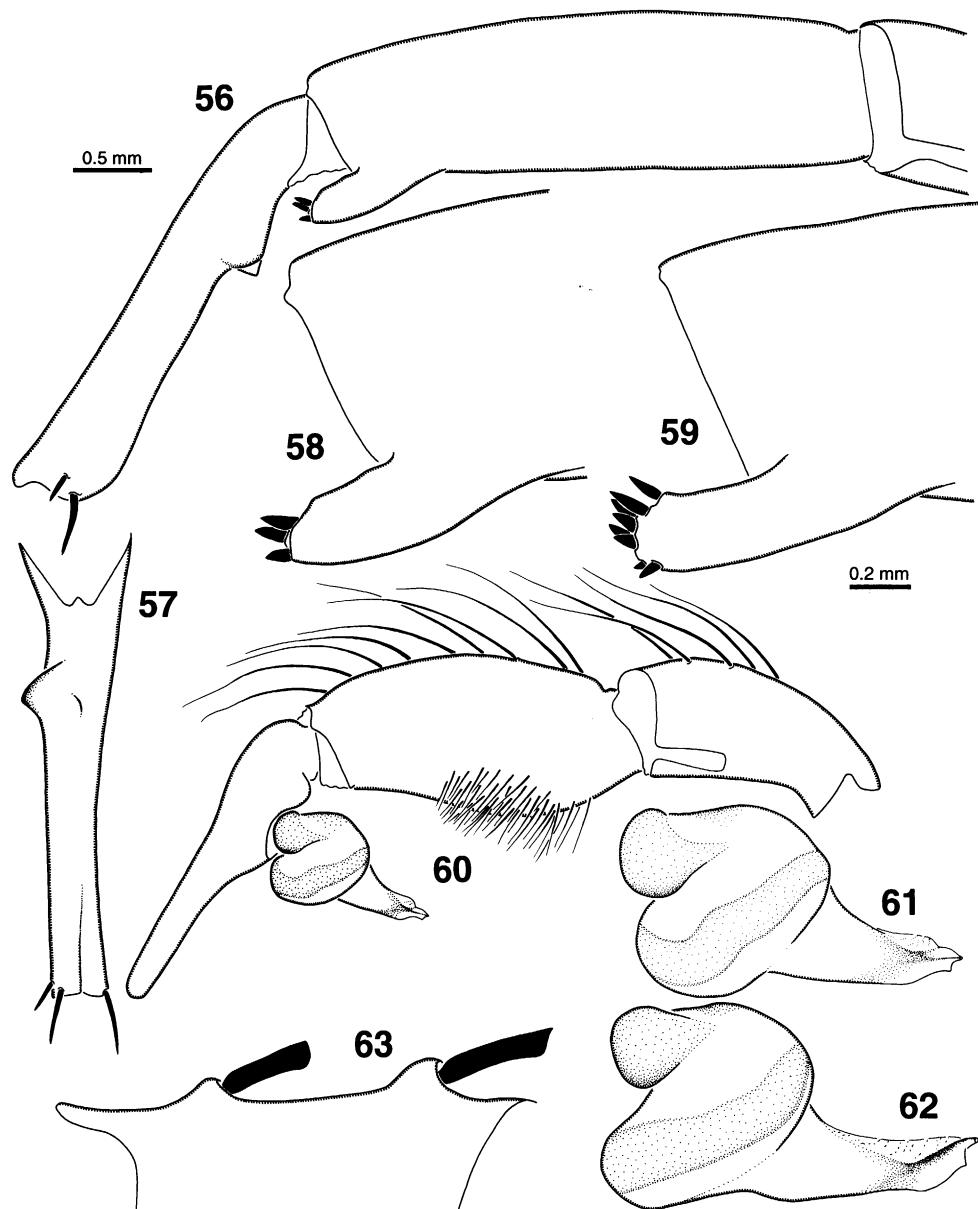
**VARIATION:** There are noteworthy differences between the two males available for this study. The leg and pedipalp articles of the La Chispa male are proportionally longer than those of the Belmonte male [IML(100)/

CL = 73 vs. 54], the tibia I apophysis of the former (fig. 59) is proportionally more slender and more nearly cylindrical than that of the latter [TAL(100)/TAW = 185 vs. 138] (fig. 58), and there are differences in the shape of the dorsal keel of the embolus and the diameter of the embolus tip (figs. 61, 62).

The four La Chispa females and the two female types have proportionally longer legs [IML(100)/CL = 55–58 ( $57 \pm 1.1$ )] than the females (N = 17) from most other samples [IML(100)/CL = 43–55 ( $50 \pm 3.1$ )] (fig. 73), a pattern consistent with that of the two males, and they also have proportionally high MC numbers [MC/CL = 19.8–23.5 ( $21.6 \pm 1.6$ )] when compared with the other females [MC/CL = 12.1–19.6 ( $16.3 \pm 2.1$ )] (fig. 74). The two Matanzas females have intermediate values for these two characters (figs. 73, 74). Marked geographic and intrapopulation variation occurs in the degree of development of the bulb on the lateral spermathecal trunk. The La Chispa and Mina Carlota females and lectotype (a large gravid female) have well-developed lateral bulbs (figs. 64, 66, 67), the paralectotype (a smaller gravid female) has rudimentary lateral bulbs (fig. 65), and the other 16 specimens, including the two Matanzas females, have either no lateral bulbs at all or one side with a rudimentary lateral bulb and the other with no bulb (figs. 68–72). The spermathecae with large lateral bulbs lack the continuously sclerotized connection between the median and lateral trunks that is usually present when the lateral bulb is rudimentary or missing.

The several divergent character states of the La Chispa and type samples strongly suggest that these populations may be reproductively isolated from the others. However, the fact that these characters vary discordantly in the samples of females from Mina Carlota and Matanzas does not fit this hypothesis, which can be rigorously tested only by studying larger samples and samples from additional localities.

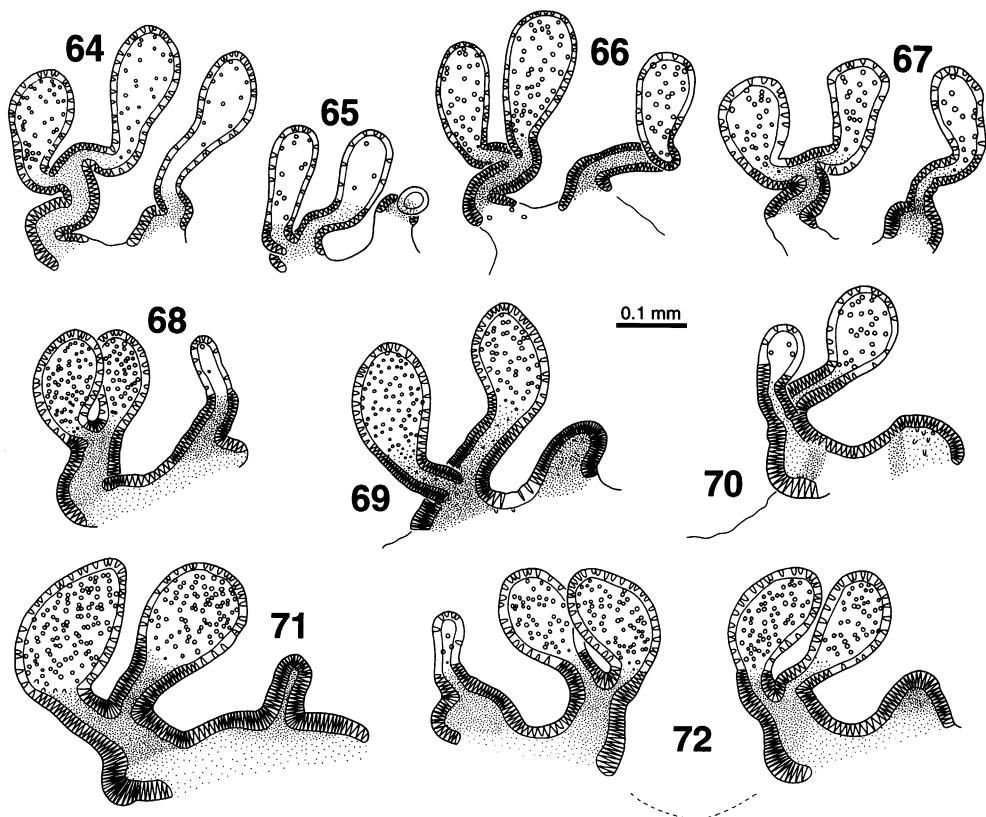
**DISTRIBUTION:** Nearly restricted to Cuba where it is widely distributed (map 1). Alayón (1992) lists additional Cuban localities. This species has also been collected on Andros Island in the Bahamas, which is not particularly surprising in view of the very close



Figs. 56–63. *Ischnothele longicauda* males. 56. Tibia and metatarsus I, retrolateral view, Belmonte. 57. Metatarsus I, ventral view, Belmonte. 58, 59. Tibia I apophysis, retrolateral view. 58. Belmonte. 59. La Chispa. 60. Pedipalp, retrolateral view, Belmonte. 61, 62. Palpal organ, retrolateral-ventral view. 61. Belmonte. 62. La Chispa. 63. Spines on prolateral surface of pedipalp patella, ventral view, Belmonte. Scale lines: 0.5 mm for figs. 56, 57, 60; 0.2 mm for figs. 58, 59, 61–63.

proximity (a few kilometers) of this island to Cuba as recently as 18,000 years ago during periods of low sea levels during Pleistocene glacial maxima (Browne et al., 1993).

MATERIAL EXAMINED: BAHAMAS: S. W. Andros Island, May 15, 1904 (W. Wheeler, AMNH), 1 ♀. CUBA: 5 mi N Baños, May 10, 1918 (AMNH), 2 ♀; Belmonte, Cienfuegos,

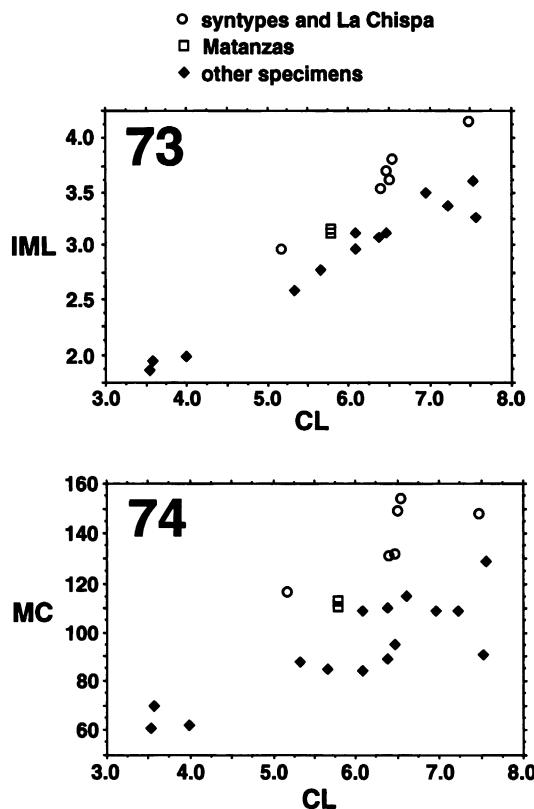


Figs. 64–72. *Ischnothele longicauda* spermathecae. 64–71. Right spermathecae. 64. Lectotype. 65. Paralectotype. 66, 67. La Chispa. 68. Belmonte. 69. Matanzas. 70. SW Andros Island. 71. 5 mi N Baños. 72. All spermathecae, Belmonte.

under stones in field, Feb. 17–28, 1920 (W. Goldring, AMNH), 1 ♂, 8 ♀, juvs.; Gran Piedra Oriente, S. de la Torre, June 29, 1955 (A. Archer, AMNH), 1 juv.; Havana, Mariana, Sept. 1939 (H. Ris, AMNH), juv.; La Chispa, Topes de Collantes, 1981 (J. Santos, G. Alayón, GAC), 4 ♀, 1 juv., Dec. 1985 (J. Santos, GAC), 1 ♂; Matanzas, E of mouth of Río Canimar, Jan. 25, 1949 (Gloria-Maris, AMNH), 2 ♀; Pinar del Río (Palmer, Riley; USNM), 1 ♀; Sierra del Cobre, Loma del Gato, elev. 2600–3325 ft (S. Bruner, MCZ), 1 juv.; Sierra Maestra, Loma del Gato (CASH), 2 ♀ (types); Soledad, June 10, 1918 (AMNH), 1 ♀, Feb. 1925 (G. Salt, MCZ), 1 ♀, Nov. 27, 1927 (Creighton, MCZ), 1 ♀; Trinidad Mtns., Buenos Aires, June 17–23 (MCZ), 1 juv.; Trinidad Mtns., Mina Carlota, Mar. 19–25, 1925 (Salt, Myers; MCZ), 1 ♀, juvs.

**NATURAL HISTORY:** Alayón (1992) reported that *I. longicauda* lives in a wide variety of habitats, ranging from humid montane forest to semideciduous microphyllous forest, the edges of pine groves, and relatively dry coastal habitats, especially "manglar" forest. He observed that the tubular retreat portion of the web may be constructed under rocks and fallen branches, in spaces under the roots of large trees, in cavities in the soil, in leaf litter, and in the foliage and branches of herbs and shrubs, and that capture webs of adult females may be as large as 60 × 60 cm. Franganillo (1930) reported that the type specimens had built their webs in debris around the bases of trees and shrubs in forest. The spiders collected by Goldring at Cienfuegos were found under stones in a field.

Alayón (1992) observed that these spiders



Figs. 73, 74. Scattergrams of character values for *Ischnothelae longicauda* females. Measurements in mm. 73. IML plotted against CL. 74. MC plotted against CL.

remain hidden in their retreat galleries during the day, except when they dash out to capture prey, but at twilight begin to position themselves where the retreat opens onto the capture sheets. As predicted by Coyle and Meigs (1989), Alayón found male and female *Mysmenopsis tibialis* (Bryant) kleptoparasites living in some of these webs. He also found pholcids (*Modisimus* sp.) in two webs and an emesine reduviid living in another.

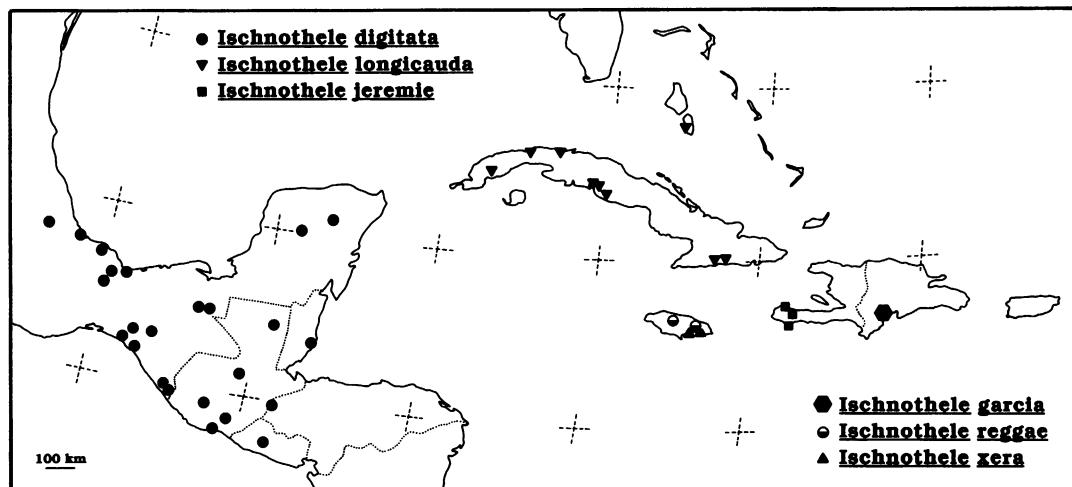
Collection dates of the two males I examined and the male examined by Alayón (1992) suggest that the breeding season includes December and February. A female with an egg sac containing eggs was collected on May 10, 5 miles north of Baños.

*Ischnothelae jeremie*, new species  
Figures 75–83; Map 1

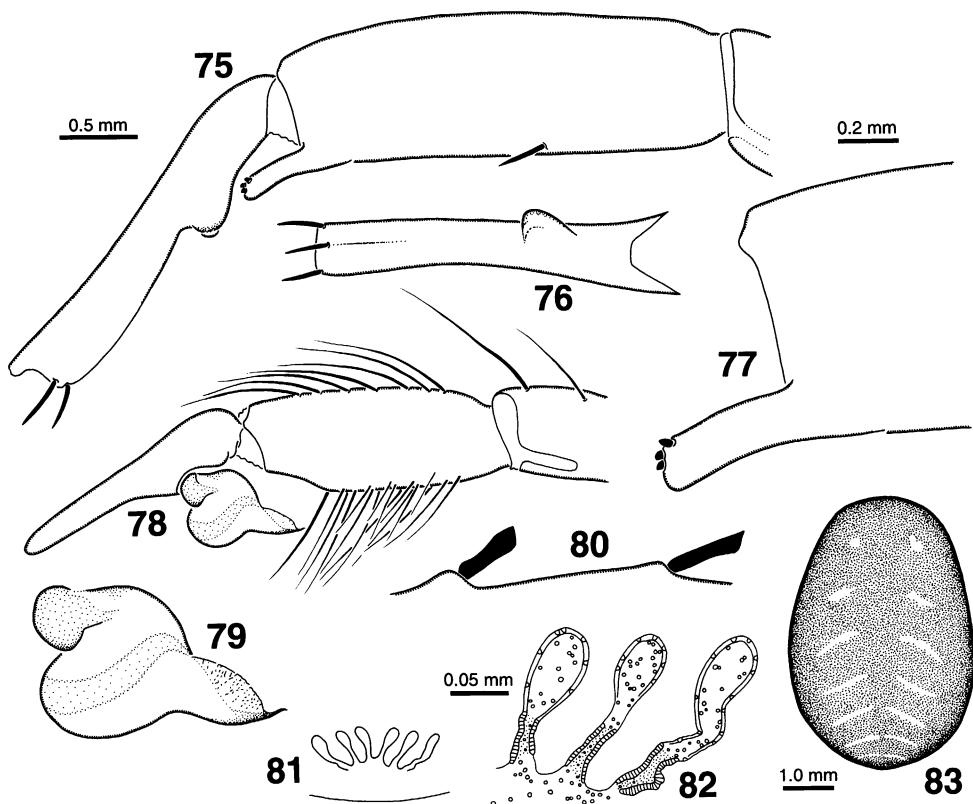
**TYPES:** Male holotype from a sinkhole at an elevation of 1220 m near Jérémie, just north of the Massif de la Hotte, in southwestern Haiti (Feb. 1984; J. Franz), deposited in AMNH.

**ETYMOLOGY:** The specific name is a noun in apposition taken from the type locality.

**DIAGNOSIS:** The single known male differs from those of all other *Ischnothelae* species except *I. longicauda* by the very thin, nearly transparent, broad keel on the embolus (fig. 79), the pair of terminally broad, flattened,



Map 1. Caribbean region, showing distribution of *Ischnothelae longicauda*, *I. jeremie*, *I. garcia*, *I. reggae*, *I. xera*, and *I. digitata*.



Figs. 75–83. *Ischnothele jeremie*. 75–80. Holotype male. 75. Tibia and metatarsus I, retrolateral view. 76. Metatarsus I, ventral view. 77. Tibia I apophysis, retrolateral view. 78. Pedipalp, retrolateral view. 79. Palpal organ, retrolateral-ventral view. 80. Spines on prolateral surface of pedipalp patella, ventral view. 81–83. Female from NE La Hotte. 81. All spermathecae. 82. Right spermathecae. 83. Abdominal dorsum. Scale lines: 0.5 mm for figs. 75, 76, 78; 0.2 mm for figs. 77, 79–81; 0.05 mm for fig. 80; 1.0 mm for fig. 83.

and truncate spines on the prolateral face of the palpal patella (fig. 80), and the extreme shortness of the tibia I apophysis spines (fig. 77). The one known female differs from those of all other *Ischnothele* species by the three moderately long, narrow, straight to sinuous, weakly sclerotized spermathecal stalks on each side (figs. 81, 82). The *I. jeremie* male differs from those of *I. longicauda* by (1) having only one (fig. 79) rather than two (figs. 61, 62) keels on the embolus, (2) a long, tapered, and curved embolus tip (fig. 79) rather than one that ends abruptly just beyond the keels (figs. 61, 62), (3) the extreme shortness of the tibia I apophysis spines and their absence from the ventral aspect of the apophysis tip (fig. 77), (4) a more slender tibia I apophysis [fig. 75 vs. fig. 56; TAW(100)/TAL

= 38 vs. 54–73], and (5) a less swollen palpal tibia [fig. 78 vs. fig. 60; PTT(100)/PTL = 42 vs. 48–51].

**MALE:** Tables 5 and 7. Palpal organ (fig. 79) with relatively short embolus with very thin, transparent, wide, dorsal keel extending about  $\frac{1}{3}$  of distance from base to tip, which tapers to fine point and is curved distally. Cymbium (fig. 78) lacking spines; no stout bristles on tip. Palpal tibia (fig. 78) with only slight ventral swelling and many long erect bristles on ventral and prolateral surface. Prolateral face of palpal patella with two spines that are truncate, flattened, and broadened at tip in dorsal and ventral view (fig. 80). Tibia I apophysis (figs. 75, 77) long and slender with few very short spines on dorsal aspect of tip. Metatarsus I (figs. 75, 76) with

ventral apophysis at just over  $\frac{1}{3}$  distance from proximal to distal end; apophysis with strong rounded retrolateral prominence and smaller, thin, keel-like, ventrally directed prolateral prominence; distal end of metatarsus with long ventral keel. One pair of weak foveal bristles. Carapace and chelicerae pale yellow-brown; pedipalps, legs, and abdominal dorsum slightly darker light brown (abdomen in poor condition, perhaps discolored).

**FEMALE:** Table 6. Three subequal spermathecae on each side (figs. 81, 82); stalks weakly sclerotized, moderately long, narrow, and straight or slightly sinuous; bulbs elongate. One pair of long foveal bristles. Carapace, chelicerae, pedipalps, and legs orange-tan; lateral edges of carapace gray. Abdominal dorsum (fig. 83) purple-brown with 8 pairs of light markings; anterior pair roughly round, others obliquely transverse and progressively (from anterior to posterior) thinner and more nearly united medially.

**DISTRIBUTION:** Known only from three localities in and near the Massif de la Hotte in southwestern Haiti (map 1).

**MATERIAL EXAMINED:** HAITI: Formond, elev. 975 m, Feb. 1984 (J. Franz, FSC), 1 juv.; foothills NE La Hotte, elev. 3000–4000 ft, Oct. 1934 (P. Darlington, MCZ), 1 ♀; Jérémie, elev. 1220 m, sinkhole, Feb. 1984 (J. Franz, AMNH), 1 ♂ (holotype).

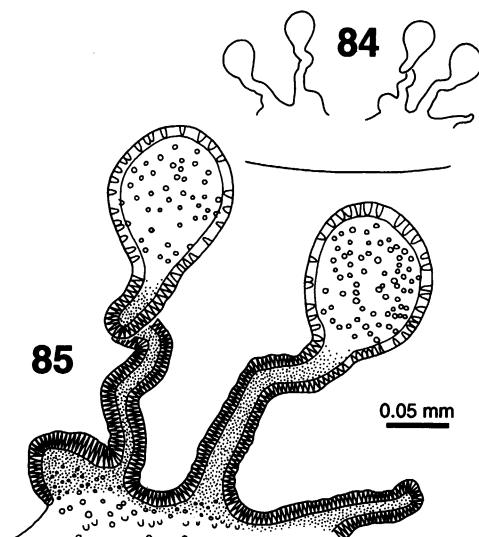
*Ischnothele garcia*, new species  
Figures 84, 85; Map 1

**TYPES:** Female holotype from Sierra Martín García, Barahona Province, in southwestern Dominican Republic (Aug. 8, 1958; A. Archer), deposited in AMNH.

**ETYMOLOGY:** The specific name is a noun in apposition taken from the type locality.

**DIAGNOSIS:** The single known female of *I. gacia* differs from those of all other *Ischnothele* species by the distinctive spermathecae (figs. 84, 85) (with long heavily sclerotized stalks and a sclerotized shoulderlike protuberance at the base of each median stalk) and by possessing 8, rather than 2, foveal bristles.

**FEMALE:** Tables 6 and 7. Two spermathecae on each side, with additional vestigial stalk lateral to the right pair (figs. 84, 85); stalks heavily sclerotized, long, narrow, and bent to highly sinuous; area around base of



Figs. 84, 85. *Ischnothele garcia* holotype spermathecae. 84. All spermathecae. 85. Right spermathecae. 0.5 mm scale line for fig. 85, which is magnified 4 times fig. 84.

stalks heavily sclerotized, with median shoulderlike protuberance at base of each median stalk; bulbs spheroid. Two rows of long foveal bristles (4 per row). Carapace and chelicerae dark orange-tan; pedipalps and legs lighter orange-tan. Abdominal dorsum light gray-brown with anterior pair of pale spots followed by 6 or 7 pairs of pale obliquely transverse chevron-like markings progressively (from anterior to posterior) thinner and more nearly united medially.

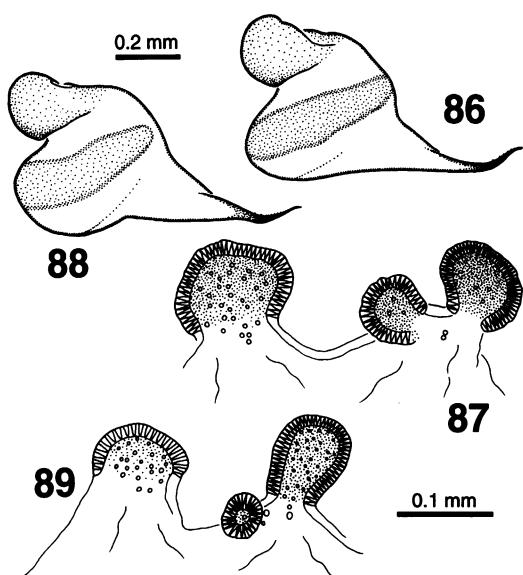
**DISTRIBUTION:** Known only from the type locality in southwestern Dominican Republic (map 1).

**MATERIAL EXAMINED:** Only the holotype.

*Ischnothele reggae* Coyle and Meigs  
Figures 2, 10, 26, 28–30, 43,  
48, 53, 86, 87; Map 1

*Ischnothele reggae* Coyle and Meigs, 1990: 106, figs. 1–4, 7–13, 18, 20, 22, 24, 25, 27–29 (male holotype and 12 female paratypes from road-banks in humid montane forest along road between Newcastle [3800 ft elev.] and Hardwar Gap [4000 ft elev.], St. Andrew Parish, Jamaica [Apr. 8, 1988], in AMNH, examined).

**DIAGNOSIS:** Males of *I. reggae* differ from those of all other *Ischnothele* species except



Figs. 86–89. *Ischnothele reggae*. 86. Holotype palpal organ, retrolateral-ventral view. 87. Right spermathecae, Whitfield Hall. 88, 89. *Ischnothele xera*. 88. Holotype palpal organ, retrolateral-ventral view. 89. Right spermathecae, paratype. Scale lines: 0.2 mm for figs. 86, 88; 0.1 mm for figs. 87, 89.

*I. xera*, its sister species, by the relatively short embolus, which is serrated and lacks thin keels (fig. 86). Females differ from those of all other *Ischnothele* species except *I. xera* by the distinctive spermathecae with vestigial stalks and heavily sclerotized bulbs (fig. 87). See Coyle and Meigs (1990) for a complete discussion and figures of the differences between *I. reggae* and *I. xera*. Males of *I. reggae* have a wider shorter tibia I apophysis [TAW(100)/TAL = 116–242 vs. 45–64] than do *I. xera* males, 0 or 1 spine on the prolateral surface of tarsus I (vs. 2 or 3 in *I. xera*), and 2 slender and gradually tapering spines on the prolateral surface of the palpal patella (in *I. xera* at least the more proximal of these patellar spines is stout and tapers suddenly to a very thin deciduous tip). *Ischnothele reggae* females are darker dorsally, usually have more retrolateral cheliceral teeth (9–12 vs. 7–9), and usually have higher values of OQW(100)/LSL3 (23–32 vs. 18–24) than do *I. xera* females.

MALES: Tables 5 and 7. See Coyle and Meigs (1990).

FEMALES: Table 6. See Coyle and Meigs (1990).

VARIATION: Five *I. reggae* males, all from the type locality, have been reared to adulthood since the species was first described (Coyle and Meigs, 1990); a note added in proof referred to two of these and the other three matured after publication. The character state values of these five specimens are included in the descriptive statistics of table 5. Although this larger sample increases the variation for several characters and reduces the gaps that exist between *I. reggae* and *I. xera* male samples for some of the diagnostically useful characters, these data are still consistent with the hypothesis that *I. reggae* and *I. xera* are different species.

DISTRIBUTION: Known from elevations above 1700 ft in the cockpit country of western Jamaica and above 3200 ft in the Blue Mountains of eastern Jamaica (map 1).

MATERIAL EXAMINED (since Coyle and Meigs, 1990): All from type locality; 3 ♂ reared from brood of 1 ♀ collected Apr. 8, 1988 (Coyle, Bennett, Robinson; AMNH); 2 males reared from juvs. collected May 1990 (D. Perlmutter, AMNH).

NATURAL HISTORY: See figures 2 and 10 and Coyle and Meigs (1990).

#### *Ischnothele xera* Coyle and Meigs

Figures 11, 32, 33, 88, 89; Map 1

*Ischnothele xera* Coyle and Meigs, 1990: 109, figs. 5–11, 14–17, 19, 21, 23, 24, 26, 30–35 (male holotype and one male and four female paratypes from cactus thorn scrub at Fort Clarence [20–100 ft elev.] and adjacent part of Hellshire Hills [20–200 ft elev.] near Seafort, St. Catherine Parish, Jamaica [Apr. 9, 1988], in AMNH, examined).

DIAGNOSIS: Males of *I. xera* differ from those of all other *Ischnothele* species except *I. reggae*, its sister species, by the proportionally short embolus, which is serrated and lacks thin keels (figs. 32, 33, 88). Females differ from those of all other *Ischnothele* species except *I. reggae* by the distinctive spermathecae with vestigial stalks and sclerotized bulbs (fig. 89). See *I. reggae* diagnosis for characters that distinguish *I. xera* from *I. reggae*. See Coyle and Meigs (1990) for a com-

plete discussion and figures of the differences between *I. xera* and *I. reggae*.

**MALES:** Tables 5 and 7. See Coyle and Meigs (1990).

**FEMALES:** Table 6. See Coyle and Meigs (1990).

**VARIATION:** One more *I. xera* male has been reared to adulthood since the species was first described (Coyle and Meigs, 1990). The character state values of this specimen are included in the descriptive statistics of table 5 and do not markedly increase the previously known variation range of *I. xera* for any characters.

**DISTRIBUTION:** Known only from two areas of low elevation along the south coast of eastern Jamaica (map 1).

**MATERIAL EXAMINED** (since Coyle and Meigs, 1990): One ♂ reared from juv. collected at the type locality on Apr. 9, 1988 (Coyle, Bennett, Robinson, AMNH).

**NATURAL HISTORY:** See figure 11, Coyle and Meigs (1990), and Coyle et al. (1991).

#### *Ischnothele digitata*

(O. P.-Cambridge)

Figures 90–104; Map 1

*Macrothele digitata* O. P.-Cambridge, 1892: 92, pl. XII, figs. 3a–3d (male lectotype, here designated, and one female and two juvenile paralectotypes from Guatemala, in BMNH, examined).

*Thelechoris digitata*: Simon, 1892: 184, 187.

*Ischnothele digitata*: F. O. P.-Cambridge, 1896: 764; 1897: 37, pl. II, figs. 8–8d. — Petrunkevitch, 1911: 357. — Lutz, 1915: 77 (in part). — Gertsch and Davis, 1937: 1. — Kraus, 1955: 30. — Platnick and Shadab, 1978: 4, 18.

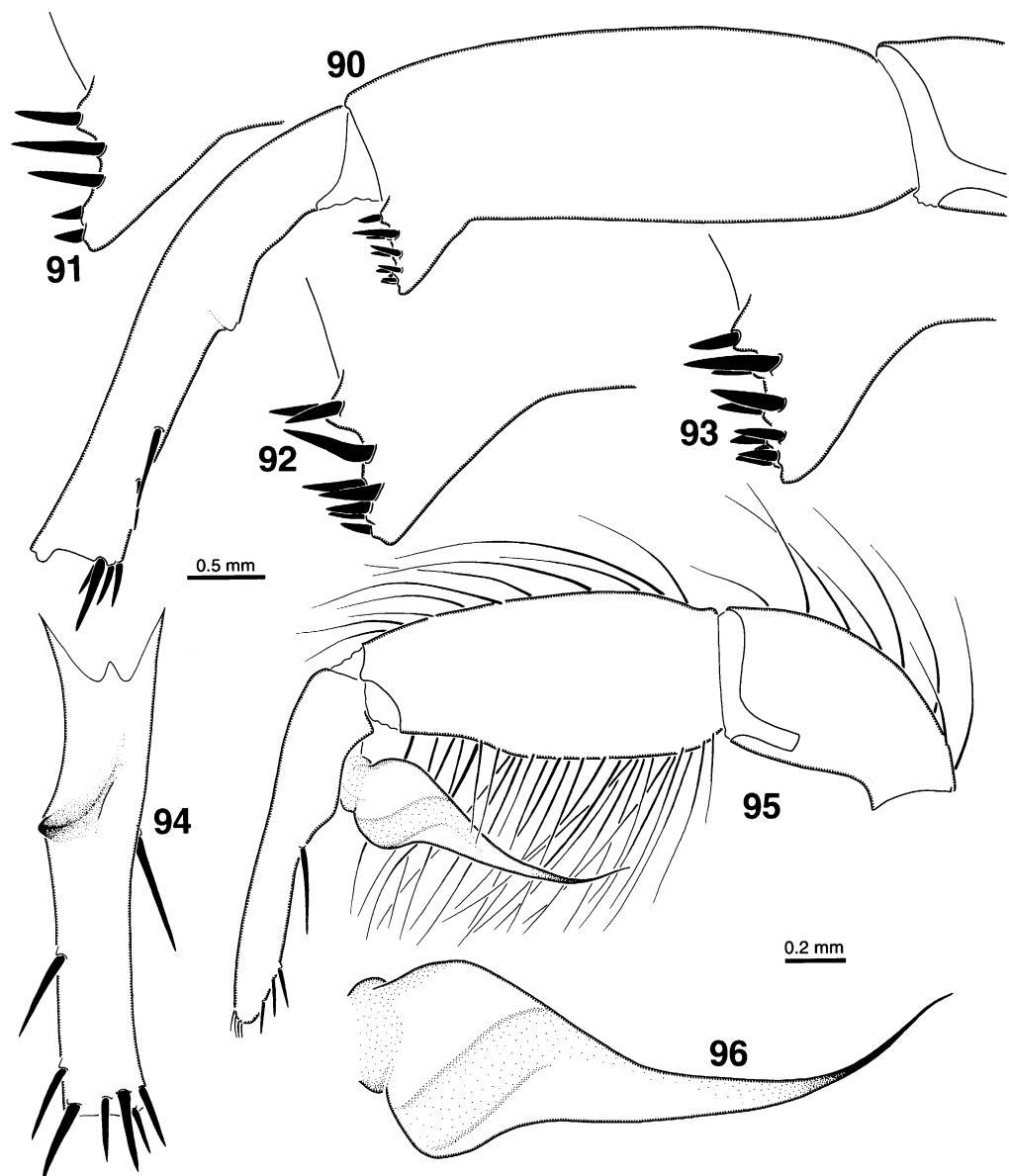
*Ischnothele ecuadorensis* Schmidt, 1956: 31 (young adult female holotype found in Mainz, Germany, banana cellar with bananas shipped from Ecuador[?], in Senckenberg Museum, no. 9850/1, examined). NEW SYNONYMY.

**DIAGNOSIS:** Males of *I. digitata* differ from those of all other *Ischnothele* species by the shape of the tibia I mating apophysis, which is wide at its base but with a short dorsal profile (figs. 90–93) [TAW(100)/TAL = 364–567 vs. 45–262] and by the absence of a pro-lateral prominence on the metatarsus I mating apophysis (figs. 90, 94). Males also differ from those of the Greater Antilles *Ischnothele* clade by the much longer embolus (fig. 96),

the absence of a distoventral longitudinal keel on tarsus I, and more cymbial apophysis spines (fig. 95) (CAS = 3–9 vs. 0–2). The palpal tibia (fig. 95) has a less prominent ventral swelling and is proportionally more slender [PTT(100)/PTL = 42–46] than that of males of the *goloboffi* species group [PTT(100)/PTL = 50–78]. Females of *I. digitata* have particularly distinctive spermathecae; no other *Ischnothele* species has four or more very weakly sclerotized spermathecae on each side (figs. 100–104).

**MALES:** Tables 5 and 7. Palpal organ (figs. 96–98) with long, gradually tapering embolus with terminal one-half slightly sinuous. Cymbial apophysis (fig. 95) with 3–9 spines; 6–18 stout bristles on tip. Palpal tibia (fig. 95) moderately swollen proximally; ventral profile of this swollen region rather flat; very long bristles and hairs on prolateral aspect of ventral surface. No spines on prolateral surface of palpal patella. Tibia I mating apophysis (figs. 90–93) wide at base and trianguloid; many strong, sharp, short to moderately long spines on distal (anterior) face. Metatarsus I (figs. 90, 94) proximally with low ventral apophysis that distally expands and turns retro-laterally, forming robust angular retro-lateral prominence just short of metatarsus mid-point; cluster of 5–11 spines at distal end of metatarsus. Tarsus I flexible. One (rarely one and a half) pair of rather weak foveal bristles. Carapace tan to light orange-brown; chelicerae like carapace or darker orange-brown; pedipalps and legs pale tan to light orange-brown, darker at distal ends of tibiae and especially metatarsi; abdominal dorsum (fig. 99) medium to dark brown with anterior pair of small, faint pale spots followed by 6–7 pairs of pale oblique stripes forming incomplete (anterior pairs) or complete (posterior pairs) chevrons; crescent-shaped area of dark pigment on median edge of each posterior book lung cover.

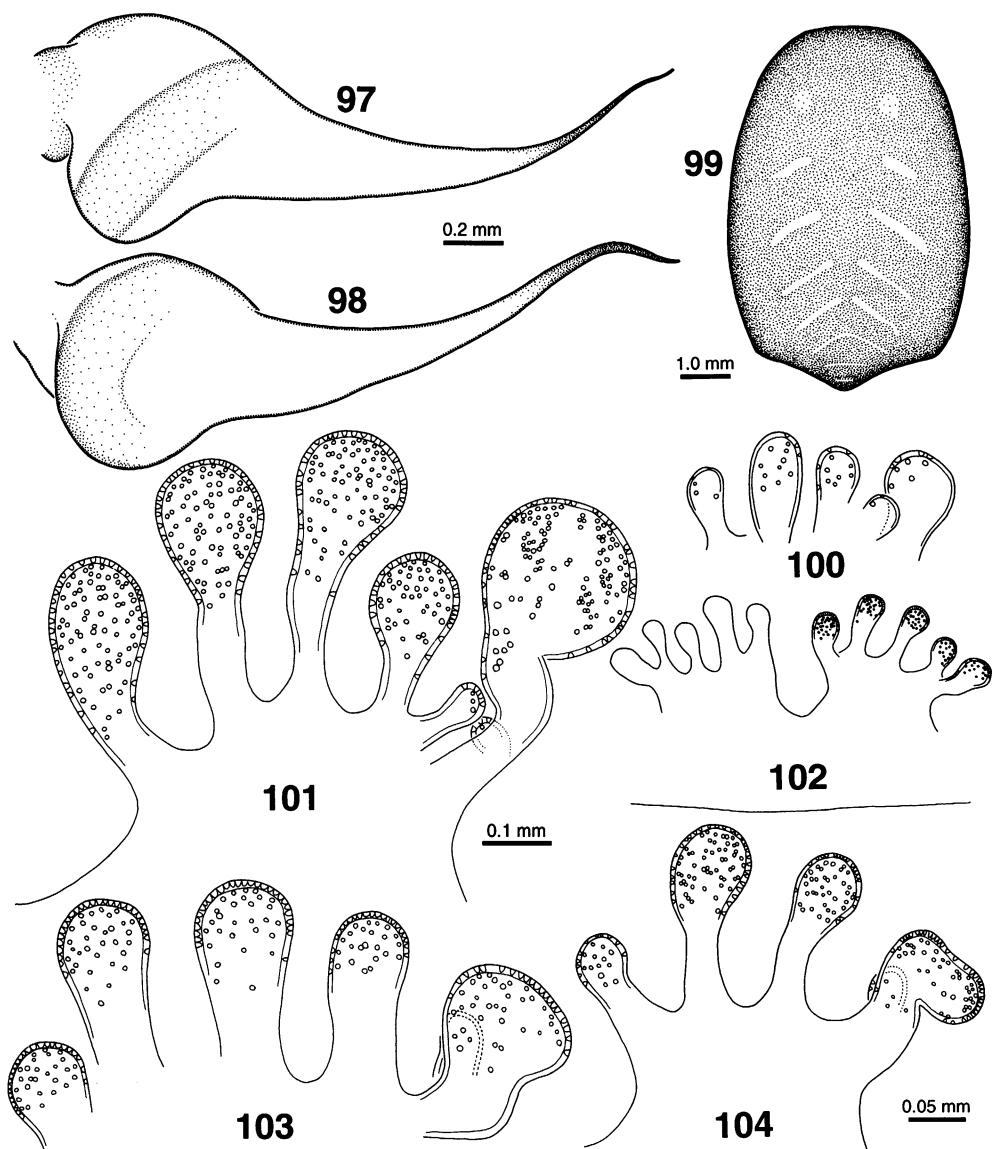
**FEMALES:** Table 6. Four to 6 spermathecae per side (occasionally 1 or 2 additional very small ones budding off stalks of lateralmost spermathecae) (figs. 100–104); stalks straight to slightly sinuous, unsclerotized; bulbs unsclerotized to weakly sclerotized; pores confined to bulbs and distalmost part of stalks; lateralmost spermatheca the largest. One (rarely one and a half) pair of foveal bristles.



Figs. 90–96. *Ischnothele digitata* males. 90. Tibia and metatarsus I, retrolateral view, lectotype. 91–93. Tibia I apophysis. 91. Trece Aguas, Guatemala. 92. Santa Rosa, Veracruz, Mexico. 93. Lectotype. 94. Metatarsus I, ventral view, Santa Rosa, Mexico. 95. Lectotype pedipalp, retrolateral view. 96. Lectotype palpal organ, retrolateral-ventral view. Scale lines: 0.5 mm for figs. 90, 94, 95; 0.2 mm for figs. 91–93, 96.

Carapace tan to moderately dark red-brown; chelicerae usually darker than carapace (medium orange-brown to dark red-brown); pedipalps and legs tan to medium orange-brown with areas of dark pigment at distal ends of

tibiae and metatarsi and usually at distal ends of patellae and near proximal ends of tibiae and often around bases of larger bristles and spines; abdominal dorsum light brown to rather dark purple-brown with pale markings



Figs. 97–104. *Ischnothele digitata*. 97–99. Males from Santa Rosa, Veracruz, Mexico. 97, 98. Palpal organ. 97. Retrolateral-ventral view. 98. Ventral view. 99. Abdominal dorsum. 100, 101. Right spermathecae. 100. *Ischnothele ecuadorensis* holotype. 101. 16 mi E Cintalpa, Chiapas, Mexico. 102. All spermathecae, Livingston, Guatemala. 103, 104. Right spermathecae. 103. Paralectotype. 104. Balneario, Quintana Roo, Mexico. Scale lines: 0.2 mm for figs. 97, 98, 102; 1.0 mm for fig. 99; 0.1 mm for figs. 101, 103; 0.05 mm for figs. 100, 104.

as in males but less pronounced; dark crescent on each posterior book lung cover as in males.

**VARIATION:** There is no marked discontinuous or clinal variation in either the male or female samples of *I. digitata* except for the unusually small and widely separated AMEs

of the male from Copán, Honduras (AMD = 0.20, AMS = 0.33).

**REMARKS:** Schmidt (1956) stated that the small-bodied (CL = 3.12) holotype of *I. ecuadorensis* was a juvenile female, but it has spermathecae that may be functional (fig. 100). These spermathecae and all other char-

acters I have examined indicate that this is a specimen of *I. digitata*. Schmidt's claim that it has many fewer cheliceral teeth than *I. digitata* is erroneous. Presumably this specimen was transported to the German cellar (where it was collected) not, as Schmidt claimed, on Ecuadorian bananas, but instead on bananas from northern Central America.

**DISTRIBUTION:** From Veracruz in southern Mexico east and south to El Salvador (map 1).

**MATERIAL EXAMINED:** **BELIZE:** Stann Cr. District, Sittee R., Possum Point Biol. Station, in coconut palm, Jan. 4, 1992 (G. Stratton, AMNH), 1 ♀, 1 juv. **EL SALVADOR:** San Salvador, Jan.–Mar. 1954 (J. Boursot, AMNH), 2 ♀, juvs. **GUATEMALA:** No specific locality or date (Sarg, HEC B113, B115), 1 ♂, 7 ♀, 1 juv.; Alta Verapaz, Lanquin, near gruta, Feb. 5, 1980 (B. and V. Roth, AMNH), 3 ♀, juvs.; Cacao, Trece Aguas, Oct. 1905 (USNM), 1 ♂; El Petén, Tikal, 500 ft elev., Oct. 7–11, 1977 (M. Bentzien, UCB), 2 ♀, juvs., Aug. 9–11, 1979 (C. Griswold, CGC), juvs.; 40 mi SE Guatemala City, Jan. 16, 1976 (V. Roth, AMNH), 1 ♀; Izabal, Livingston, Dec. 25, 1979 (C. Gold, UCB), 1 ♀; Izabal, Ruinas de Quirigua, Oct. 12, 1977 (M. Bentzien, UCB), 1 ♀, juvs.; Olas de Yoca, Solola, Mar. 1945 (H. Elishewitz, AMNH), 1 ♂; San José, May 16, 1951 (CAS), juv.; Tucuru, July 12–13, 1947 (C. and P. Vaurie, AMNH), juv. **HONDURAS:** Copan, 1939 (R. Chamberlin, AMNH), 1 ♂, Mar. 1939 (AMNH), 2 ♀, juvs., sweeping weeds, Feb. 15, 1937 (MCZ), juvs. **MEXICO:** **Chiapas:** 10 km N Arriaga, 305 m elev., Aug. 23, 1972 (C. Mullinex, K. Lucas; CAS), juv.; Chiapa, Sept. 6, 1947 (H. Wagner, AMNH), juv.; Cintalpa, Sept. 17, 1947 (H. Wagner, AMNH), juvs.; 16 mi E Cintalpa on rt. 190, 800 m elev., June 15, 1982 (F. Coyle, AMNH), 2 ♀; Finca Santa Marta, near Huehuetan, July 31, 1950 (C. and M. Goodnight, AMNH), 2 ♂, 2 ♀; Huixtla, Jan. 26, 1945 (T. Schneirla, AMNH), 1 ♂; 8 km NE Huixtla, 225 m elev., Sept. 1, 1980 (E. Ross, CAS), 1 ♀; La Zacualpa, July–Aug. 1909 (A. Petrunkevitch, AMNH), 2 ♂, 4 ♀; 5 mi SE Palenque, Mizola Waterfall, Jan. 14, 1980 (B. and V. Roth, AMNH), 1 ♀; Tapachula, July–Aug. 1909 (A. Petrunkevitch, AMNH), 3 ♀; 8.2 mi from Tapachula by road to N. Alemania, 1800 ft elev., May 8, 1977

(R. Seib, CAS), 1 ♀; 25 km SE Tonola, by creek, Feb. 21, 1980 (B. and V. Roth, AMNH), 1 ♀; Tuxtla Gutiérrez, Aug. 20, 1966 (J. and W. Ivie, AMNH), juv. **Oaxaca:** Cueva de Juan Sánchez, 12 km NW Acatlán, Dec. 20, 1976 (Reddell, Grubbs, Soileau, AMNH), juv.; Playa Hati, Río Tonto, July 27, 1946 (H. Wagner, AMNH), juv.; Temascal, in rotten planking of half-sunk barge, Apr. 6, 1967 (W. Peck, MCZ), 1 ♀. **Quintana Roo:** Balneario, 4 mi S Ucum, 18°27'N, 88°31'W, Feb. 9, 1984 (B. and V. Roth, AMNH), 1 ♀. **Tabsco:** Boca del Cerro, Mar. 1945 (M. Guerra, AMNH), 1 ♀. **Veracruz:** 4 mi NE Acayucan, Apr. 27, 1963 (Gertsch, Ivie; AMNH), juv.; Alvarado, July 17, 1946 (H. Wagner, AMNH), 1 ♀, 2 juvs.; 7.5 km W Catemaco on rt. 180 and 2 km S to holding pond, 400 m elev., June 23, 1982 (Coyle, AMNH), 2 ♀; W side Coatzacoalcos, 18°09'N, 94°26'W, Aug. 11, 1966 (J. and W. Ivie, AMNH), juvs.; Cordoba, Jan. 20, 1946 (H. Wagner, AMNH), juv.; Franca Vieja, Aug. 1944 (M. Guerra, AMNH), 1 ♀; La Buena Ventura, Santa Rosa, July 16, 1909 (A. Petrunkevitch, AMNH), 2 ♂, 4 ♀; Los Cocos, July–Aug. 1909 (A. Petrunkevitch, AMNH), 2 ♂, 4 ♀; Medias Aguas (Crawford, MCZ), 2 ♂, 2 ♀; San Cristobal, July 20–21, 1946 (H. Wagner, AMNH), 1 ♀; Peñuela, 18°53'N, 96°48'W, Apr. 26, 1963 (Gertsch, Ivie; AMNH), 2 ♀, juvs.; Potrero, Nov. 12, 1941 (C. Bolívar, F. Bonet; AMNH), juv.; 23 mi SE San Andrés Tuxtla, July 6, 1963 (J. Beatty, F. Coyle; AMNH), 2 ♀, juv.; **Yucatan:** Chichenitza, July 8, 1948 (C. Goodnight, AMNH), juvs., Feb. 15–18, 1939 (Chamberlin, AMNH), juvs.; 2 km E Chichenitza, 20 m elev., forest litter, July 20, 1983 (S. and J. Peck, AMNH), juvs.; Tekax, Xmahit Cave, July 31, 1936 (A. Pearse, AMNH), juv.

**NATURAL HISTORY:** This species appears to be restricted to elevations below 1000 m. In Mexico I found several *I. digitata* webs on roadbanks on the edge of second growth forests near Catemaco, Veracruz, and Cintalpa, Chiapas. One roadbank was a limestone roadcut with exposed roots and some herbs and shrubs; the other was a steep but firm soil bank with less vegetation. The retreat tubes, which extended as far as 23 cm into crevices or holes in the banks, typically opened out onto the exposed capture web via

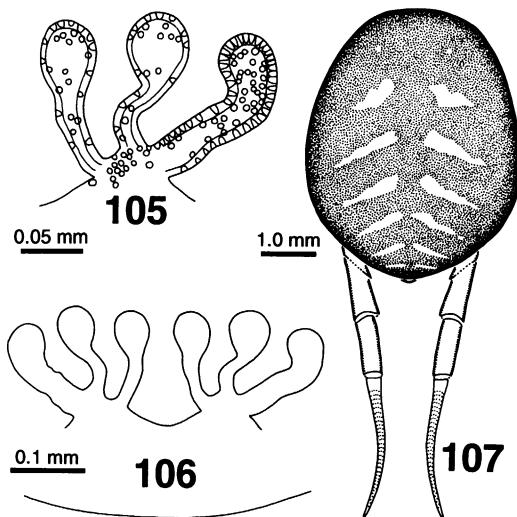
two or three divergent access tunnels penetrating the complex of curtains and oblique sheets forming the three-dimensional core of the exposed web. Radiating fanlike out from this tangled core for up to 15–20 cm was a more or less horizontal capture sheet attached to roots, branches, and bank surfaces (fig. 10.6 in Coyle, 1986). Typically some lines extended up to 30 cm vertically from the capture web to attachment points above. A population observed on the coast of Belize frequented palm trees (including coconut and cahoon palms); some trees harbored as many as a dozen or more webs (G. Stratton, personal commun.).

The kleptoparasitic mysmenid spider, *Mysmenopsis palpalis* (Kraus), frequents *I. digitata* webs. Hans Peters found *M. palpalis* males and females with egg sacs living in *I. digitata* webs at Copán, Honduras (Kraus, 1955). The *M. palpalis* specimens examined by Platnick and Shadab (1978) were collected by Petrunkevitch in the same places (Tlapachula, Chiapas, and La Buena Ventura, Veracruz) and dates, and therefore probably the same webs, as the *I. digitata* specimens I have examined. In portions of two *I. digitata* webs collected near Cintalpa, Chiapas, I found two probable symbionts, a juvenile *Scytodes* sp. and a dermestid beetle larva (in the host's prey remains). Prey remains included exoskeletal parts of one hemipteran, two lepidoptera larvae, and several beetle and ant species.

At Cintalpa on June 15, two webs contained egg sacs containing only recently hatched, unpigmented, second postembryonic stage spiderlings (57 spiderlings in one sac and 135 in the other) and another web contained active, pigmented, third postembryonic stage spiderlings, most of which had emerged from the egg sac. Eight of the 11 males with sufficient collection date data were collected between late July and the end of August.

***Ischnothele huambisa*, new species**  
Figures 105–107; Map 3

**TYPES:** Female holotype from Falso Paquisha, Alto Río Comaina, at an elevation of 800 m in the Cordillera del Cóndor, Ama-



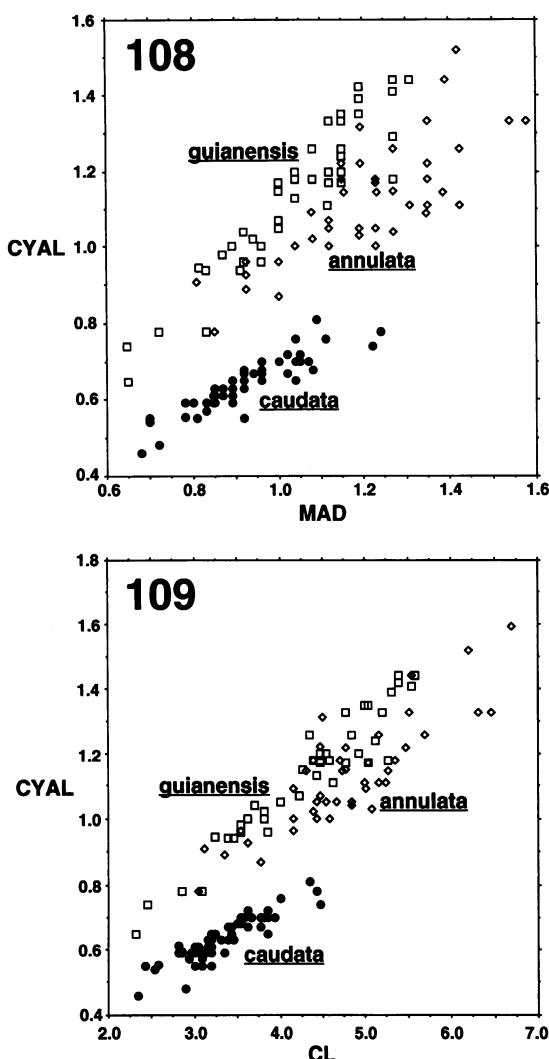
Figs. 105–107. *Ischnothele huambisa* holotype. 105. Right spermathecae. 106. All spermathecae. 107. Abdominal dorsum and spinnerets.

zonas, Peru (Oct. 28, 1987; D. Silva), deposited in MHNL.

**ETYMOLOGY:** The specific name is derived from the Huambisa Indian tribe of northwestern Peru.

**DIAGNOSIS:** The female of *I. huambisa* is distinguished from those of all other South American *Ischnothele* species by (1) its spermathecae, which consist of three weakly sclerotized stalk/bulb units per side (figs. 105, 106), (2) relatively long carapace edge setae [CS(100)/CW = 14.5 vs. 4.0–12.3], (3) a proportionally long leg I [ITL(100)/CL = 51 vs. 40–50], (4) proportionally large AMEs [AMD(100)/CL = 4.9 vs. 2.6–4.9], and (5) a more anterior ocular lobe (OL = 0.00 vs. –0.24–0.00).

**FEMALE:** Tables 6 and 7. Three spermathecae per side (figs. 105, 106); stalks rather weakly sclerotized, straight to weakly sinuous; lateral spermatheca more sclerotized, with more pores, its stalk wider, and its bulb no wider than the two median spermathecae. One pair of long strong foveal bristles. Carapace tan to medium brown, darkest centrally and near lateral edges; chelicerae tan; legs and pedipalps light tan with gray-brown rings prominent on distal ends of patellae, tibiae, and metatarsi, less so near proximal ends of tibiae and metatarsi; abdominal dor-



Figs. 108, 109. Scattergrams of male characters that distinguish *Ischnothele caudata* from *Ischnothele guianensis* and *Ischnothele annulata*. Measurements in mm. 108. CYAL plotted against MAD. 109. CYAL plotted against CL.

sum (fig. 107) purple-brown with longitudinal series of 7 pairs prominent oblique white marks, last 4 of which are nearly joined medially to form chevrons. Median  $\frac{1}{3}$  of posterior book lung cover pigmented.

**DISTRIBUTION:** Known only from the type locality near the western edge of the Amazon Basin in northwestern Peru (map 3).

**MATERIAL EXAMINED:** Only the holotype.

**NATURAL HISTORY:** The holotype was collected in the understory of undisturbed mid-

elevation rainforest (in the transition zone between lowland rainforest and cloud forest) (D. Silva, personal commun.).

*Ischnothele caudata* Ausserer  
Figures 12, 14–19, 34, 108–137;  
Map 2

*Ischnothele caudata* Ausserer, 1875: 163 (female holotype from Yucatan, Mexico, in BMNH, examined). — Simon, 1891a: 328; 1892: 187. — Pocock, 1895: 224. — F. O. P.-Cambridge, 1896: 762; 1897: 37. — Raven, 1985a: 77.

*Entomothele pusilla* Simon, 1889b: 190 (male lectotype, here designated, and female paralectotype from Orinoco, Venezuela, in MNHN, examined); 1892: 188. NEW SYNONYMY.

*Thelechoris zebrina* Simon, 1891a: 329 (juvenile male holotype from El Polvón, Nicaragua, in MNHN, examined). 1892: 187. NEW SYNONYMY.

*Ischnothele pusilla*: F. O. P.-Cambridge, 1896: 764. — Vellard, 1945: 199.

*Ischnothele zebrina*: F. O. P.-Cambridge, 1896: 764; 1897: 37.

*Ischnothele guianensis* (or *guyanensis*) (misidentification): Simon, 1891b: 551. — F. O. P.-Cambridge, 1896: 762; 1897: 37 (in part). — Banks, 1909: 195. — Mello-Leitão, 1923: 85 (in part). — Petrunkevitch, 1925: 65. — Banks, 1929: 54. — Bücherl, 1967: 117 (in part). — Platnick and Shadab, 1978: 5. — Vollrath, 1978: 351. — Nentwig and Wissel, 1986: 595. — Strohmenger and Nentwig, 1987: 10. — Jantschke and Nentwig, 1987: 315. — Coyle and Ketner, 1990: 103 (in part).

*Thelechoris funesta* Fischel, 1927: 61, figs. 1–3 (male holotype from Maracay or Caracas, Venezuela, probably lost). NEW SYNONYMY.

*Thelechoris obtusa* Fischel, 1927: 63, figs. 4–6 (male holotype from Maracay or Caracas, Venezuela, probably lost). NEW SYNONYMY.

*Ischnothele sexpunctata* Bücherl et al., 1971: 123, figs. 17, 18 (three female syntypes from Bogotá, Colombia, in MNRJ, no. 1035, examined). — Mello-Leitão, 1941: 237 (nomen nudum). NEW SYNONYMY.

**DIAGNOSIS:** Males of *I. caudata* are most clearly distinguished from males of its closest relatives, *I. guianensis* and *I. annulata*, by a proportionally short cymbial apophysis, a relatively long MAD, and a proportionally wide palpal tibia (figs. 108, 109, 111–120). Consequently, the following ratios (particularly the first) are diagnostic: (1) CYAL(100)/MAD = 60–79 ( $69.7 \pm 3.8$ ) vs. 93–119 (109.3

$\pm 6.5$ ) for *I. guianensis* and 78–112 ( $93.3 \pm 8.6$ ) for *I. annulata*; (2) CYAL(100)/CL = 17–23 vs. 22–30 for *I. guianensis* and 20–29 for *I. annulata*; (3) CYAL(100)/PTT = 71–97 ( $83.2 \pm 4.6$ ) vs. 103–146 ( $123.5 \pm 7.5$ ) for *I. guianensis* and 90–118 ( $102.3 \pm 6.6$ ) for *I. annulata*. Unlike all other *Ischnothele* species, males of *I. caudata* and its two closest relatives have a large number of spines pro-laterally on tarsus I (TSP = 4–38 vs. 0–4 for all other *Ischnothele* species) and tarsus I is not pseudosegmented. *Ischnothele caudata* females have distinctive spermathecae (figs. 123–133) that differ from those of *I. guianensis* and *I. annulata* by the presence of a median shoulder at the base of the stalk of each lateral spermatheca and by the relatively short median spermathecae in combination with the relatively broad bulb on each lateral spermatheca (fig. 110); MH/LBD = 1.09–1.83 ( $1.45 \pm 0.17$ ) ( $N = 78$ ) vs. 1.76–2.68 ( $2.28 \pm 0.25$ ) ( $N = 50$ ) for *I. guianensis* and 1.75–3.00 ( $2.26 \pm 0.26$ ) ( $N = 64$ ) for *I. annulata*. Almost all examined females of *I. caudata* have proportionally more CDR than do *I. annulata* females; CDR(100)/CL = 120–435 ( $260 \pm 82$ ) vs. 0–174 ( $76 \pm 50$ ).

**MALES:** Table 5. Palpal organ (figs. 119, 121) with bulb narrowing rather abruptly to base of sinuous embolus, which curves strongly at base in retro-lateral and dorsal direction and, more distally, curves less strongly back toward pro-lateral. Cymbial apophysis (figs. 118, 120) with 0–3 pro-lateral and 1–3 retro-lateral spines; 3–11 stout bristles on very tip. Palpal tibia (figs. 118, 120) with strong ventral swelling; relatively short bristles ventrally on distal  $\frac{2}{3}$  of tibia. No pro-lateral spines on palpal patella. Tibia I apophysis (figs. 111–117) moderately long, with distal face more or less vertical and 3–6 strong sharp spines in row along distal face; proximal spines moderately long, distal ones much shorter. Metatarsus I (figs. 111–113) with ventral apophysis at or just proximal of midpoint; apophysis with thick rounded retro-lateral prominence and thinner pro-lateral prominence with pointed tip; 2–5 (usually 3) spines at distal end of metatarsus. Tarsus I not flexible. One (rarely 1.5) pair strong foveal bristles. Color of living male from Cerro Galera, Panama: Carapace very dark gray-brown with broad diffuse patches of long white recum-

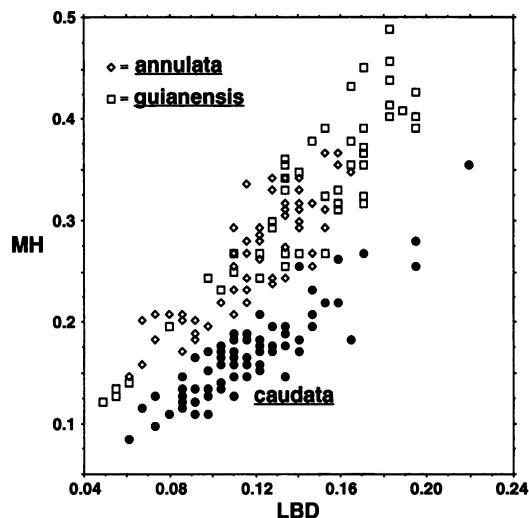
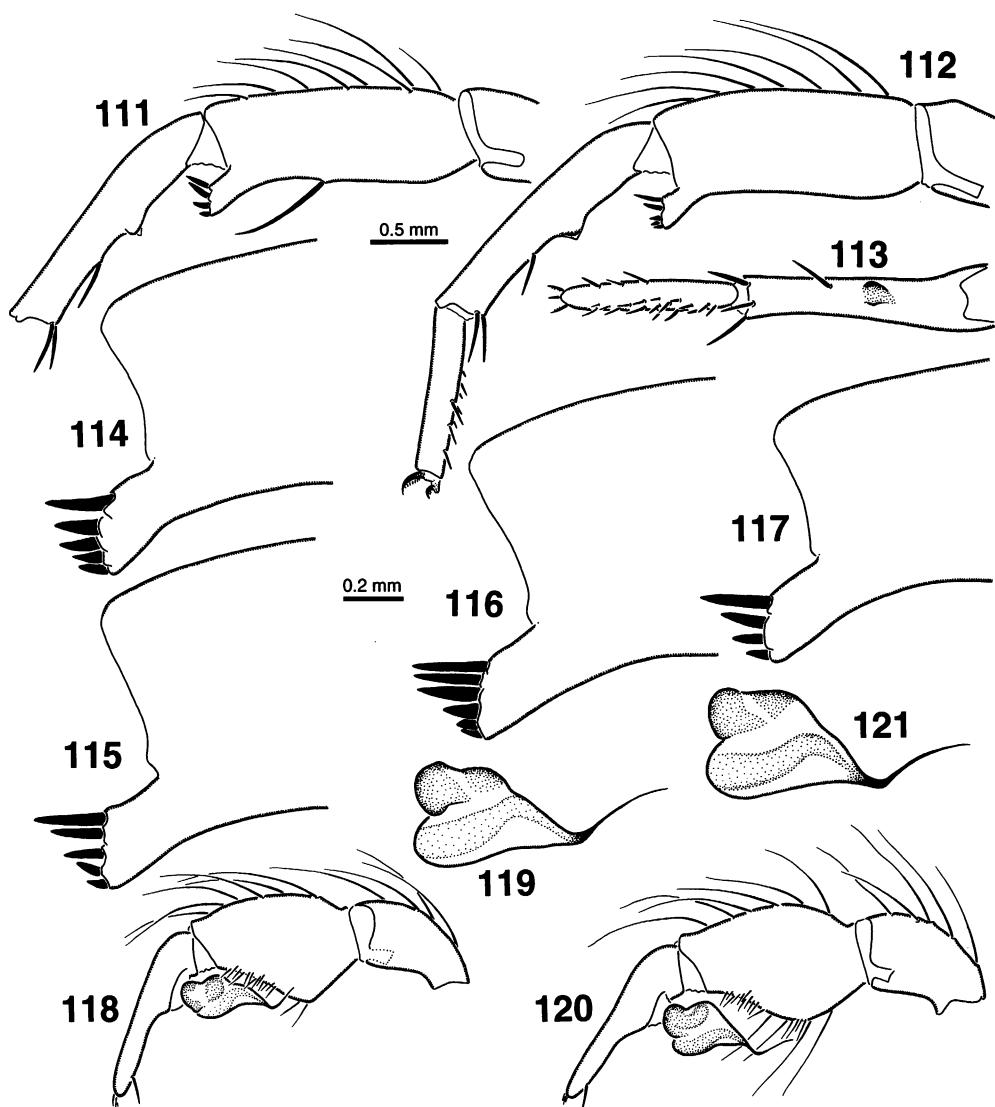


Fig. 110. Scattergram of MH plotted against LBD, spermathecal measurements that help distinguish *Ischnothele caudata* females from those of *Ischnothele guianensis* and *Ischnothele annulata*. Measurements in mm.

bent hairs occupying outer half of each side of carapace; chelicerae, pedipalps, and legs (femora, patellae, and tibiae) dark gray-brown like carapace, metatarsi and tarsi of legs lighter medium brown; abdominal dorsum with prominent white median longitudinal pattern (large anterior median rounded spot connected to and followed by series of 5 chevrons) created primarily by dense patches of recumbent white hairs. After preservation, the white pattern on the abdomen of this male became duller and less conspicuous. Preserved males colored like females (figs. 134–137).

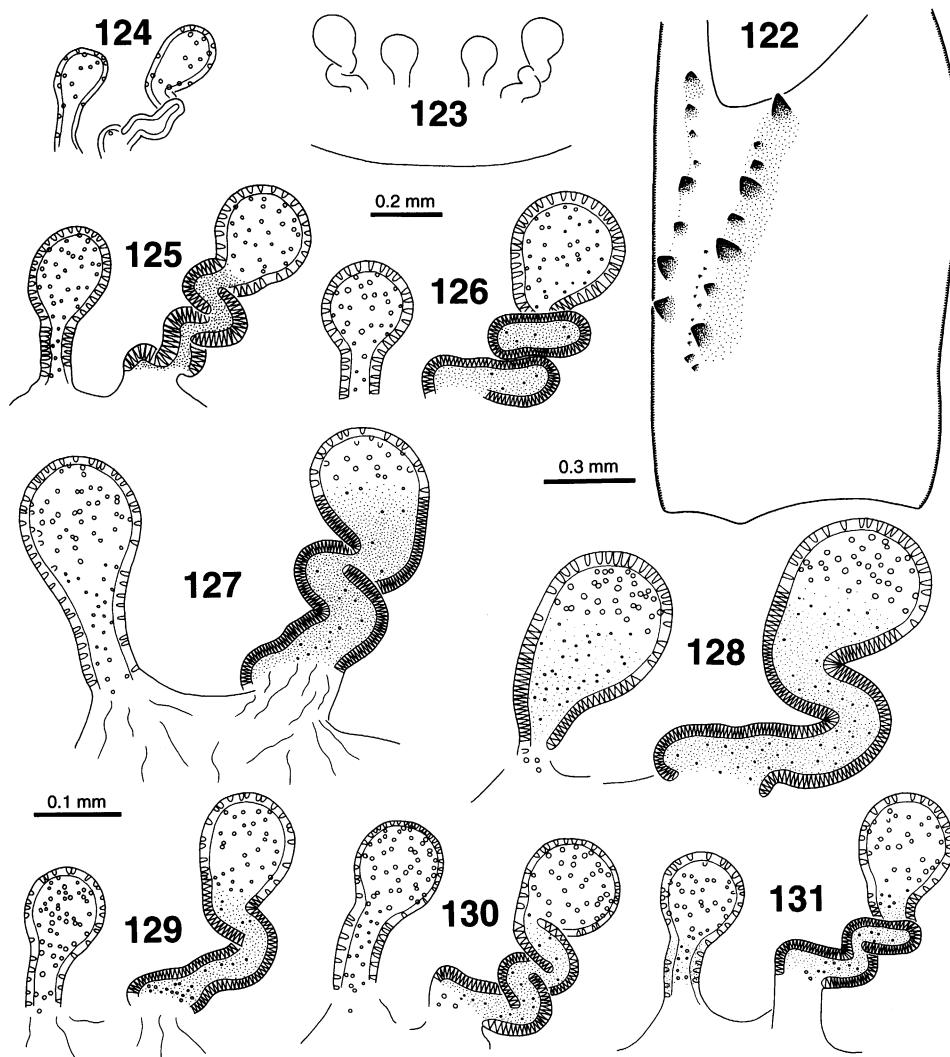
**FEMALES:** Tables 6 and 7. Two spermathecae per side (figs. 123–133); stalks weakly to moderately sclerotized, at least distal  $\frac{2}{3}$  of each bulb unsclerotized; median spermatheca relatively short, usually with straight stalk making rather abrupt transition to bulb; lateral spermatheca with longer, coiled (or strongly sinuous), usually more sclerotized, stalk with median shoulder at its base, and with relatively large spherical bulb. Foveal bristles as in males. Color of preserved specimens (figs. 134–137): (The pigment-poor areas of the dorsal abdominal body wall usually are smaller than the area covered by recumbent white hairs.) Carapace and chelicerae



Figs. 111–121. *Ischnothele caudata* males. 111, 112. Leg I, retrolateral view. 111. *Entomothele pusilla* lectotype. 112. Cerro Galera, Canal Zone, Panama. 113. Metatarsus and tarsus I, ventral view, Cerro Galera, Panama. 114–117. Tibia I apophysis, retrolateral view. 114. SIMLA, Trinidad. 115. Santa Rosa National Park, Guanacaste, Costa Rica. 116. San Pablo to San Pedro, Cesar, Colombia. 117. 150 km NE Barrancas, Mexico. 118, 119. *E. pusilla* lectotype. 118. Pedipalp, retrolateral view. 119. Palpal organ, retrolateral-ventral view. 120, 121. Cerro Galera, Panama. 120. Pedipalp, retrolateral view. 121. Palpal organ, retrolateral-ventral view. Scale lines: 0.5 mm for figs. 111–113, 118, 120; 0.2 mm for figs. 114–117, 119, 121.

orange-tan to dark chestnut-brown; legs and pedipalps tan to dark red-brown, dark bands (rings) usually on distal end of patellae and proximal and distal ends of tibiae and metatarsi; abdominal dorsum light brown to dark purple-brown with anterior median patch of

dense white hairs followed by very faint to prominent median longitudinal strip of similar white hairs and 4 to 6 pairs of oblique white or cream pigment-poor spots or lines in the body wall that are often marked also by white hairs, third pair (sometimes) and

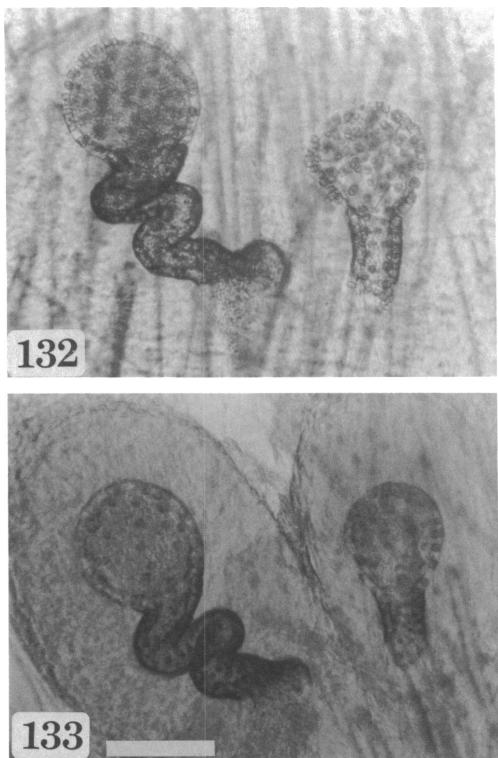


Figs. 122-131. *Ischnothele caudata* females. 122. Teeth on left chelicera, ventral view, San Pablo to San Pedro, Cesar, Colombia. 123. All spermathecae, *Ischnothele sexpunctata* syntype. 124-131. Right spermathecae. 124. *Entomothele pusilla* paralectotype. 125. Holotype. 126. Mérida, Mérida, Venezuela. 127. David, Chiriquí, Panama. 128. Santo Tomás, Guanacaste, Costa Rica. 129. California, Trinidad. 130. Mt. Pichincha, Ecuador. 131. Parita, Puntarenas, Costa Rica. Scale lines: 0.3 mm for fig. 122; 0.2 mm for fig. 123; 0.1 mm for figs. 124-131.

more posterior pairs (almost always) joined medially to form chevrons, but these may be very faint; roughly crescent-shaped area of dark pigment on median  $\frac{1}{5}$  to  $\frac{1}{2}$  of posterior book lung covers.

**VARIATION:** There is no marked geographic variation in any quantitative character examined. Preserved specimens from Mexico

southeast to Costa Rica tend to have the median longitudinal strip of white hair on the abdominal dorsum (and often the paired pale spots/lines) very poorly developed (fig. 134); in Panama these markings are more prominent (fig. 135), and in northern South America and the Lesser Antilles these marks are even more prominent (figs. 136, 137), occa-

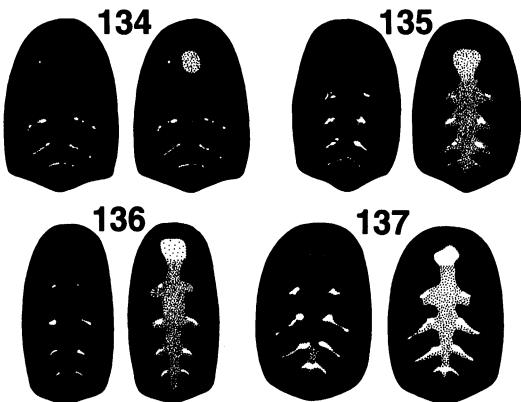


Figs. 132, 133. *Ischnothele caudata*, left spermathecae. 132. Curumani, César, Colombia. 133. Uaxactún, Petén, Guatemala. Scale bar 0.1 mm for both figures.

sionally resembling closely the pattern of *I. guianensis*. Variation in spermathecal form is moderate and continuous (figs. 123–133).

**REMARKS:** The holotype of *I. caudata*, which is impaled on an insect pin in alcohol, is not accompanied by any label with locality, collector, or date information. It matches Ausserer's (1875) brief description except that there are no "small humps" (cuspules?) on the labium. Ausserer probably mistook the bases of broken hairs for cuspules. The holotype's spermathecae are illustrated in figure 125.

The specimens of *E. pusilla* labeled as syntypes (and designated by me as lectotype and paralectotype) (figs. 111, 118, 119, 124) are much smaller than the dimensions given by Simon (1889b). Simon (1889b) lists three collecting localities in Venezuela (Caracas, Puerto Cabello, and Valencia), but the label (in Simon's handwriting) accompanying the types



Figs. 134–137. *Ischnothele caudata*, dorsal abdominal color patterns of four preserved specimens. For each specimen, left drawing shows only body wall pigment pattern and right drawing shows overall pattern resulting from hairs and body wall pigmentation. Background color, which varies from light to dark brown, shown in black. 134. Tikal, Petén, Guatemala. 135. Cerro Galera, Canal Zone, Panama. 136. Puerto Lleras, Meta, Colombia. 137. Buccoo Bay, Tobago.

includes only the designation "Orinoco (Chauff.)."

The holotype of *T. zebra*, which Simon (1891a) identified as a female, lacks a genital opening and has slightly swollen pedipalpal tarsi; it is probably a penultimate male. Its size, color pattern, and locality indicate that it is conspecific with *I. caudata*.

Regrettably, the types of Fischel's (1927) *T. funesta* and *T. obtusa*, which were presumably deposited in the Munich Zoological Collection, have apparently been lost. Fortunately there are enough details in portions of Fischel's description and drawings (particularly figs. 2 and 5 of the first legs) to confidently conclude that his specimens (only males) are conspecific with *I. caudata*.

As explained by Brignoli (1983), Mello-Leitão (1941) intended to publish a description of *I. sexpunctata* but somehow failed to do so. Bücherl et al. (1971) subsequently described the species but apparently based their description (in part, at least) on a specimen that is not included among the syntypes and is not even an *Ischnothele*! The spermathecae they describe (Bücherl et al., 1971: fig. 18) do not resemble those of the three syntypes that



Map 2. Central and South America, showing distribution of *Ischnothele caudata*, *I. guianensis*, and *I. annulata*.

I examined (fig. 123) nor those of any other species of *Ischnothele*. These syntypes (which, unfortunately, are highly fragmented) are similar to all other *I. caudata* females I have examined.

**DISTRIBUTION:** Yucatan Peninsula south and east through Central America and throughout much of northern South America north of the Amazon Basin and east into the Lesser Antilles (map 2). There is only one Amazon Basin site where *I. caudata* is known to live, on Maracá Island in the state of Roraima, Brasil, about 60 miles south of Venezuela in a region dominated by grassland

and gallery forest at the northern edge of the Amazon Basin.

**MATERIAL EXAMINED:** **BRASIL:** Roraima: Maracá Island on the Urariquera R., Mar. 26, 1987 (A. Lise, PAM), 2 ♀. **COLOMBIA:** Cesar: Curumani, beating dry banana leaves, July 22, 1968 (B. Malkin, AMNH), 1 ♀; Sierra Nevada de Santa Marta, San Pablo to San Pedro, 2200 ft elev., Feb. 3, 1974 (J. Kochalka, JKC), 2 ♂, 5 ♀, juvs.; 1000 ft elev., Feb. 4, 1974 (J. Kochalka, JKC), 2 ♀; 500 ft elev., Feb. 2, 1974 (J. Kochalka, JKC), 1 ♀; north stream between Cerros Chivola and Chumchuruba, 3700 ft elev., Mar. 8, 1974

(J. Kochalka, JKC), 4 ♂, 2 ♀, juvs.; Serachui, 5300 ft elev., Mar. 4, 1974 (J. Kochalka, JKC), 1 ♀; South Cerro Juaneta, 6000 ft elev., Mar. 6, 1974 (J. Kochalka, JKC); juvs.; Valledupar, 450 ft elev., Dec. 25, 1973 (J. Kochalka, JKC), 1 ♀. **Cundinamarca:** Near highway below Finca Bella Vista, near Sasaima, Mar. 21 and Apr. 17, 1965 (P. Craig, J. Robb; CAS), 8 females, juvs.; W of Sasaima, 5350 ft elev., on steep bank in funnel webs, May 7, 1965 (P. Craig, CAS), 3 ♀. **Meta:** Carimagua, 100 m elev., Oct. 1973 (W. Eberhard, MCZ), 2 ♀; Finca Chenevo, ca. 20 km N Río Muco and 20 km S El Porvenir, ca. 170 m elev. (MCZ), 1 ♀; Puerto Lleras, Lomalinda, 3°18'N, 73°22'W, ca. 300 m elev., grassland with patches of jungle, woods, and marsh, Sept. 26, 1985 (Carroll, AMNH), 1 ♂; from sheet-web on fallen log, Dec. 18, 1985 (Carroll, AMNH), 1 ♂; indoors on floor at night, Feb. 22, 1986 (Carroll, Smathermon; AMNH), 1 ♂; Apr. 7, 1986 (Carroll, Klumpp; AMNH), 2 ♂; small webs under rocks on hillside, Apr. 12, 1986 (Carroll, AMNH), 2 ♀; from sheet-webs on shore of lake, Feb. 4, 1985 (Carroll, AMNH), 1 ♂, 1 ♀; Sept. 1986 (Carroll, AMNH), 2 ♀; webs on clay cliffside and rotten logs, Mar. 8, 1986 (Carroll, AMNH), juvs.; ca. 15 km SW Puerto Lopez, Hacienda Mozambique, 200 m elev., July (MCZ), juv. **COSTA RICA:** Alajuela: Atenas, 9°56'N, 84°23'W, Nov. 30, 1988 (R. Edwards, AMNH), 1 ♀; 30 km W San Jose, La Garita Hydroelectric Plant, wooded slope, Aug. 18, 1983 (Coyle, AMNH), 1 ♂, 1 ♀, juvs. **Guanacaste:** Abangares, Aug. 25, 1973 (R. La Val, UCR 369), juv.; Cerro Azul, Carmona, July 23, 1985 (C. Valerio, UCR), 2 ♂, juvs.; 4 km W La Pacífica resort, along Pan Amer. Hwy. NW of Cañas, Aug. 11, 1983 (Coyle, AMNH), 1 ♀, juv.; 3 mi S turnoff to Monte Verde near Río Cañamazo, on roadside bank, Feb. 5, 1976 (Roth, Schroepfer; AMNH), 1 ♀; Palo Verde, Bagaces, Jan. 16–22, 1978 (C. Valerio, C. Zúñiga; UCR 496), 1 ♀, Refugio R. L. Rodríguez, Jan. 8–9, 1983 (C. Valerio, G. Mora; UCR), juvs.; Palo Verde OTS Field Station, Jan. 22–23, 1976 (V. Roth, AMNH), juv.; litter (in dry stream bed, floodplain, under trees, and road bank), Aug. 18–25, 1976 (R. and E. Edwards, MCZ), juvs.; Parque Nac. Barra Honda, Apr. 4, 1985 (B. Morera, UCR), 1 ♀; Santa Rosa Natl. Pk., deciduous forest,

250 m elev., Apr. 5–9, 1983 (D. Ubick, DUC), 2 ♂; Santo Tomás, Liberia, Apr. 9, 1966 (C. Valerio, UCR 126), 2 ♀; Taboga, 10°19'N, 85°12'W, Dec. 2, 1988 (R. Edwards, MCZ), 1 ♀. **Puntarenas:** Aranjuez, Aug. 30, 1986 (J. Maunio, UCR), juv.; Bajo La Bonga, Chánquina, Buenos Aires, Jan. 8, 1982 (F. Fallas, UCR), 1 ♀; Carara, near Tarcoles, Mar. 1986 (W. Eberhard, MCZ), 1 ♀, egg sac; Chomes, 10°03'N, 84°45'W, funnel webs in Río Lagarito floodplain detritus, Nov. 28, 1988 (R. Edwards, MCZ), 2 ♀, egg case; Parrita, old oil palm grove, Jan. 1986 (W. Eberhard, MCZ), 1 ♀; Reserva Biol. Carara, Dec. 3, 1982 (A. Gómez, UCR), 1 ♀. **San José:** Río Tulín, W of Puriscal on rt. 239, 900 m elev., web at end of hollow log, Nov. 28–30, 1988 (R. Edwards, MCZ), 1 ♀, juvs.; Machuca (Tristan, MCZ), 1 ♀. **ECUADOR:** Pichincha: Mt. Pichincha near Quito, Aug. 1944 (G. Prescott, MCZ), 1 ♀. **GUATEMALA:** Petén: Tikal, 500 ft elev., Aug 7–12, 1979 (Griswold, Meikle; CGC), 1 ♀, juvs.; Uaxactún, Mar. and Apr. 1931 (H. Bartlett, MCZ), 4 ♂, 8 ♀. **HONDURAS:** Atlantida: East Tela Beach, July 17, 1929 (MCZ), 1 ♀, juv. **Cortez:** La Lima banana plantation, Jan. 1960 (L. Roth, MCZ), 1 ♂, juvs.; Lancetilla, July 10, 1929 (MCZ), 1 ♀, juvs. **MEXICO:** Quintana Roo: Coba ruins, 20°30'N, 87°44'W, Jan. 31, 1984 (V. and B. Roth, AMNH), 1 ♀. **Yucatán:** (BMNH), female (holotype); 150 km NE Barrancas, Aug. 1, 1958 (A. Menke, AMNH), 1 ♂. **NICARAGUA:** El Polvón (MNHN, 1206), juv. (*Thelechoris zebrina* holotype). **PANAMA:** **Canal Zone:** Cerro Galera, 10 km W Panamá City, behind palm leaves on jungle-covered hill, early July 1984 (A. Decae, AMNH), 3 ♂ (1 matured later in Aug.), 3 ♀; with female in web at base of palm frond, Aug. 12, 1976 (L. Kirkendall, AMNH), 1 ♂; in shrubs, Jan. 7, 1977 (Levi, Lubin; MCZ), 2 ♀; Farfan, Jan. 9, 1958 (Chickering, MCZ), 2 ♂, juvs. **Chiriquí:** Bugaba, Nov. 1–2, 1985 (Quintero; Cambra; UPC), 1 ♀; David, on walls, Dec. 1975 (D. Quintero, UPC), 1 ♀; Río Hulo, near Cementerio Bugaba, Nov. 2, 1985 (Quintero, Cambra; UPC), 2 ♀. **Herrera:** NE part of Azuero Peninsula between Aguadulce and Chitre, almost desert, early Aug. 1984 (A. Decae, AMNH), 2 ♂, 4 ♀, juvs.; Boca de Parita, desert, July 7, 1985 (Quintero, Cambra, Jard; UPC), juv.; foothills of Cerro Tigre near

Paris, Jan. 20, 1980 (León, Araúz, Quintero; UPC), 1 ♀, juv.; París, Jan. 19, 1980 (León, Araúz, Quintero; UPC), 2 ♀, juvs. **Panama:** Bayano Region, upper Río Maje, June 4 and 11, 1976 (F. Vollrath, L. Kirkendall; AMNH), 2 ♀, juvs. (one web in old bird nest). **SAINT VINCENT:** (NMHN 14339), 1 ♂, 1 ♀, juvs.; Oct. 15–24, 1966 (MCZ), juvs. **TOBAGO:** Buccoo Bay, Aug. 15, 1965 (Waering, AMNH), 1 ♂, 2 ♀; near King Bay, Apr. 21, 1916 (H. Clark, MCZ), juv. **TRINIDAD:** (Peceth, NMHN 14353), 6 ♂, 4 ♀, juvs.; Arima, Aug. 1937 (MCZ), juv.; Arima Ward, La Laja Rd., 10°42'N, 61°17'W, 500 m elev., sunny roadside, Feb. 7, 1984 (Coddington, USNM), 1 ♂, 3 ♀; Arima, Spring Hill, July 15, 1979 (L. Sorkin, B. Faber; AMNH), juvs.; Arima Valley, 800–1200 ft elev., Feb. 10–22, 1964 (Wygodzinsky, Rozen; AMNH), 1 ♀; 5 mi N Arima, 700 ft elev., Apr. 15, 1964 (CAS), juv.; 4 mi W Arima, Oct. 2, 1981 (J. Rozen, AMNH), juvs.; road to Blanchisseuse, 4–13 mi N SIMLA, April 1964 (Chickering, MCZ), 2 ♂, 2 ♀, juvs.; California, Esperanea Lugar Estate, Dec. 1912 (R. Thaxter, MCZ), 1 ♀; Caparo, in woods on leaves, Feb. 16, 1910 (P. Whelpley, AMNH), 2 ♀, juv.; Chachacare Island, from bromeliad (*Gravisia aquilega*), Mar. 18, 1956 (Aitken, AMNH), 2 ♀; Côte est (Pil, NMHN 17278), 1 ♂; El Tucuche, 3072 ft elev., Dec. 16, 1934 (N. Weber, MCZ), 1 ♀; Piarco, Nov. 27, 1954 (A. Nadler, AMNH), juvs.; Port of Spain, Jan. 29, 1910 (P. Whelpley, AMNH), 1 ♀; St. Ann's, Aug. 1957 (M. Nieves, AMNH), juv.; St. Augustine, Feb. 1972 (J. Cooke, AMNH), 1 ♀; St. Patrick Co., Erin Rd. between Cap-de-ville and Buenos Ayres, forest, ca. 50 m elev., Feb. 4, 1984 (Coddington, Sobrevida; USNM), 2 ♂, 2 ♀, egg sac; Sangre Grande, Dec. 6, 1944 (T. Jones, AMNH), 1 ♀; SIMLA, Apr. 1964 (Chickering, MCZ), 2 ♂, juvs.; behind SIMLA Research Center, June 7, 1987 (T. Mason, MCZ), 1 ♂; Soldado Rock, Apr. 20, 1968 (Waering et al., AMNH), 1 ♀; Oct. 27, 1963 (H. Aitken, AMNH), 1 ♀, from under rocks, June 18, 1961 (T. Aitken, AMNH), 1 ♀, juvs.; southeast Trinidad, mile post 46 on Manzanillo-Guayaguayare Rd., 2–5 ft elev., Apr. 5, 1964 (E. Kjellesvig-Waering, AMNH), 1 ♀, juvs.; Turure, Brigand Hill, July 21, 1979 (L. Sorkin, AMNH), juv. **VENEZUELA:** **Amazonas:** Puerto Ayacucho, gallery forest,

webs under bark or rotten logs, Oct. 9–11, 1991 (R. West, AMNH), 1 ♀, juvs. **Aragua:** Hacienda la Trinidad, near Maracay, 1940 (C. Vogl, AMNH), 1 ♀; San Sebastián, near Cueva del Murcielagos, 9°55'N, 67°15'W, 515 m elev., Feb. 15, 1984 (Coddington, USNM), 1 ♀, juvs. **Barinas:** Hato Palma Sola, ca. 5 km SW Barinas on hwy. #5, 280 m elev., seasonal savanna habitat, Jan. 16, 1985 (J. Palmer, MCZ), 1 ♂; Reserva Forestal de Ticoporo, off hwy. #5 near Socopo, ca. 29 km down logging road into forest, 240 m elev., Jan. 15, 1985 (J. Palmer, MCZ), 2 ♂. **Bolívar:** Las Trincheras, 6°57'N, 64°55'W, Aug. 1891 (F. Meinert, ZMC), 1 ♀, juv. **Carabobo:** Puerto Cabello (ZMH), 2 ♀. **Dist. Federal:** Caracas, Apr. 1936 (Vellard, MACN), 1 ♀; Parque Nac. El Ávila, trail between Mirador and La Julia, 1140–1440 m elev., dry, Jan. 24, 1985 (J. Palmer, MCZ), 2 ♂, 1 ♀. **Lara:** Posada El Sauce, Sanare, 1330 m elev., Dec. 6, 1985 (J. Lattke, W. Brown; MCZ), 1 ♀. **Mérida:** Mérida, 2000–2500 m elev. (ZMB), 1 ♀. **Monagas:** Caripito, July 1, 1942 (W. Beebe, AMNH), juv. **Portuguesa:** Guanare, Sept. 10–17, 1957 (B. Malkin, AMNH), 1 ♀. **Yaracuy:** La Puerta, Campo Elías, May 27, 1980 (J. Osorio, FSC), 1 ♂; Río Albiz Legar (Briseño, MHNH 14707), 1 ♀.

**NATURAL HISTORY:** Although I have observed only two populations of *I. caudata* in the field, these observations, data accompanying borrowed specimens, and observations shared by others (R. Edwards, A. Decae, and B. Carroll, personal commun.) and in the literature begin to reveal this species' natural history. In the published accounts of Panamanian *I. caudata*, the spiders were misidentified as *I. guianensis* (Platnick and Shadab, 1978; Vollrath, 1978; Nentwig and Wissel, 1986; Jantschke and Nentwig, 1987; Strohmenger and Nentwig, 1987). Subsequent papers on the biology of *I. guianensis* (Coyle and Ketner, 1990; Höfer, 1990b) referred to these papers, thereby perpetuating the confusion.

The species occurs from sea level up to an elevation of about 2500 m; most collections are from localities below 1000 m, but a number of populations have been found between 1000 and 2500 m in the foothills of the Andes in Ecuador, western Colombia, and northwestern Venezuela. This species lives in a

wide range of natural habitats: near-desert xeric scrub (fig. 12), dry deciduous woodland, grassland, savanna, gallery forest, and humid semideciduous forest. Vellard (1945) noted that this species was abundant in the forest at the base of La Silla de Caracas between 1200 and 1500 m in Venezuela. It is common in disturbed habitats such as road banks, towns (Simon, 1889b), old oil palm groves, jungle, banana plantations, pasture, and woody vegetation or earth banks bordering agricultural fields. Apparently it seldom, if ever, lives in rain forest; I suspect that the "tropical rain forest" site in Panama where Nentwig (Strohmenger and Nentwig, 1987) collected this species was not true rain forest. I have searched carefully for *I. caudata* in three Costa Rican rain forest sites (Monteverde, the OTS La Selva station, and the OTS Las Cruces station near San Vito) and in the Choco rain forest of western Colombia without success.

Dense aggregations of *I. caudata* webs have frequently been observed in Costa Rica, Panama, and Colombia. In both Panama (where such webs are often clustered around termite nests) and Colombia, some aggregations are so dense that the capture sheets of as many as six adjacent webs may interconnect, giving the appearance of a single communal web. Webs occur in the following microhabitats: crevices in earth road banks, in walls, or beside or between exposed tree roots; bases of trees and shrubs (especially between multiple trunks); rough tree trunks (especially among leaf bases on palm trunks); inside hollow branches or logs; under logs or rocks; and in leaf litter on the ground. Simon (1889b) observed that these spiders frequently lived in holes in trees and walls, even in towns, and were extremely common in all the parts of Venezuela he visited.

Webs often consist of a horizontal to strongly sloping capture sheet funneling via one or two passageways into a hidden tubular silk retreat. Sometimes the capture web is a more complex system of smaller sloping sheets and curtains with two or more funnels converging into the hidden retreat tube. Capture sheets of adult females are usually rather small, ranging from 10 to 35 cm wide and covering 150–900 cm<sup>2</sup>. The capture web design features and capture behavior of this spe-

cies have been studied by Nentwig and Wissel (1986) and Strohmenger and Nentwig (1987). Decae (personal commun.) reported that most prey are ambulatory insects, but that saltatory and flying insects are sometimes captured. The struggles of some kinds of prey (particularly ants) trigger attack (immobilization) wrapping in which the spider rapidly encircles the prey while throwing silk over it, a behavior that may help *I. caudata* capture proportionally larger prey than species that do not perform immobilization wrapping (Nentwig and Wissel, 1986; Decae, personal commun.). Immobilization wrapping has not been found in any other ischnotheline species (Coyle and Ketner, 1990). The capture of three termites in 2 min by one spider shows that *I. caudata*, like other ischnothelines (Coyle and Ketner, 1990), is capable of rapid repetitive prey capture when the opportunity arises. Palmer (personal commun.) observed that these spiders can employ draglines to break their fall and lower themselves onto the substrate below.

The kleptoparasite *Mysmenopsis ischnamigo* (and perhaps also *Mysmenopsis dipluramigo*) lives in *I. caudata* webs in central Panama (Platnick and Shadab, 1978; Vollrath, 1978); however, no kleptoparasites have been found in *I. caudata* webs in Costa Rica, even by collectors (D. Ubick and myself) who were carefully looking for them. A pompilid wasp (9.3 mm long body, black head with two vertical white stripes on the face, black thoracic dorsum with three white median spots, and amber-brown abdomen) was collected in Sarigua, Herrera, Panama, carrying a female *I. caudata* of equal length and 2–3 times the wasp's weight. All of the spider's legs and pedipalps were missing.

That 31 of the 47 male *I. caudata* specimens with known collecting dates were collected in January through April suggests that mating occurs primarily in the dry season, but this data pattern may be an artifact of collector preference for the dry season. Eleven of the other 16 males were collected in July and August, the middle of the wet season. Observations on courtship and mating behavior will be published separately (Coyle, in prep.). Decae (personal commun.) found egg sacs of *I. caudata* at Cerro Galera, Panama, in January, April, July, and October,

and other egg sac records are from February, March, August, and November. These data suggest that egg-laying may not be seasonal. Two of the collected egg sacs (from Costa Rica) contained 48 and 49 offspring, while the other (from Trinidad) contained 194. Egg diameter was recorded for 10 eggs in each of these broods (two) in the egg stage: the Costa Rican eggs ranged from 0.80 to 0.93 mm and the Trinidad eggs ranged from 0.93 to 1.02 mm. Palmer (personal commun.) observed a female enlarging an egg sac opening with her pedipalps (and perhaps chelicerae) after only a few third instar spiderlings had emerged; whether the female made the initial opening is not known.

Jantschke and Nentwig's (1987) laboratory studies of maternal care in *I. caudata* indicate that this species is subsocial (as defined by Wilson [1971] and others). They found that spiderlings tend to remain for a long time in the mother's web, that they may collectively overpower and feed on small prey, that the mother allows them to feed collectively on large prey that she is consuming, that she sometimes "calls" the spiderlings to such prey items with vibration signals, and that groups of spiderlings living with a mother gain weight faster and experience much lower mortality than those separated from the mother.

*Ischnothele guianensis* (Walckenaer)

Figures 1, 3, 6, 7, 27, 40, 44, 49, 108–110, 138–171, 175, 176; Map 2

*Mygale guianensis* Walckenaer, 1837: 231 (male holotype and male paratype from French Guiana, lost). – Ausserer, 1871: 217. – Pocock, 1895: 224. – Raven, 1985a: 77.

*Entomothele guyanensis*: Simon, 1889a: 235, 236; 1889b: 190, 216.

*Thelechoris guyanensi*: Simon, 1891a: 329.

*Ischnothele guianensis*: F. O. P.-Cambridge, 1896: 762 (in part). – Höfer, 1990a: 174.

*Ischnothele siemensi* F. O. P.-Cambridge, 1896: 762, pl. 35, figs. 7, 9, 15 (female holotype from Santarem, Para, Brasil, in BMNH, examined). – Tullgren, 1905: 18. – Mello-Leitão, 1923: 86. – Bücherl, 1967: 117. – Galiano, 1972: 169, figs. 1–17. NEW SYNONYMY.

*Ischnothele guyanensis*: Mello-Leitão, 1923: 85 (in part). – Bücherl, 1967: 117 (in part). – Höfer, 1990b: 101.

**DIAGNOSIS:** The prominent, continuous,



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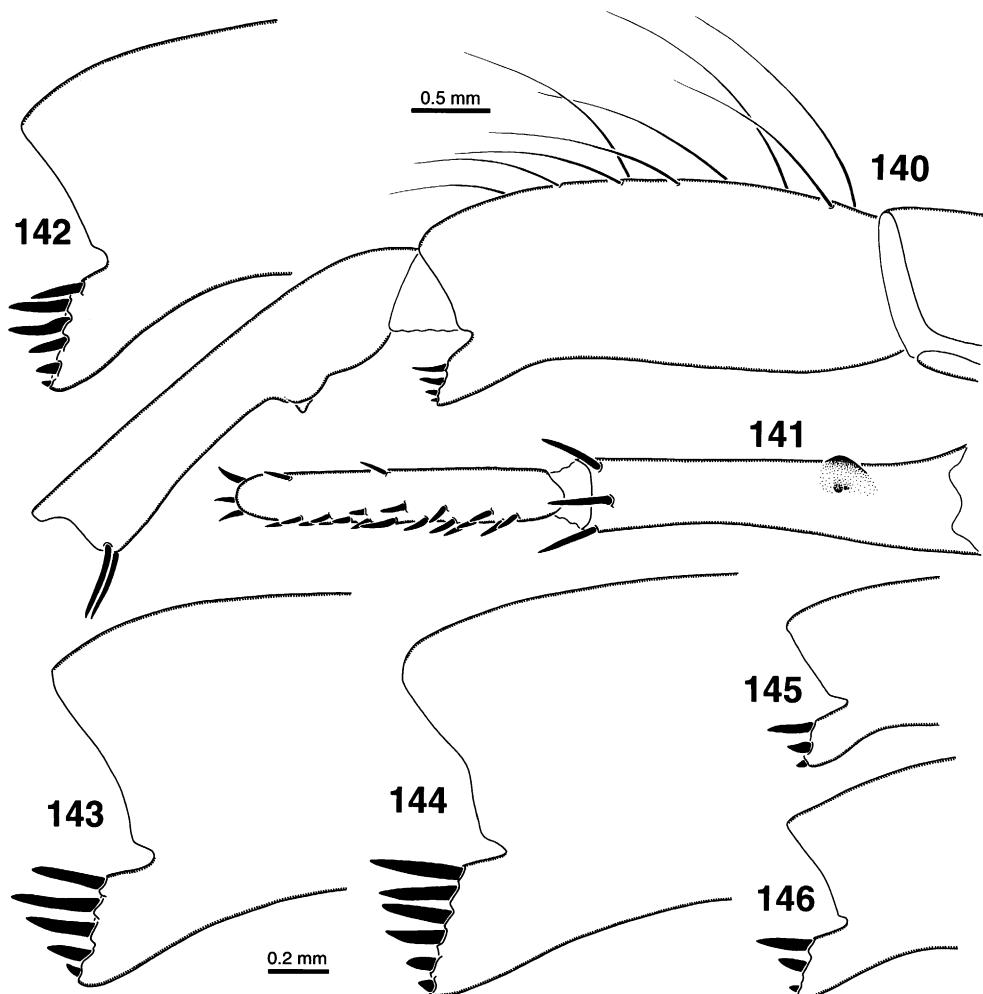


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Figs. 138, 139. Live *Ischnothele guianensis*.

138. Female from Puerto Maldonado, Madre de Dios, Peru. 139. Male from Rio Tarumã Mirim, near Manaus, Amazonas, Brasil.

white, pectinate longitudinal band on the abdominal dorsum (figs. 1, 3, 138, 139, 156–159) distinguishes live males and females of *I. guianensis* from nearly all other *Ischnothele* species, including its close relative *I. annulata* (figs. 172–174, 200–202), which has no white area connecting the anterior median spot and the paired spots behind. However, this pattern may be obscured and thus diagnostically less useful for preserved specimens. The high number of TSP (11–29) and the distinctive tibia I apophysis (figs. 142–146) and palpal organ (figs. 148, 149) distinguish males of *I. guianensis* from all other *Ischnothele* species except its close relatives *I. annulata* and *I. caudata*. Spermathecal form readily distinguishes *I. guianensis* females (figs. 160–171) from all but *I. annulata*. See

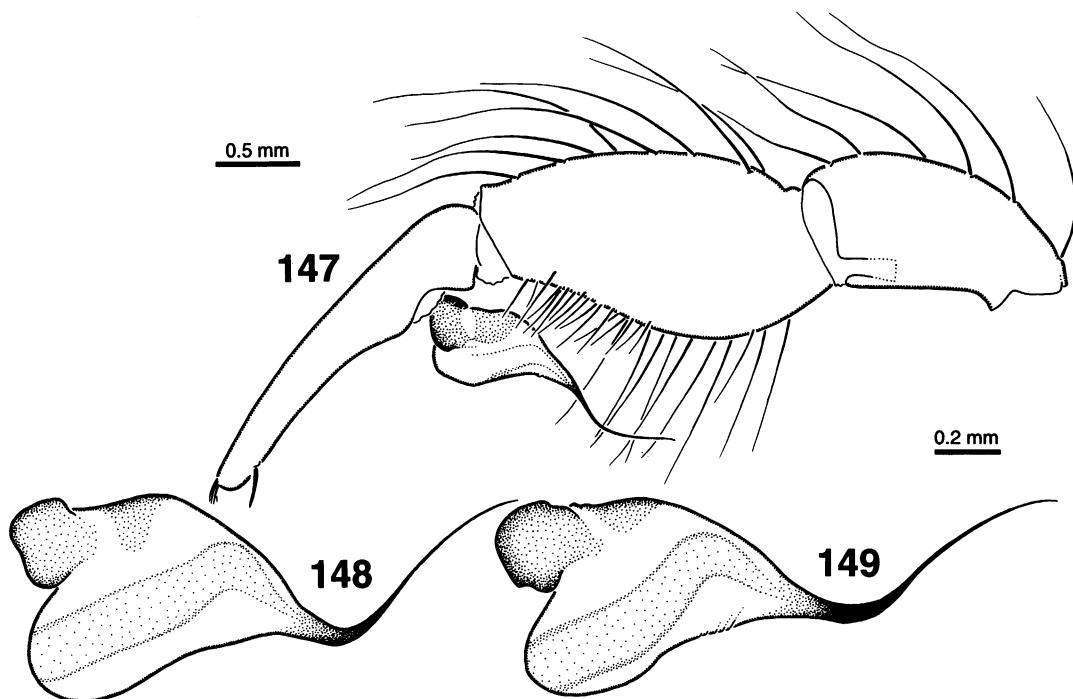


Figs. 140–146. *Ischnothele guianensis* males, leg I. 140, 141. Rio Tarumã Mirim, near Manaus, Amazonas, Brasil. 140. Tibia and metatarsus, retrolateral view. 141. Metatarsus and tarsus, ventral view. 142–146. Tibia I apophysis, retrolateral view. 142. Puerto Maldonado, Madre de Dios, Peru. 143. Belem, Para, Brasil. 144. Paramaribo, Surinam. 145. Ilha de Marchantaria, near Manaus, Brasil. 146. Colonia Calleria, Ucayali, Peru. Scale lines: 0.5 mm for figs. 140, 141; 0.2 mm for figs. 142–146.

the *I. caudata* diagnosis for male and female characters that best separate *I. guianensis* from *I. caudata*. The ventral swelling of the palpal tibia is weaker and the many erect bristles on that swelling are much longer and more slender in *I. guianensis* males (fig. 147) than in *I. annulata* males (fig. 182). Because of the proportionally long tibia I apophysis (TAL2), relatively short MAD, relatively large AMEs, and relatively weak ventral swelling on the palpal tibia, males of *I. guianensis* can also be separated from *I. annulata* males by the following ratios: TAL2(100)/MAD = 40–49

( $43.2 \pm 2.2$ ) vs. 27–39 ( $33.5 \pm 2.8$ ), respectively (fig. 150), TAL2(100)/PTT = 44–56 ( $48.9 \pm 2.8$ ) vs. 31–43 ( $36.8 \pm 3.1$ ) (fig. 151), AMD(100)/MAD = 18–22 ( $19.8 \pm 1.0$ ) vs. 13–18 ( $15.8 \pm 1.2$ ) (fig. 152), and AMD(100)/PTT = 20–27 ( $22.4 \pm 1.4$ ) vs. 14–21 ( $17.4 \pm 1.3$ ). See the diagnosis of *I. annulata* for traits that distinguish *I. guianensis* females from those of *I. annulata*.

**MALES:** Table 5. Palpal organ (figs. 148, 149) with bulb narrowing rather abruptly to base of sinuous embolus, which curves strongly at base in retrolateral direction and,



Figs. 147–149. *Ischnothelus guianensis* males. 147. Pedipalp, retrolateral view, Rio Tarumã Mirim, near Manaus, Amazonas, Brasil. 148, 149. Palpal organ, retrolateral-ventral view. 148. Paramaribo, Surinam. 149. Rio Tarumã Mirim, near Manaus, Amazonas, Brasil. Scale lines: 0.5 mm for fig. 147; 0.2 mm for figs. 148, 149.

more distally, curves more gradually back toward prolateral. Cymbial apophysis (fig. 147) with 1–3 prolateral and 0–3 retrolateral spines; 4–13 stout bristles on very tip. Palpal tibia (fig. 147) with strong ventral swelling with very long slender erect bristles; shorter stronger bristles ventrally on distal half of tibia. No prolateral spines on palpal patella. Tibia I apophysis (figs. 140–146) moderately long, with distal face weakly inclined from vertical and 3–7 strong sharp spines in row along distal face, proximal spines moderately long, distal ones much shorter. Metatarsus I (figs. 140, 141) with ventral apophysis proximal of midpoint; apophysis with thick rounded retrolateral prominence and weaker prolateral prominence with more pointed tip; 2–4 (usually 3) spines at distal end of metatarsus. Tarsus I not flexible. One pair of strong foveal bristles. Color of live (from Puerto Maldonado, Peru, and Manaus, Brasil) (figs. 1, 138): Carapace dark brown on pars cephalica and central and posterior part of pars thoracica; lateral part of pars thoracica much lighter, with dense covering of recumbent white hairs; chelicerae dark brown to black; legs and pedipalps light brown to dark brown; leg coxae (covered with white hairs) and sometimes metatarsi and tarsi lighter than other articles; abdominal dorsum dark to very dark brown with prominent median longitudinal white to cream-colored band, rounded at anterior end, with 4–6 pairs of lateral, slightly oblique and tapered branches forming chevron-shaped expan-

side (figs. 160–171); stalks weakly to moderately sclerotized, at least distal  $\frac{2}{3}$  of each bulb unsclerotized; median spermatheca relatively long, with stalk nearly straight to weakly bent outward and stalk-to-bulb transition often rather gradual; lateral spermatheca with longer, coiled (or strongly sinuous), usually more sclerotized, stalk. Foveal bristles as in males. Color of live specimens (from Puerto Maldonado, Peru, and Manaus, Brasil) (figs. 1, 138): Carapace dark brown on pars cephalica and central and posterior part of pars thoracica; lateral part of pars thoracica much lighter, with dense covering of recumbent white hairs; chelicerae dark brown to black; legs and pedipalps light brown to dark brown; leg coxae (covered with white hairs) and sometimes metatarsi and tarsi lighter than other articles; abdominal dorsum dark to very dark brown with prominent median longitudinal white to cream-colored band, rounded at anterior end, with 4–6 pairs of lateral, slightly oblique and tapered branches forming chevron-shaped expan-

FEMALES: Table 6. Two spermathecae per

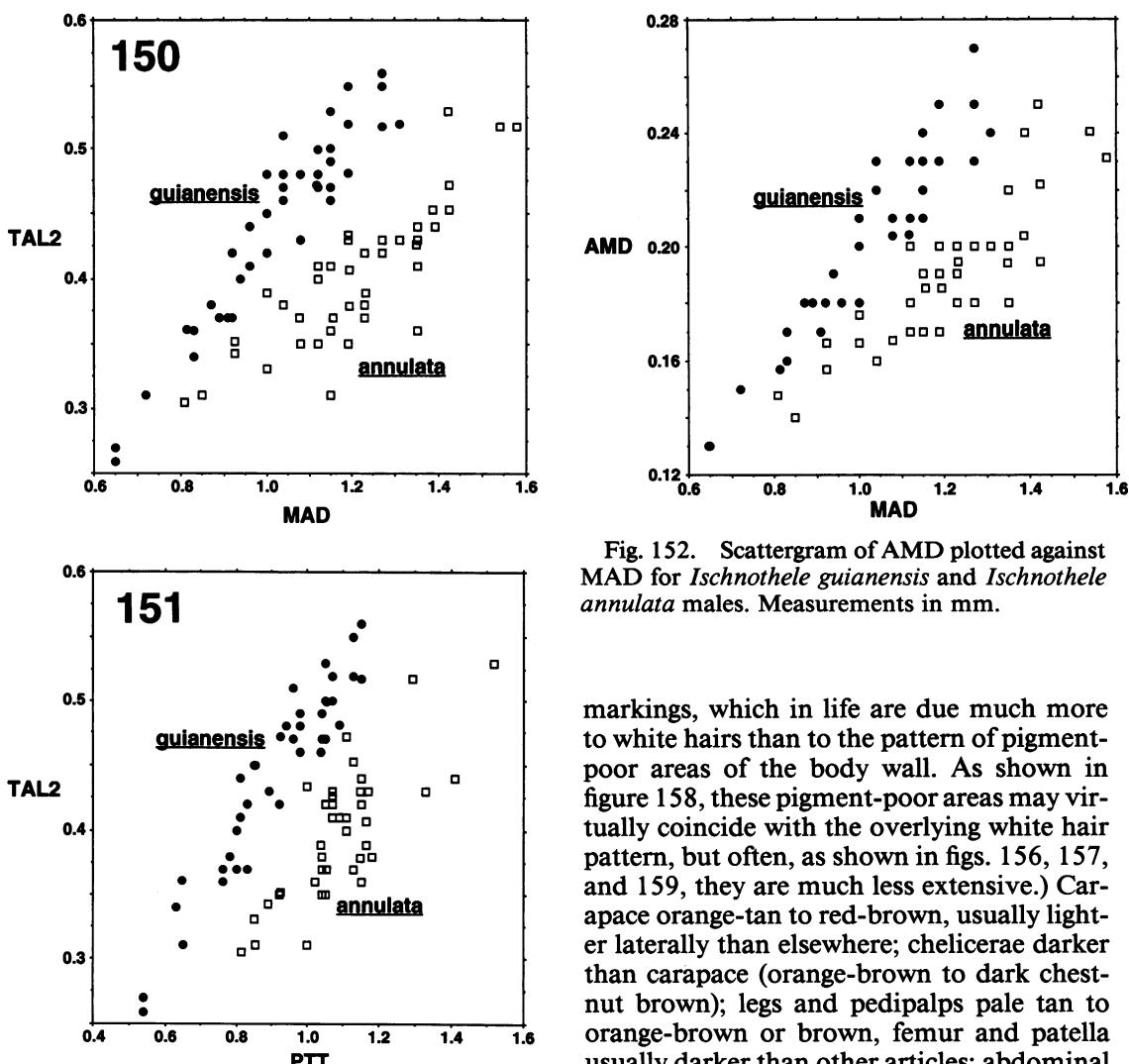


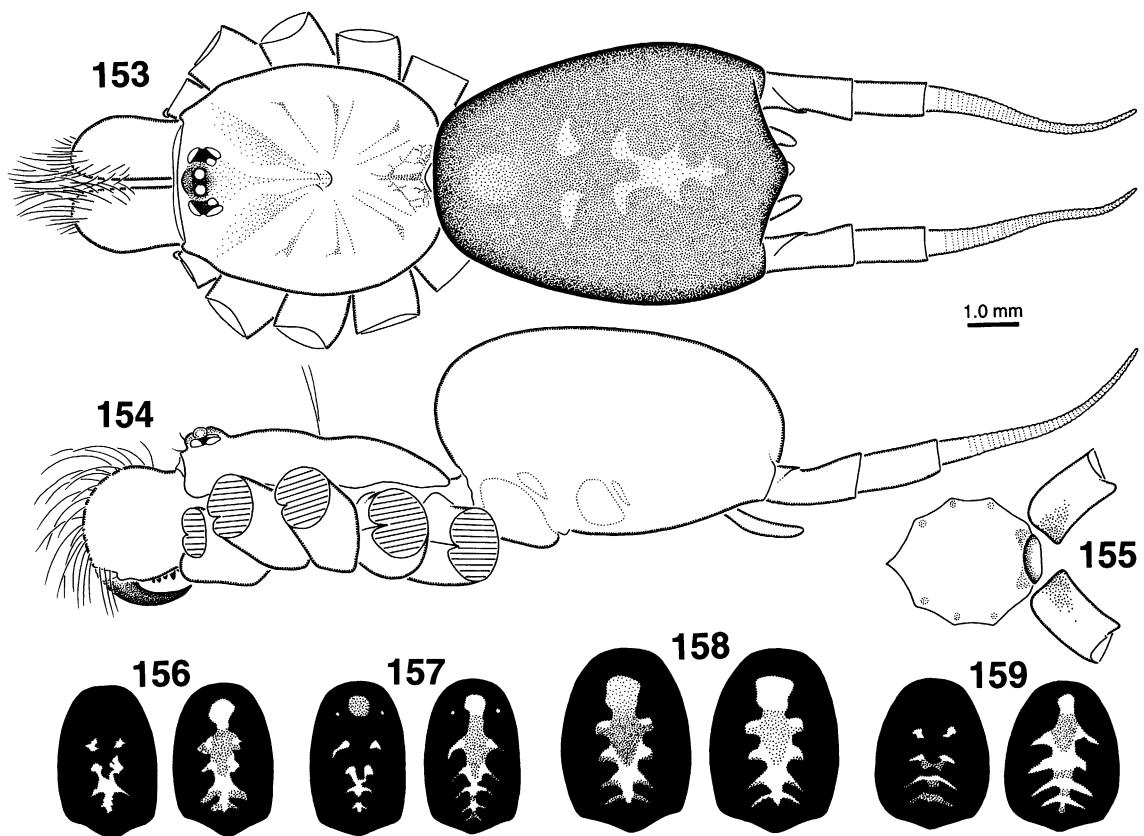
Fig. 152. Scattergram of AMD plotted against MAD for *Ischnothele guianensis* and *Ischnothele annulata* males. Measurements in mm.

Figs. 150, 151. Scattergrams of characters that help distinguish *Ischnothele guianensis* males from those of *Ischnothele annulata*. Measurements in mm. 150. TAL2 plotted against MAD. 151. TAL2 plotted against PTT.

sions along the band, which becomes much thinner near posterior end of abdomen; anterior three chevrons most prominent, 5th and 6th (when present) very thin and faint. Color of preserved specimens (figs. 153, 156–159): (Preservation makes the body wall much lighter and reduces the reflectance of light hairs, thereby reducing the brightness of the white hair patches. Both of these effects reduce the prominence of dorsal abdominal

markings, which in life are due much more to white hairs than to the pattern of pigment-poor areas of the body wall. As shown in figure 158, these pigment-poor areas may virtually coincide with the overlying white hair pattern, but often, as shown in figs. 156, 157, and 159, they are much less extensive.) Carapace orange-tan to red-brown, usually lighter laterally than elsewhere; chelicerae darker than carapace (orange-brown to dark chestnut brown); legs and pedipalps pale tan to orange-brown or brown, femur and patella usually darker than other articles; abdominal dorsum medium brown to dark gray-brown or purple-brown with dull white or dull cream-colored central pattern of nearly same form as when alive but duller; roughly crescent-shaped area of dark pigment on median  $\frac{1}{4}$  to  $\frac{1}{2}$  of each posterior book lung cover.

**VARIATION:** Variation in color (figs. 156–159) and spermathecal form (figs. 160–171) are summarized in the description and appear to be moderate and continuous. The only case of markedly discontinuous variation that I have discovered while analyzing the large samples of *I. guianensis* involves males of two demes sampled by Höfer near Manaus, Brasil. The three males collected in white water inundation forest (várzea) on Ilha de Marchantaria (IM) in the Rio Solimões are much



Figs. 153–159. *Ischnothele guianensis*. 153–155. Female from Belem, Para, Brasil. 153, 154. Whole body. 153. Dorsal view. 154. Lateral view. 155. Sternum, labium, and maxillae. Dots on maxillae represent cuspules. 156–159. Dorsal abdominal color patterns of four preserved specimens. For each specimen, left drawing shows only body wall pigment pattern and right drawing shows overall pattern resulting from hairs and body wall pigmentation. Background color (various shades of brown) shown in black. 156. Estacion Biologica Beni, Beni, Bolivia. 157. Paramaribo, Surinam. 158. Puerto Maldonado, Madre de Dios, Peru. 159. Pakitzá, Madre de Dios, Peru. 1.0 mm scale for figs. 153–155.

smaller (CL = 2.31–3.08;  $2.62 \pm 0.41$ ) than the nine males collected about 30 km away in black water inundation forest (igapó) near the mouth of the Rio Tarumá Mirim (TM) at the Rio Negro (CL = 4.35–5.58;  $5.06 \pm 0.43$ ) (Höfer, 1990b, personal commun.). These two samples also differ in three ratio characters: (1) AMD(100)/CL = 5.3–5.6 ( $5.5 \pm 0.2$ ) for IM vs. 4.1–4.8 ( $4.5 \pm 0.2$ ) for TM; (2) MAD(100)/CL = 26–28 ( $27 \pm 0.9$ ) for IM vs. 22–25 ( $24 \pm 0.9$ ) for TM; (3) AMD(100)/PTT = 24–27 ( $25 \pm 1.7$ ) for IM vs. 20–23 ( $21 \pm 1.0$ ) for TM. The small males from IM may represent a new species distinct from *I. guianensis*, but two observations argue against this hypothesis: the two samples

cannot be distinguished by any other morphological features, and each sample overlaps the remainder (N = 31) of the *I. guianensis* male sample. It is also important to note that, because of its small size (N = 3), the IM sample may not be representative of the IM population. Perhaps the body size difference between these two samples is due to habitat differences that affect nutrition and/or developmental schedules, and the few ratio character differences may simply be the result of allometric growth.

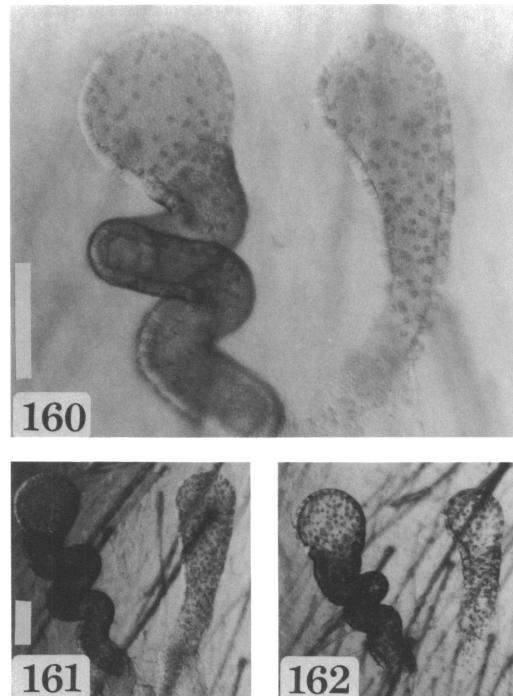
**REMARKS:** The types of *I. guianensis*, like virtually all of Walckenaer's types (Levi, personal commun.), have almost certainly been lost. Fortunately, Walckenaer (1837) de-

scribed just enough diagnostic characters to allow me to match specimens to his types. He described the extremely long spinnerets and the four spines on the tibia I apophysis, two character states that place the species very close to *I. caudata*. His description of the longitudinal yellow dentate stripe on the dorsum of the abdomen convinces me that his types are most similar to the *Ischnothelae* specimens I have examined from the Guianas (where his types were collected), Surinam, and the Amazon Basin.

The poor description and missing type of *I. guianensis* fostered several misidentifications and the creation of one synonym. Specimens of *I. caudata* have often been misidentified as *I. guianensis* (see the synonymy section in the *I. caudata* description). Although F. O. P.-Cambridge (1896) suggested that Simon (1891b) may have misidentified specimens collected on the island of St. Vincent as *I. guianensis*, F. O. P.-Cambridge nevertheless based his concept of *I. guianensis* on these same misidentified *I. caudata* specimens. Consequently, he erroneously concluded that specimens he collected from the lower Amazon represented an undescribed species, which he named *I. siemensi* (fig. 165).

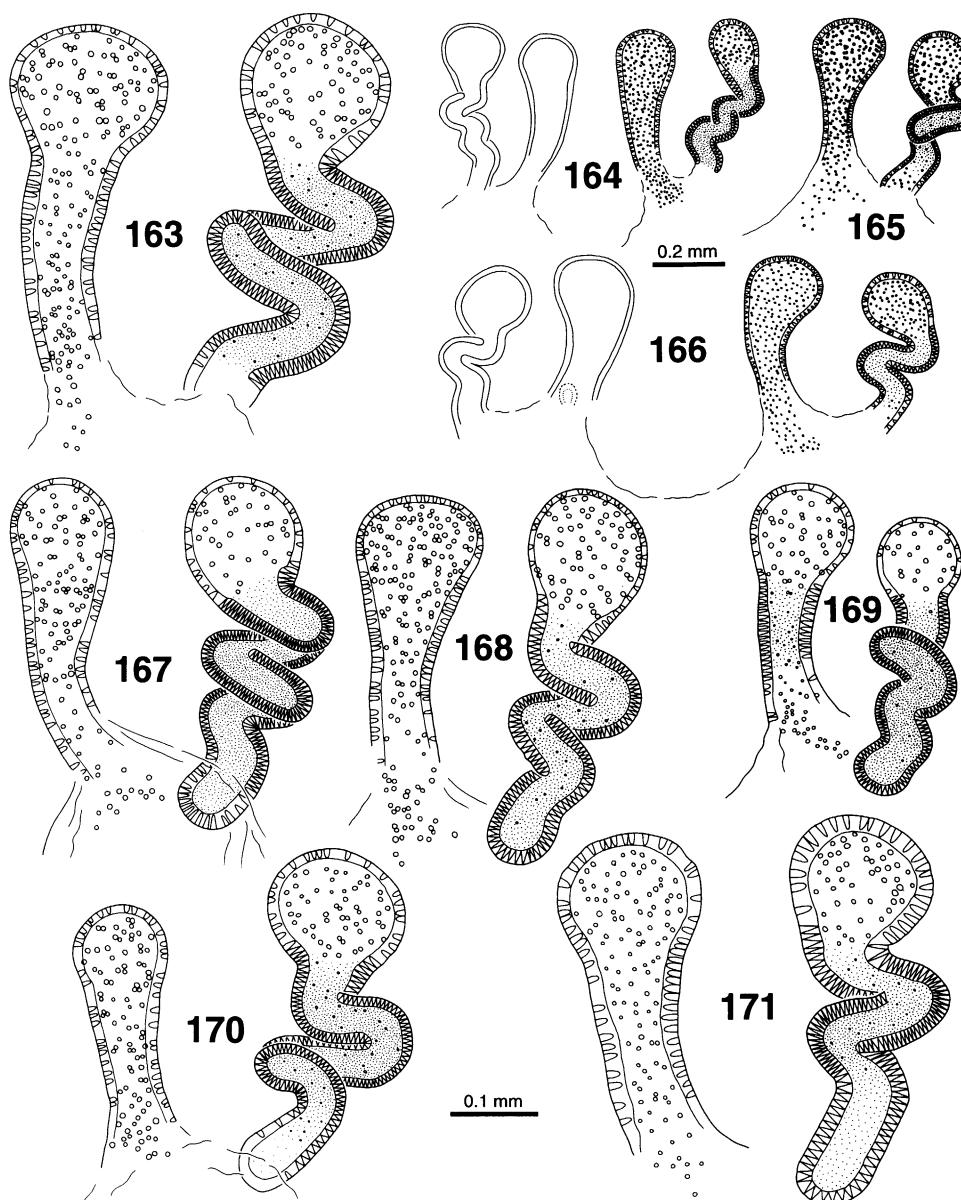
**DISTRIBUTION:** Guyana, Surinam, French Guiana, and the Amazon Basin of Brasil, Colombia, Peru, and Bolivia (map 2).

**MATERIAL EXAMINED:** **BOLIVIA:** Beni: Estación Biológica Beni, 14°47'S, 66°15'W, 100 m elev., trail S of camp in area of Río Curiaba and toward savanna, Sept. 6, 1987 (Larcher, Coddington, Arce; USNM), 3 ♂, juv.; Sept. 13, 1987 (Larcher, USNM), 1 ♂, area of forest camp at Río Curiaba, Sept. 6–16, 1987 (Coddington, Larcher, Arce, Steiner; USNM), 1 ♂, 1 ♀, juvs.; zone 1, ca. 225 m elev., Nov. 8–14, 1989 (Coddington et al., USNM), 4 ♂, 3 ♀, juvs.; Río Itenez at mouth of Río Baures, Oct. 1–3, 1964 (Bouseman, Lussenhop; AMNH), juv. La Paz: 5 km from Sapecho, Río Beni, and road, Jan. 5, 1991 (Goloboff, Santisteban, McHugh; MACN), 1 ♀. **Pando:** Abuña, June–Sept. 1911 (Mann, Baker; MCZ), 1 ♂. **BRASIL:** Acre: Rio Purus W of Sena Madureira at mouth of Furo do Juruá, Sept. 3, 1973 (B. Patterson, MCZ), 1 ♀; V. Placido Castro (Exped. CDZ, MZUSP 8510), 1 ♀. **Amapá:** Sierra do Navio, June 16–17,



Figs. 160–162. Left spermathecae of *Ischnothelae guianensis*. 160. Leticia, Amazonas, Colombia. 161. Belem, Para, Brasil. 162. Pakitzá, Madre de Dios, Peru. Scale bars 0.1 mm; figs. 161 and 162 are same scale.

1966 (Galiano, MACN), 1 ♀. **Amazonas:** Alto Solimões, Dec. 1979 (A. Lise, PAM 8810), 6 ♀, juvs.; Manaus, June–Sept. 1911 (Mann, Baker; MCZ), 1 ♂; Manaus, Ponta Negra, Dec. 20, 1987 (A. Lise, PAM), 1 ♀; near Manaus, Rio Solimoes, Ilha de Marchantaria, 3°15'S, 59°58'W, Várzea, Oct. 21, Nov. 17, Dec. 21, 1987 (H. Höfer, INPA/MP), 3 ♂, various dates in 1987–1988 (H. Höfer, INPA/MP), 10 ♀, juvs.; near Manaus, Rio Tarumá Mirim, 03°02'S, 60°17'W, Igapó, Aug. 4, 1976 (J. Adis, INPA/MP), 3 ♂, Aug. 16, 1976 (J. Adis, INPA/MP), 1 ♂, Sept. 16, 1976 (J. Adis, INPA/MP), 1 ♂, Sept. 30, 1976 (J. Adis, INPA/MP), 3 ♂, various dates in 1976 (J. Adis, INPA/MP), 4 ♀, Dec. 16, 1987 (A. Lise, PAM 17251), 1 ♀, 1988 (H. Höfer, INPA/MP), 1 ♂, various dates in 1987–1988 (H. Höfer, INPA/MP), 11 ♀, juvs. **Para:** Belem, Aug. 18, 1962 (K. Lenko, MZUSP 10831), 1 ♀, June 1966 (M. Galiano, MACN 5913), 1 ♀, Aug. 1970, 1971 (M. Galiano, MACN



Figs. 163–171. *Ischnothele guianensis* spermathecae. 163. Right spermathecae, Rio Tarumã Mirim, near Manaus, Amazonas, Brasil. 164. All spermathecae, Puerto Maldonado, Madre de Dios, Peru. 165. Right spermathecae, *Ischnothele siemensi* holotype. 166. All spermathecae, Ekin, San Martin, Peru. 167–171. Right spermathecae. 167. Leticia, Amazonas, Colombia. 168. Paramaribo, Surinam. 169. Canje Ikuruwa River, Guyana. 170. Estacion Biol. Beni, Beni, Bolivia. 171. Jaunjui, San Martin, Peru. Scale lines: 0.2 mm for figs. 164–166; 0.1 mm for figs. 163, 167–171.

5913), 7 ♂, 12 ♀; Jacareacanga, Dec. 1968 (M. Alvarenga, AMNH), juv.; Lago Paru, Arriximina, Feb. 28–Mar. 5, 1967 (Exped. da Amazôna, MZUSP 6969), 1 ♀; Itupiranga, Dec. 1971 (P. Villela, IB 1.805), juv.; Rio

Maputra, 10 mi S Equator, Feb. 8–9, 1938 (W. Hassler, AMNH), 1 ♀. COLOMBIA: Amazonas: Leticia, June 16, 1965 (P. Craig, J. Robb; CAS), 2 ♀. FRENCH GUIANA: Road cut, Feb. 1983 (S. Marshall, AMNH),

1 ♀; Maripasoula, open cattle fields, under wood, Dec. 18–19, 1972 (D. Quintero, UPC), 1 ♀. GUYANA: Canje Ikuruwa River (forest savanna), 05°?N, 57°50'W, Aug.–Dec. 1961 (G. Bentley, AMNH), 1 ♂, 1 ♀, juv.; near Yupukari, Rupununi River, Nov. 10, 1937 (W. Hassler, AMNH), 1 male. PERU: Loreto: Iquitos, Nov. 1962 (AMNH), juv. Madre de Dios: Puerto Maldonado, ca. 200 m elev., Mar. 31 and Apr. 3, 1988 (Coyle, Bennett; AMNH), 8 ♂ (4 of these matured later in captivity), 7 females, juvs.; 15 km NE Puerto Maldonado, 200 m elev., July 6, 1990 (D. Silva, MHNL), 1 ♂; Zona Reservada de Manú, Puesto de Vigil, Pakitza, 11°58'S, 71°18'W, Oct. 1, 1987 (Silva, Coddington; USNM), 2 ♀; Zona Reservada Pakitza, Río Manú, ca. 275 m elev., Sept. 26–Oct. 7, 1987 (Coddington, Silva; MHNL), 1 ♂, 3 ♀; Zona Reservada Tambopata, Laguna Cocochoa, 12°50'S, 69°17'W, 290 m elev., in palm tree, June 5, 1988 (D. Silva, MHNL), 1 ♀. San Martin: Ekin, E of Tarapoto, Mar. 9–21, 1947 (F. Woytkowski, AMNH), 1 ♀; Jaunjui, forest, 350 m elev., Aug. 16, 1948 (MHNL), 1 ♀. Ucayali: N Pucallpa, Colonia Callería on Río Callería 15 km from Río Ucayalí, Sept. 10–Oct. 16, 1961 (B. Malkin, AMNH), 2 ♂, 2 ♀, juvs. SURINAM: Benzendorf, Lawa River, forest sweep at night, Nov. 6, 1963 (B. Malkin, AMNH), 1 ♂; Browns Berg, 05°00'N, 55°27'W, Feb. 20, 1982 (D. Smith Trail, MCZ), juvs.; Paramaribo, Mar. 20, 1908 (Heller, ZMB), 1 ♂, 1 ♀, July 27, 1908 (Heller, ZMB), 1 ♂, Dec. 1908 (Heller, ZMB), 4 ♀; Paramaribo botanical gardens (Reynes, MCZ), juv.

NATURAL HISTORY: *Ischnothelie guianensis* is strictly a lowland species; all specimens have been collected between sea level and 350 m. It lives in open canopy forests (like igapó and várzea inundation forests) and other open and disturbed habitats (forest savanna, pasture, botanical garden, towns), but is absent, or at least uncommon, in typical closed canopy rain forest (J. Kovoor, personal commun.). I found none in the rain forest at Tambopata, Peru, during two days of searching, and D. Silva (personal commun.) has never found it at other Peruvian localities inside Amazon Basin rain forest, but only in cleared areas around buildings. H. Höfer (1990b) found this species much more abundant in the more open, lighter, species-poor,

lower igapó forest along the river near Manaus, Brasil, than in the darker, less open, more species-rich, upper igapó slightly farther inland. F. O. P.-Cambridge (1896: 763) observed that *I. guianensis* was "one of the most abundant spiders on the lower Amazon" River and that it lived along the river margin. I am skeptical, however, of his subsequent observation that this species also lived "in the forest on the terra firma." P. Maréchal (personal commun.) has observed that *I. guianensis* juveniles exhibit positive phototaxis until a later age than most mygalomorphs before becoming nocturnal, and that this may help explain why this species lives in more open habitats and is so widely distributed.

*Ischnothelie guianensis* microhabitats include tree trunks, board fences, walls and foundations of buildings, road banks, bromeliads, logs, and stumps. Webs are particularly common on structurally complex surfaces, especially trunks with many crevices and web attachment points provided by loose bark, buttress roots, and/or epiphytes and vines (Höfer, 1990b). Coddington (personal commun.) found that *I. guyanensis* webs were especially abundant on *Scheelea* palm trunks at Beni, Bolivia. In a yard in Puerto Maldonado, Peru, I found a very dense aggregation of webs (21 between the ground and 3 m) on a palm trunk to which frond bases (and *Philodendron* plants) were still attached (figs. 1, 6, 7). Near Belém, Brasil, Galiano (1972) found the webs to be especially abundant in a palm plantation on palm trunks, where the retreat tubes were constructed in spaces between leaf bases and the trunk.

Galiano (1972) described the web structure of this species (figs. 1, 6). Web structure, prey capture behavior, and prey have been described by Coyle and Ketner (1990). Ants (72%) as well as beetles, isopods, and termites made up most (96%) of the exoskeletal remains of prey found in retreats. I observed that some ants (particularly ponerines) could quickly walk across the capture web, but that others rather easily became entangled. Some spiders could not hold onto the hard slippery surface of isopods, which balled up when attacked. When forced out of their retreats, these spiders are very fast and difficult to capture. Live booklice were sometimes found on prey refuse in the retreats of webs.

In his study of the spiders of blackwater

inundation forest (igapó), Höfer (1990b) found that *I. guianensis* move down the trunks (males and females first, followed by juveniles) to colonize the newly exposed lower trunk area and ground in August and September at the start of the noninundated period. Adults usually construct their webs on the trunks, whereas most juveniles move out over the forest floor from October to December (although most seem to remain close to the trunks). Most individuals return to the trunks a few weeks before the ground is inundated in February.

Thirty-four of the 39 males with known collecting dates were collected from July to December, suggesting that this might be a primary period of mating activity. In August near Belém, Brasil, Galiano (1972) observed adult males in their own webs. In early April at Puerto Maldonado, I collected four penultimate (which can be recognized by the slightly swollen palpal tarsi) and four adult males. One of the adults was in a web with a female, but the other three were apparently in their own webs and were captured while trying to attack prey. Courtship and mating behavior will be described elsewhere (Coyle, in prep.).

Egg sacs have been collected in early April (Puerto Maldonado, Peru), August (Belém, Brasil), and September (Manaus, Brasil) and are constructed of opaque white silk beneath and on top of a spheroid (sometimes flattened) mass of eggs. Like those of other ischnothelins, the sacs are hammock-shaped (flat on top, convex on the bottom, usually elongate) and constructed in the wall of the retreat. Dimensions of three sacs from Puerto Maldonado (length-width-thickness) were 20–10–5, 20–11–8, and 24–23–9 mm. A female can produce more than one egg sac after a mating. Galiano (1972) and Maréchal (personal commun.) noted that individual females from near Belém, Brasil, and Cayenne, French Guiana, produced three to five egg sacs in succession when kept in the laboratory. Galiano's Belém females produced 80–150 eggs per sac. Maréchal's French Guiana females put 250–500 eggs in each sac, the number decreasing with each new sac. Brood sizes for two egg sacs from Puerto Maldonado were 164 and 391; a sac from the igapó near Manaus contained 256 eggs. The egg diam-

eters (10 eggs selected at random from each brood) of these broods are, respectively, 0.93–1.04, 0.89–0.98, and 0.83–0.93 mm. Galiano and Maréchal both found egg diameter to vary from 0.90 to 1.00 mm.

Galiano (1972) gave a detailed description of the timing and morphology of early postembryonic development of *I. guianensis*. At 26°C, eggs hatch 10–12 days after oviposition, hatching and shedding of the first postembryonic cuticle occur together during a 24-hour period, the second instar (= "deutovum" of Yoshikura [1955, 1958], "larva" of Vachon [1958], "first free postembryonic stage" of Holm [1954], and "first instar" of Coyle [1971]) lasts 7 days, and the third instar spiderlings, which are fully equipped for independent life, emerge from the egg sac, remain for varying periods in the maternal web where they may capture small prey, and then disperse to construct their own webs.

*Ischnothelie annulata* Tullgren

Figures 35, 108–110, 150–152,  
172–217; Map 2

*Ischnothelie annulata* Tullgren, 1905: 16 (female lectotype, here designated, and six female paralectotypes from Tatarendá, Tarija, Bolivia, in SMNH, examined).

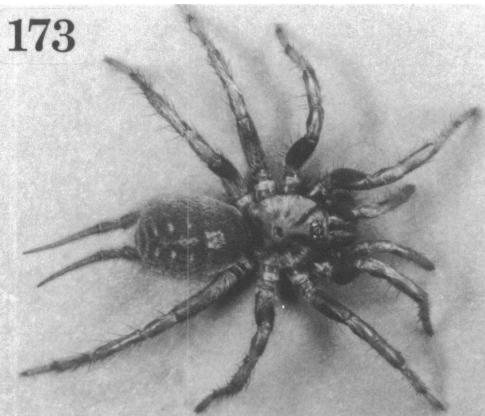
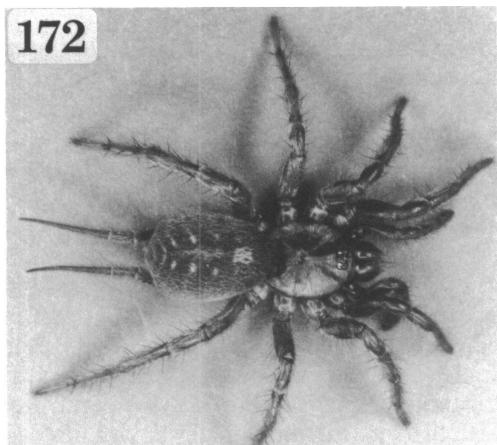
*Ischnothelie indigena* Vellard, 1924: 157, fig. 42 (holotype female and some paratype females from Catalão, Goias, Brasil, or Campo Grande, Matto Grosso, Brasil, presumably lost). — Schiapelli and Gerschman, 1945: 174. NEW SYNONYMY.

*Ischnothelie zorodes* Mello-Leitão, 1943: 256 (female holotype from Veadeiros, Goias, Brasil, in MNRJ, no. 14010, examined). — Bücherl et al., 1971: 123, figs. 19, 20. NEW SYNONYMY.

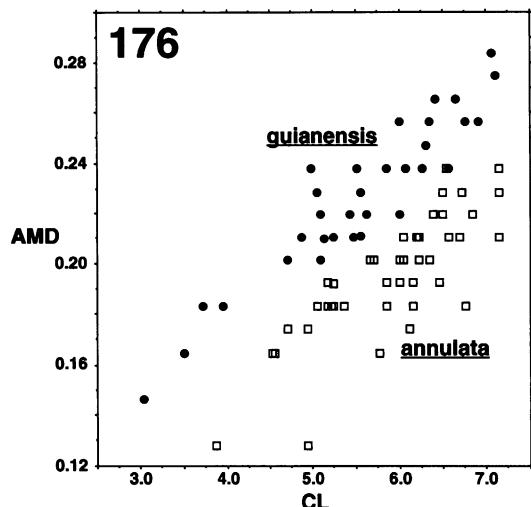
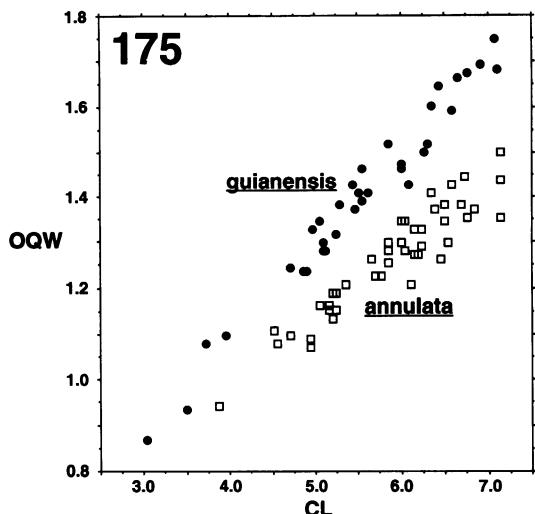
*Ischnothelie campestris* Schiapelli and Gerschman, 1945: 173, pl. III (female holotype from Vilhena, Matto Grosso, Brasil, in MACN, no. 834, examined). NEW SYNONYMY.

*Ischnothelie affinis* Schiapelli and Gerschman, 1945: 174, pl. IV (male holotype from Rio Pimenta Bueno, Rhondonia, Brasil, presumably missing; another male, apparently substituted for holotype, in MACN, no. 847, examined; see Remarks section below). NEW SYNONYMY.

*Ischnothelie cranwelli* Gerschman and Schiapelli, 1948: 2, figs. 1–3 (male holotype and female allotype from General Pinedo, Chaco, Argentina, in MACN, no. 1726, examined). — Schiapelli and Gerschman, 1962: 74, pl. IV, fig. 3. NEW SYNONYMY.



Figs. 172–174. Live *Ischnothelus annulata*. 172. Female from Villa Carlos Paz, Córdoba, Argentina. 173. Female from Hickman, Salta, Argentina. 174. Male from Villa Carlos Paz, Argentina.



Figs. 175, 176. Scattergrams of characters that help distinguish females of *Ischnothelus annulata* from those of *Ischnothelus guianensis*. Measurements in mm. 175. OQW plotted against CL. 176. AMD plotted against CL.

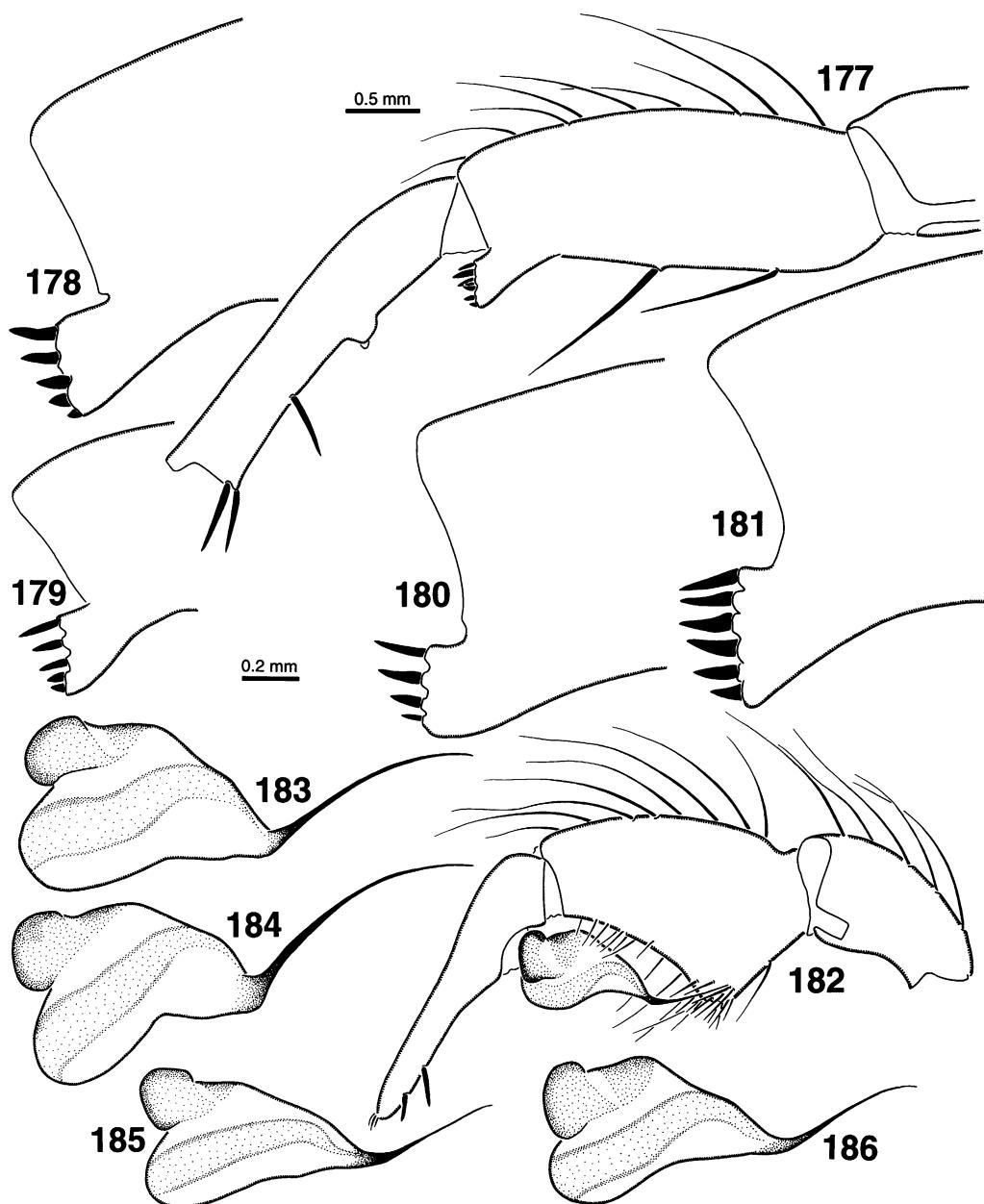
**DIAGNOSIS:** The high number of TSP (10–38) and the distinctive tibia I apophysis (figs. 177–181) and palpal organ (figs. 183–186) distinguish *I. annulata* males from all other *Ischnothelus* species except its closest relatives, *I. caudata* and *I. guianensis*. See the diagnoses of these two species for male traits that distinguish them from *I. annulata*. Spermathecal form distinguishes *I. annulata* fe-

males (figs. 187–199) from all *Ischnothele* species but *I. guianensis*. *Ischnothele annulata* females differ from *I. guianensis* females by their proportionally narrower ocular quadrangle [OQW(100)/CL = 19–25 vs. 24–29] (fig. 175), proportionally smaller AMEs [AMD(100)/CL = 2.6–3.7 vs. 3.6–4.9] (fig. 176), and high number of spines on the first tarsus (ITarS = 4–17 vs. 2–7). See the diagnoses of *I. caudata* and *I. guianensis* for other characters that help separate those species from *I. annulata*. The median spermathecae of *I. annulata* females are bent more (outward) and their bulbs are more distinctly set off from the stalk (figs. 187–199, 206–214) than in many *I. guianensis* females (figs. 160–171), but the two species overlap too much in these traits for them to be clearly diagnostic.

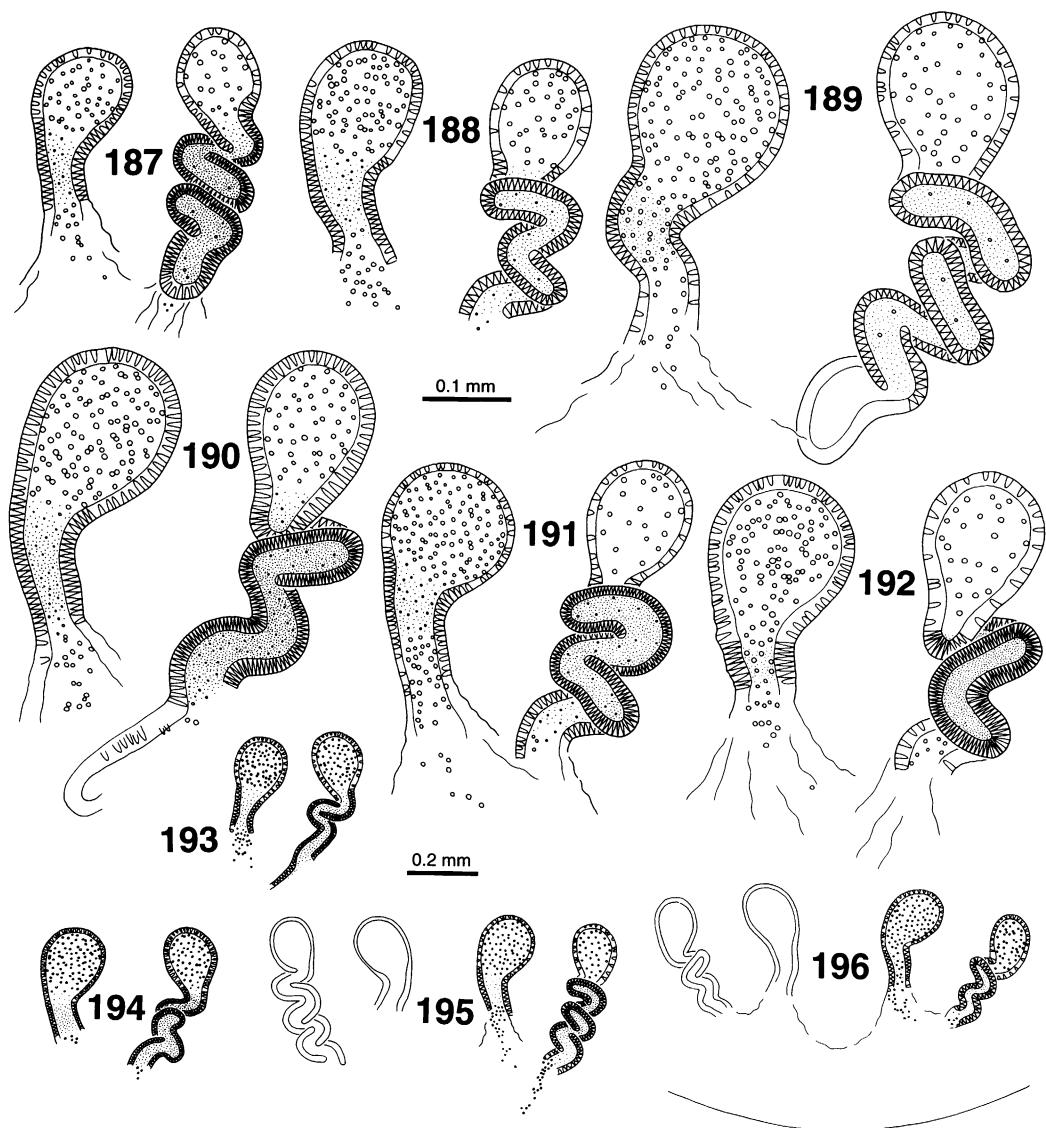
**MALES:** Table 5. Palpal organ (figs. 183–186) with bulb narrowing rather abruptly to base of embolus, which curves weakly to strongly at base in retrolateral direction and then, more distally and gradually, back toward the prolateral. Cymbial apophysis (fig. 182) with 1–5 prolateral and 0–3 retrolateral spines; 5–13 stout bristles on very tip. Palpal tibia (fig. 182) with very strong ventral swelling with dense cluster of relatively short strong bristles. No prolateral spines on palpal patella. Tibia I apophysis (figs. 177–181) moderately broad and subtruncate with distal face more or less vertical and with 3–8 strong sharp spines in row along distal face; proximal spines moderately long, distal ones much shorter. Metatarsus I (fig. 177) with ventral apophysis just proximal of midpoint; apophysis with thick rounded retrolateral prominence and weaker prolateral prominence with more pointed tip; 3–5 spines at distal end of metatarsus. Tarsus I not flexible. One (rarely 1.5) pair of strong foveal bristles. Color of live (from Villa Carlos Paz, Argentina) and preserved specimens similar to females (figs. 172–174, 200–202).

**FEMALES:** Tables 6 and 7. Two spermathecae per side (figs. 187–199, 206–214); stalks weakly to moderately sclerotized, at least distal  $\frac{2}{3}$  of each bulb unsclerotized; median spermatheca short to relatively long, with stalk nearly straight to strongly bent outward and making gradual to rather abrupt transi-

tion to bulb; lateral spermatheca with longer, coiled (or strongly sinuous), usually more sclerotized, stalk. Foveal bristles as in males. Color of live specimens (from Villa Carlos Paz, Bosque Alegre, and Hickman, Argentina) (figs. 172, 173): Carapace light gray (because of many recumbent white hairs) to very dark brown, usually darkest on pars cephalica and middle of pars thoracica; chelicerae very dark brown to black; legs and pedipalps light gray to very dark brown; leg coxae, femora, and patellae usually lighter than more distal articles because of abundant white hairs; abdominal dorsum medium gray-brown to very dark brown (virtually black) with anterior median white to cream-colored spot followed by two or three pairs of smaller, sometimes oblique, white spots that are followed by one or two thin oblique pairs of lines forming faint chevrons; faint median longitudinal area with white hairs behind anterior white spot, but this does not connect with the paired spots. Color of preserved specimens: (Preservation makes the body wall much lighter and reduces the reflectance of the light hairs, thereby reducing the brightness of the white hair patches. Both of these effects reduce the prominence of the dorsal abdominal markings, which in life are due much more to white hairs than to the pattern of pigment-poor areas of the body wall. As shown in figures 200–202, except for the usual absence of an anterior median pigment-poor spot, these pigment-poor areas of the body wall tend to coincide with the overlying white hair pattern.) Carapace tan to dark amber-brown; chelicerae darker than carapace (orange-tan to dark chestnut brown; legs and pedipalps tan to dark amber-brown, sometimes dark areas give ringed appearance and sometimes these dark areas are confluent except for light longitudinal stripes dorsally on femora, patellae, and tibiae; abdominal dorsum light to dark purple-brown with dull white anterior median spot followed by two or three pairs of smaller, sometimes oblique, dull white spots that are followed by one or two thin oblique pairs of lines forming faint chevrons; faint median longitudinal area of white hairs extends short distance back behind anterior white spot; sometimes the posterior three pairs of oblique marks connected by pale median area; an-



Figs. 177–186. *Ischnothelus annulata* males. 177. Tibia and metatarsus I, retrolateral view, Puerto Max, Paraguay. 178–181. Tibia I apophysis, retrolateral view. 178. Ojo de Agua, Santiago del Estero, Argentina. 179. Utiariti, Mato Grosso, Brasil. 180. Metán, Salta, Argentina. 181. Estancia la Gama, Boquerón, Paraguay. 182. Pedipalp, retrolateral view, Puerto Max, Paraguay. 183–186. Palpal organ, retrolateral-ventral view. 183. Puerto Max, Paraguay. 184. Fazenda Monjolinho, Goiás, Brasil. 185. Villa Carlos Paz, Córdoba, Argentina. 186. Tartagal, Salta, Argentina. Scale lines: 0.5 mm for figs. 177, 182; 0.2 mm for all other figs.

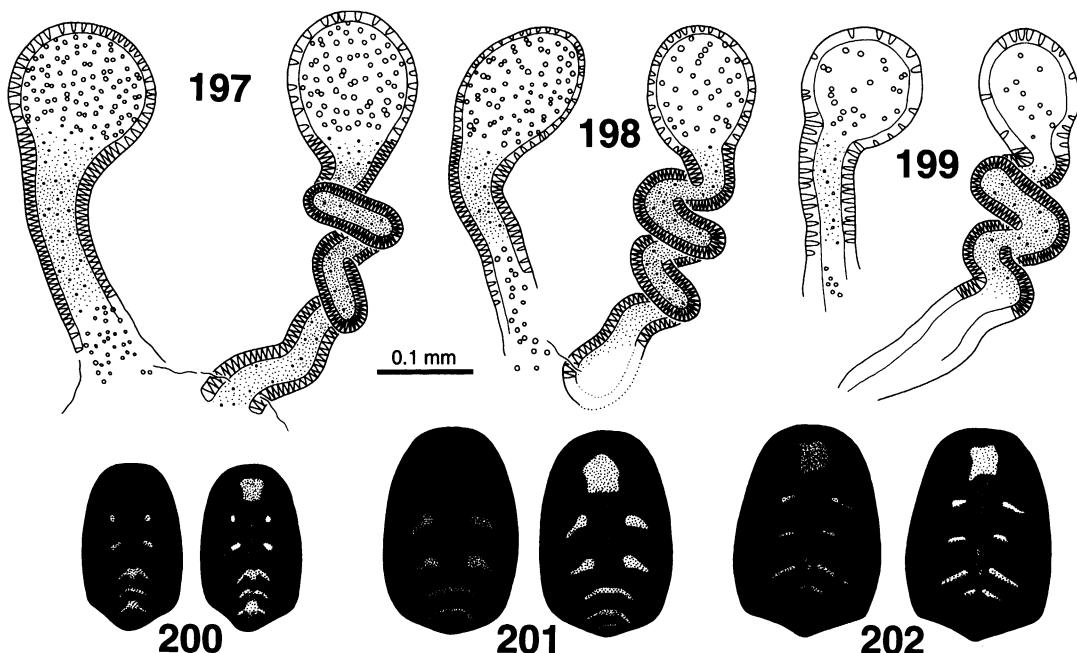


Figs. 187–196. *Ischnotheloides annulata* spermathecae. 187–194. Right spermathecae. 187. Lectotype. 188. Chavantina, Mato Grosso, Brasil. 189. Bahia (Salvador), Bahia, Brasil. 190. *Ischnotheloides campestris* holotype. 191. Mombaco, Ceará, Brasil. 192. Suriname, São Paulo, Brasil. 193. Tres Lagoas, Mato Grosso, Brasil. 194. *Ischnotheloides zorodes* holotype. 195, 196. All spermathecae. 195. Morro Garca, Mato Grosso, Brasil. 196. Arroyo la Coronada, Santa Cruz, Bolivia. Scale lines: 0.1 mm for figs. 187–192; 0.2 mm for figs. 193–196.

terior median light spot usually not present on hairless specimens; roughly crescent-shaped area of dark pigment on median  $\frac{1}{6}$ – $\frac{1}{3}$  of posterior book lung cover.

**VARIATION:** Noteworthy geographic variation is exhibited by several male characters. In Brasilian males the palpal organ is pro-

portionally longer and wider, the cymbium proportionally longer, and the palpal tibia proportionally thicker than in the great majority of males from Paraguay and Argentina (figs. 203–205). The palpal organ varies in a nearly continuous clinal pattern from north to south; in particular, the base of the em-



Figs. 197–202. *Ischnothele annulata*. 197–199. Right spermathecae, 0.1 mm scale. 197. Charata, Chaco, Argentina. 198. Alta Gracia, Córdoba, Argentina. 199. Filadelfia, Boquerón, Paraguay. 200–202. Dorsal abdominal color patterns of three preserved specimens. For each specimen, left drawing shows only body wall pigment pattern and right drawing shows overall pattern resulting from hairs and body wall pigmentation. Background color (various shades of brown) shown in black. 200. La Quena, Salta, Argentina. 201. Hickman, Salta, Argentina. 202. Puerto Max, Paraguay.

bolus is most strongly curved in many Brasilian males (fig. 184), strongly to moderately curved in Paraguayan males (fig. 183), and moderately (fig. 186) to weakly (fig. 185) curved in Argentine males. The Argentine males from Villa Carlos Paz ( $N = 7$ ) and Metán ( $N = 1$ ) have proportionally shorter tibia 1 apophyses [ $TAL2(100)/CL = 6.6\text{--}8.8$  ( $7.6 \pm 0.7$ )] (fig. 180) than most other *I. annulata* males (figs. 178, 179, 181) [ $TAL2(100)/CL = 7.8\text{--}10.2$  ( $8.8 \pm 0.6$ )], including those from other Argentine localities. Only one quantitative female character exhibits marked geographic variation; CDR number is higher for all examined Brasilian ( $N = 7$ ) and some Bolivian females ( $N = 5$ ) than for females ( $N = 27$ ) collected in Paraguay and Argentina [CDR = 4–11 ( $7.8 \pm 1.9$ ) vs. 0–6 ( $2.9 \pm 1.6$ )]. Variation in spermathecal form is rather wide but continuous (figs. 187–199). There is a tendency for Brasilian females to have proportionally shorter median spermathecae (higher MBD/MH values) (figs. 206–208) than do fe-

males from Paraguay and Argentina (figs. 209–214), but there is very broad overlap, and intrapopulation variation (see figs. 209–211 for specimens from Filadelfia, Paraguay) is sometimes nearly as great as that observed among all populations. There is no marked geographic variation in dorsal abdominal pigmentation (figs. 200–202).

The existence of male characters [particularly PL(100)/CL (fig. 203)], which make it possible to distinguish Brasilian males [ $PL(100)/CL = 31\text{--}37$ ;  $34.5 \pm 1.8$ ] from Paraguayan and Argentine males [ $PL(100)/CL = 25\text{--}32$ ;  $28.4 \pm 2.2$ ] with considerable confidence, might justify designating the Brasilian populations as one species and all other populations as another species. However, the clinal pattern of variation in palpal organ form and in the only female character (CDR) to exhibit marked geographic variation suggests that when Bolivian males become available for study the apparently diagnostic male characters may prove to be clinal. The avail-

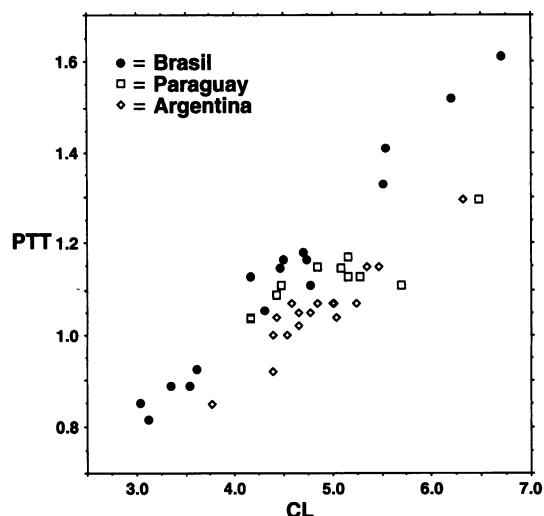
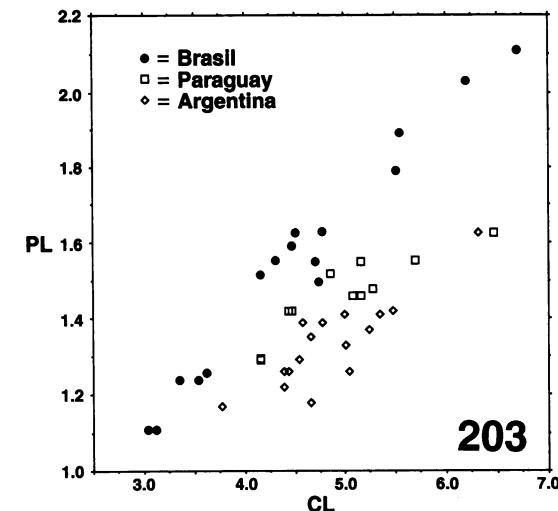
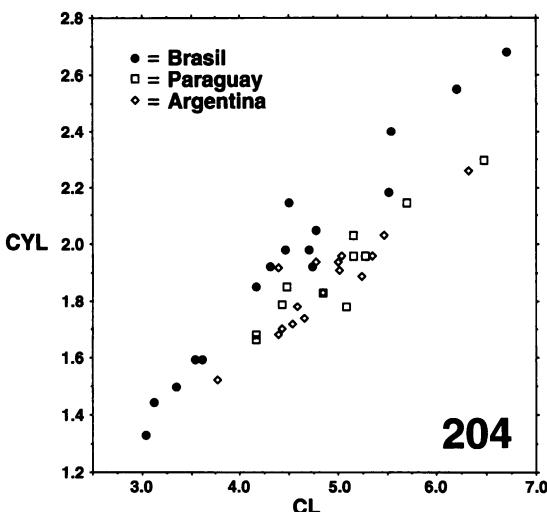


Fig. 205. Scattergram of PTT plotted against CL for males of *Ischnothele annulata*.

Vellard's (1924) description and the type locality (either Catalão or Campo Grande, Brazil), these specimens were almost certainly conspecific with *I. annulata*.

The descriptions of *I. zorodes* are very brief and contain puzzling errors. As noted by Brignoli (1983), Mello-Leitão (1943) erroneously indicated that the type of *I. zorodes* was a male. The spermathecae illustrated by Bücherl et al. (1971) are very different from those of the type specimen and from any other known *Ischnothele* species. The specimen that is labeled as the type conforms to other females of *I. annulata* in spermathecal form (fig. 194) and all other character states.

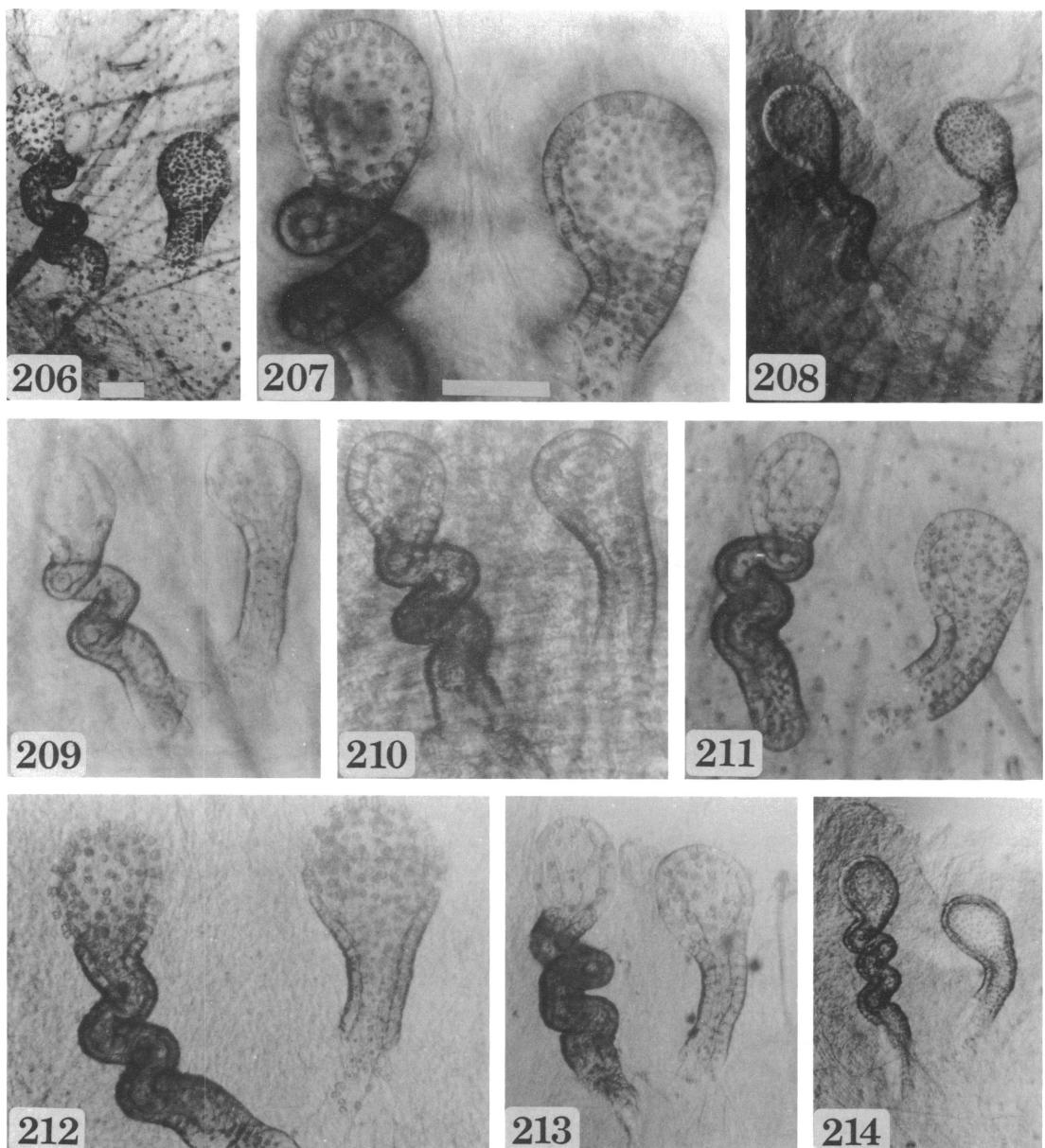
Galiano and Goloboff were unable to locate the holotype of *I. affinis* in the MACN. Subsequently, when studying the MACN ischnotheline material that they loaned to me, I discovered a vial containing a male and female with the same catalog number (847), locality, and date specified by Schiapelli and Gerschman (1945) for the holotype. Because both specimens matched *I. caudata* in all diagnostic characters, I am confident that they were actually collected from somewhere north and west of the Amazon Basin, far from the published type locality of *I. affinis*. (Vellard [1945] observed and probably collected *I. caudata* near Caracas, Venezuela.) This male does not match the character states given in the published description of the *I. affinis* ho-



Figs. 203, 204. Scattergrams of male characters which vary geographically in *Ischnothele annulata*. Measurements in mm. 203. PL plotted against CL. 204. CYL plotted against CL.

able data support the hypothesis that *I. annulata* is a widespread species of regional semi-isolated populations among which genes flow only sluggishly, and in many cases very indirectly. More samples and, ultimately, cross-mating experiments are needed to rigorously test these competing hypotheses.

**REMARKS:** According to H. W. Levi and P. Goloboff (personal commun.), the types of Vellard's *I. indigens*, as well as virtually all the rest of his types deposited in the Instituto Vital Brazil, have been destroyed. Based on



Figs. 206–214. Left spermathecae of *Ischnothelus annulata*. 206–208. Brasil. 206. Barra do Tapirape, Mato Grosso. 207. Suriname, São Paulo. 208. Barra do Tapirape. 209–211. Filadelfia, Boquerón, Paraguayan Chaco. 212–214. Argentina. 212. Charata, Chaco. 213. Villa Carlos Paz, Córdoba. 214. El Yacaré, Formosa. Scale bars 0.1 mm; fig. 206 bar also for figs. 208, 214; fig. 207 bar for all other figs.

lototype (it is smaller, has 50 cuspules per maxilla, etc.). Schiapelli and Gerschman's (1945) description and figures suggest (but do not confirm) that the actual *I. affinis* holotype is distinct from *I. guianensis* and conspecific with *I. annulata* males collected from nearby

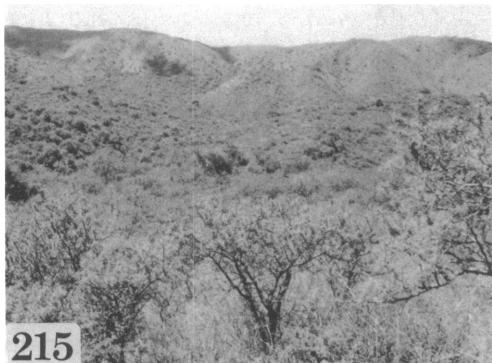
Vilhena, Brasil. Another female was found in the MACN collection that has the same locality and date given by Schiapelli and Gerschman (1945) for the holotype; this female matches the diagnostic characters of *I. annulata*.

Schiapelli and Gerschman (1962) illustrated the spermathecae of the allotype of *I. cranwelli* in figure 3 of plate IV, but, because figures were transposed, the legend (*Pselligmus argentinensis*) with that figure is in error.

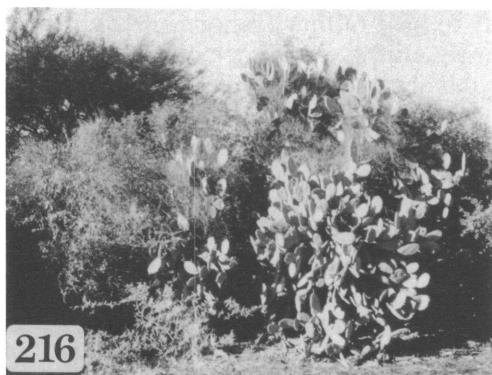
**DISTRIBUTION:** East and south of the Amazon Basin in Brasil, Bolivia, Paraguay, and northern Argentina (map 2).

**MATERIAL EXAMINED:** **ARGENTINA:** **Catamarca:** Las Pirquitas, 16 km San Fernando del Valle de Catamarca, May 2, 1989 (Coronel-Soubirain, MACN), 1 ♂ (matured July 1989); La Tortuga, 12 km San Fernando del Valle de Catamarca, May 1, 1989 (Coronel-Soubirain, MACN), 1 ♂ (matured July 1989), juv. **Chaco:** Charata, Oct. 1924 (Canals, MACN), 4 ♀; General Pinedo, 1946 (Cranwell, MACN 1726), 1 ♂, 1 ♀ (holotype and allotype of *I. cranwelli*). **Córdoba:** Agua de Ramón, June 1961 (Martínez, MACN), 1 ♀; Alta Gracia, Jan. 1940 (C. Bruch, MACN), 6 ♀, juvs.; Anisacate, July 1973 (Carpintero, MACN), 1 ♀, juvs.; Cañada de Alvarez, Mar. 1940 (Vucetich, MACN), 1 ♀; Cavalango, Apr. 5, 1985 (E. Maury, MACN), juv.; Churqui Cañada, Sept. 24, (Maldonado, MACN), 1 ♂, juv.; 38 km S Lucio V. Mansilla, highway 60, dense thorn scrub, Mar. 16, 1988 (Coyle, Bennett, Goloboff; AMNH), 1 ♀; Tulumba, Mar. 1949 (Birabén, MACN), 2 ♀; Villa Carlos Paz, July 12, 1979 (Goloboff, MACN), 3 ♂, 5 ♀; Apr. 1987 (Goloboff, MACN), 1 ♂, juvs.; 2 km NE Villa Carlos Paz, savanna, Mar. 15, 1988 (Coyle, Bennett, Goloboff; AMNH), 3 ♂ (matured later in captivity); 20 km S Villa Carlos Paz, Cerca del Observatorio de Bosque Alegre, Jan. 1981 (Goloboff, MACN), 1 ♂, 1 ♀, Sept. 1981 (Goloboff, MACN), 2 ♀, juvs. **Formosa:** El Yacaré, Pilagá, Nov. 1944 (Pierotti, MACN), 5 ♀, juvs. **Jujuy:** Fraile Pintado, Oct. 1967 (Maury, MACN), 1 ♀. **La Rioja:** Chepes, Mar. 14, 1940 (Birabén, MACN), juv. **Salta:** Alto Pilcomayo, July 1951 (Boero, MACN), 2 ♀; Hickman, July 20, 1943 (Lillo, MACN), 4 ♀, juvs., Nov. 11, 1944 (Pierotti, MACN), 1 ♂, 6 ♀, Mar. 1945 (Pierotti, MACN), 2 ♀, Oct. and Nov. 1967 (Galiano, MACN), 4 ♀; 0.5 km E Hickman, chaco thorn forest, Mar. 20–21, 1988 (Coyle, Bennett, Goloboff; AMNH), juvs.; La Quena, high banks along Río Bermejo, May 14–15, 1983 (Goloboff, MACN), 1 ♀, juvs., Mar. 20–21, 1988 (Coyle, Bennett,

Goloboff; AMNH), 1 ♂ (matured Dec. 15, 1989), juvs.; Metán, Mar. 1967 (Galiano, MACN), 1 ♂; Pocitos, Sept. 1949 (Prosen, MACN), 1 ♀, juv., Nov. 21, 1951 (Birabén, MACN), 2 ♀, juv.; Tartagal, Oct. 1940 (Birabén, MACN), 1 ♂, 1 ♀. **San Luis:** Quines, Feb. 17, 1940 (MACN), juvs. **Santiago del Estero:** Colonia Dora, 1940 (Prosen, MACN), juv., Feb. 7–8, 1985 (Goloboff, MACN), 1 ♀; S edge Ojo de Agua, rock road bank, Mar. 22, 1988 (Coyle, Bennett, Goloboff; AMNH), 1 ♂ (matured later in captivity), 1 ♀, juvs.; Santiago del Estero, Sept. 23, 1947 (Weisburd, MACN), 1 ♂, 1 ♀, juv. **BOLIVIA:** **Santa Cruz:** Arroyo La Coronada and road to Camiri, 20 km S Santa Cruz, Jan. 12, 1991 (Goloboff, Santisteban, McHugh; MACN), 5 ♀; San Antonio, 10 km S Tatarenda, Sept. 1–4, 1960 (B. Malkin, AMNH), juv. **Tarija:** Tatarenda, 1901–1902 (SMNH), 7 ♀ (lectotype and paralectotypes of *I. annulata*); Crevaux, Río Pilcomayo, Aug. 5–15, 1964 (B. Malkin, AMNH), juv. **BRASIL:** **Bahia:** Bahia (Salvador), 1880 (P. Gonn, MNHN 9980), 2 ♀. **Ceará:** Camarão, Município Mumbaco, Feb. 12, 1948 (deSouza, MZUSP 6360), 2 ♀. **Goiás:** Anápolis, 1942 (F. Lane, MZUSP 0604), 2 ♀; Aragarca, 1946 (Sick, MZUSP 1247), 1 ♀, juv.; Fazenda Monjolinho, May 4, 1942 (F. Lane, MZUSP 5164), 2 ♀; Fazenda Monjolinho, Corumbá, May 28, 1942 (F. Lane, MZUSP 6296), juvs., June 7–8, 1942 (F. Lane, MZUSP 10828, 6659), 3 ♀, juvs., Aug. 1952 (F. Lane, MZUSP 10829), 1 ♂; Goiana, Oct. 12, 1957 (B. Malkin, AMNH), 1 ♀, juvs.; Leopoldo Bulhões, Nov. 1937 (R. Spitz, MZUSP 10834), 1 ♂; Pirapitinga, Pirenópolis, June 20, 1942 (F. Lane, MZUSP 10833), 2 ♀; Rio Oliveira, Pirenópolis, June 23, 1942 (F. Lane, MZUSP 6245), 2 ♀, juvs. **Mato Grosso:** Barra do Tapirape, Aug. 1–15, 1962 (B. Malkin, AMNH), 1 ♂, 15 ♀, juvs., 1963 (B. Malkin, MZUSP 3149), 1 ♀, July 15–25, 1963 (B. Malkin, AMNH), 2 ♀, juvs., Jan 17–Feb. 2, 1964 (B. Malkin, AMNH), 1 ♂, 1 ♀; Tapirapé, Dec. 1960 (B. Malkin, MZUSP 7488), 1 ♀; Chapada dos Guimarães, Nov. 1963 (M. Alvarenga, AMNH), 1 ♂; Chavantina, Oct. 1946 (Sick, MZUSP 1254), 3 ♂, 4 ♀; Diamantina, Oct. 21, 1966 (Lenko and Pereira, MZUSP 10830), 1 ♀; Fazenda Canaã, Três Lagoas, Oct. 1966 (F. Lane, MZUSP 5349), 1 ♂; Palmito, Três Lagoas, May 20, 1964 (Exped.



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Figs. 215–217. *Ischnothele annulata*. 215. Scrub savanna habitat at Villa Carlos Paz, Córdoba, Argentina. 216. Thorn forest/thorn scrub habitat at Hickman, Salta, Argentina. 217. Web at Hickman with vertical strands.

DZ, MZUSP), 1 ♀; Três Lagoas, Oct. 1964 (Exped. DZ, MZUSP 3764), 1 ♀; July 1965 (Lenko, MZUSP 1938), 1 ♀; Utiariti, 1961 (Lenko, MZUSP 4153), 3 ♂. **Minas Gerais:** Lagoa Santa, 19°39'S, 43°44'W, 1847 (J. Reinhardt, ZMC), 1 ♀; Morro Garca, 1964 (CDZ, MZUSP 4214), 1 ♂, 3 ♀; Municipio do

Prata, Dec. 12, 1979 (de Almeida, IB 4.520), 1 ♀. **Rondonia:** Rio Pimenta Bueno, Oct. 1938 (Vellard, MACN 847), 1 ♀, juvs.; Vilhena, Sept. 1938 (MACN), 2 ♂, juv. (Vellard, MACN 834), 1 ♀ (holotype of *I. campestris*). **São Paulo:** Assis, Aug. 1970 (G. Brisolla, IB 4.080), 3 ♀; Nova Granada, Aug. 16, 1968 (Biasi, Vizotto; MZUSP), 2 ♀; Rio dos Castores, São José do Rio Preto, Jan. 27, 1968 (Vizotto, MZUSP 10832), 1 ♀, juv. Suriname, Matapica Beach, Nov. 4, 1962 (B. Malkin, AMNH), 2 ♂, 2 ♀, juvs. **PARAGUAY:** **Boquerón:** Estancia la Gama, between cruce ruta 14 and Palmar, Oct. 20, 1990 (J. Kochalka, JKC), 4 ♂, 2 ♀; Filadelfia, July 14–17, 1983 (J. Kochalka, JKC), 5 ♀. **Chaco:** Parque Nac. Defensores del Chaco, Madrejón, under a log, Aug. 25–29, 1983 (J. Kochalka, JKC), 1 ♀, juvs.; Misión Cuā Tribu Nueva, Aug. 21, 1983 (J. Kochalka, JKC), 1 ♀. Province unknown: Postillon, Oct. 29, 1902 (J. Anisits, ZMB), 2 ♂, 1 ♀, juv.; Puerto Max, Oct. 19, 1902 (J. Anisits, ZMB), 4 ♂, 15 ♀, juvs.

**NATURAL HISTORY:** *Ischnothele annulata* has been collected from sea level up to elevations of about 1000 m. Most natural history data for this species come from Argentine populations; little is known about the populations from Brasil, Bolivia, and Paraguay. This species is typically associated with relatively dry habitats, including scrub savanna (fig. 215), thorn scrub, and chaco thorn forest (fig. 216) in Argentina, tropical deciduous woodland/forest (chaco) in southeastern Bolivia (Tullgren, 1905; Paynter, 1992), and the grassland/savanna of the Mato Grosso of Brasil (Vellard, 1945). Apparently this species seldom, if ever, lives in humid or wet forest; the only indication of such an association is Vellard's (1945) description of the *I. affinis* type locality (Rio Pimenta Buena, Brasil) as humid and semi-dark forest; perhaps this was gallery forest along the river. In Argentina, webs often extend out from under rocks or fallen *Opuntia* cactus pads (figs. 216, 217), crevices in rock outcrops or earth banks, depressions or fissures in the ground, and the bases of *Opuntia* and other plants. In Paraguay, Kochalka (personal commun.) found webs extending out from under logs and dry clumps of soil. In the Mato Grosso, Vellard (1945) found that the crevices in large termite mounds were favorite web sites. In

the forest at Rio Pimenta Buena he found webs on tree trunks and at the bases of palm leaves.

The webs (fig. 217) and prey capture behavior of this species are described by Coyle and Ketner (1990). The horizontal areas covered by the largest webs in the several Argentine populations studied range from 575 to 900 cm<sup>2</sup>. Vellard (1945) describes the webs he found on termite mounds in the Mato Grosso. As is typical for other *Ischnothele* species, ants and beetles comprise most of the prey remains found in retreats (Coyle and Ketner, 1990). These spiders will readily capture prey in daylight, but are reluctant to stay exposed on the capture web for more than a few moments.

A male and female *Mysmenopsis* kleptoparasite were found together in the web of an *I. annulata* female from Estancia la Gama, Dpt. Boquerón, Paraguay, on October 20, 1990. Comparison of these specimens to the type specimen of *M. ischnamigo* and another male from Trinidad and to Baert's (1990) drawings of *M. ischnamigo* from Peru indicates that they are also *M. ischnamigo*, and that this kleptoparasite is therefore remarkably widespread (Panama to Paraguay).

It is likely that the breeding season is between July and November since 29 of the 32 males with known collecting dates were collected then. Vellard's (1945) observation that many females in the Mato Grosso had egg sacs in September and October is consistent with this hypothesis. The courtship and mating of this species will be described in another paper (Coyle, in prep.).

*Ischnothele goloboffi*, new species  
Figures 218–225; Map 3

**TYPES:** Male holotype and one male and two female paratypes from Puerto Picse at km 147 on road from Olmos to Bagua, Cajamarca, Peru (Dec. 26, 1990; Goloboff, Santisteban, and McHugh), deposited in AMNH.

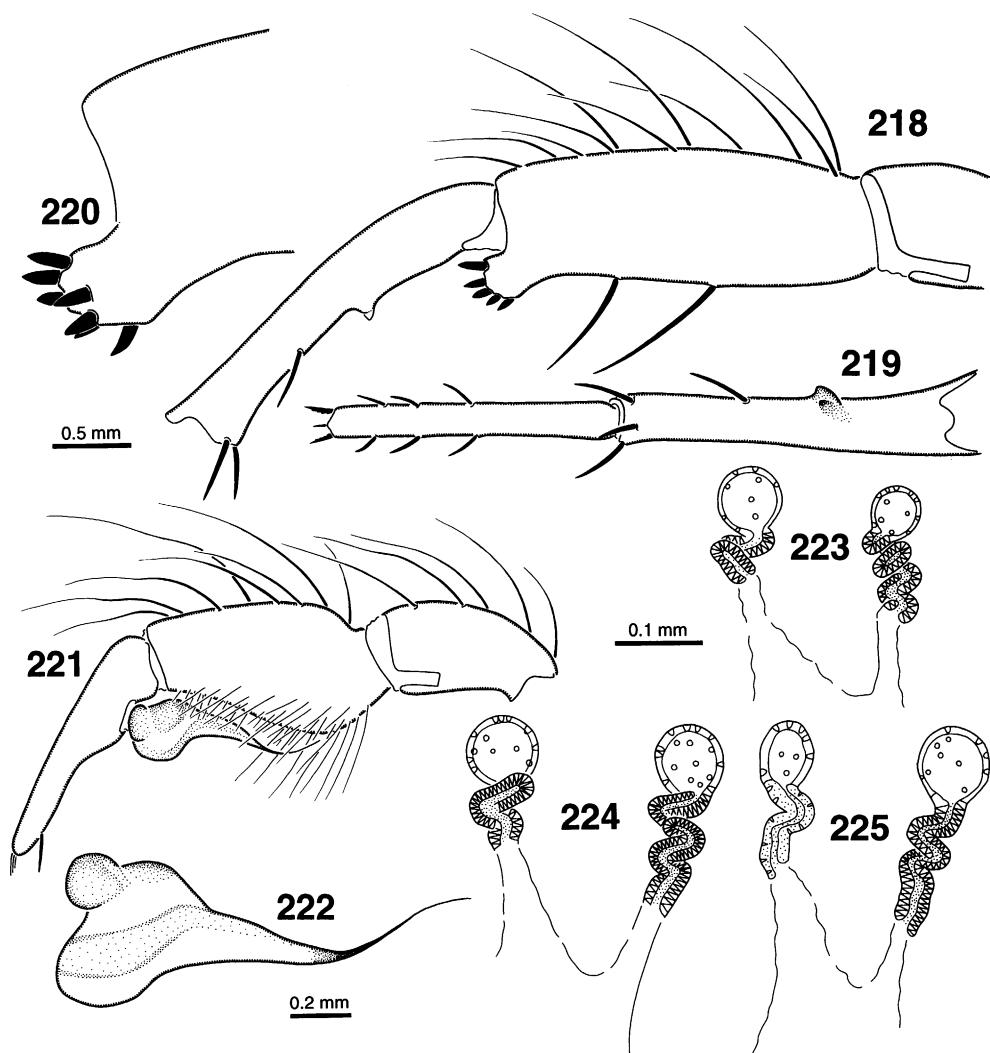
**ETYMOLOGY:** The specific name is a patronym in honor of Pablo Goloboff, collector of the type series and author of exemplary papers on mygalomorph systematics.

**DIAGNOSIS:** Males of *I. goloboffi* are most readily distinguished from those of its sister

clade (*I. caudata*, *I. guianensis*, and *I. annulata*) by the small number of spines pro-laterally on tarsus I (TSP = 2–4 vs. 4–38) (fig. 219) and the gradually tapering embolus base (fig. 222) of the elongate palpal organ [PL(100)/BD = 261–264 vs. 195–267]. Females can be distinguished from those of all other *Ischnothele* species by the distinctive spermathecae (figs. 223–225), and in particular by the strongly sinuous to looped nature of the median spermathecal stalks.

**MALES:** Tables 5 and 7. Elongate palpal organ (fig. 222) with bulb narrowing gradually to base of long sinuous embolus, which gently curves retrolaterally and dorsally. Cymbial apophysis (fig. 221) with 2 prolateral and 1 or 2 retrolateral spines; 6–11 stout bristles on very tip. Palpal tibia (fig. 221) with strong ventral swelling proximally; long erect bristles and hairs along ventral surface. No prolateral spines on palpal patella. Tibia I apophysis (figs. 218, 220) relatively wide, with rounded distoventral profile and 5–7 sharp, strong, mostly subequal, spines (dorsalmost spine longest). Metatarsus I (figs. 218, 219) with ventral apophysis just proximal of mid-point; apophysis with thick rounded retrolateral prominence and thinner but more pointed prolateral prominence; 3 or 4 spines at distal end of metatarsus. Tarsus I semi-flexible, with area of unsclerotized cuticle ventrally and laterally. One pair of strong foveal bristles. Color like that of females.

**FEMALES:** Table 6. Two spermathecae per side (figs. 223–225); stalks weakly to moderately heavily sclerotized, sinuous to tightly coiled, connected to bursa copulatrix by relatively long unsclerotized ducts; bulbs unsclerotized and spherical to ovoid; median spermathecal stalk relatively short; lateral spermathecal stalk longer and usually more heavily sclerotized than median. One to 1.5 pair strong foveal bristles. Carapace orange-tan to light orange-brown; chelicerae medium to dark red-brown; legs and pedipalps tan to orange-tan with faint to prominent dark marks at proximal end of tibia and at distal ends of tibia, metatarsus, and tarsus; abdominal dorsum dark gray-brown with faint diffuse light median longitudinal band and 4 or 5 chevrons composed of patches of sparse whitish setae; diffuse dark pigment on median  $\frac{1}{3}$ – $\frac{2}{3}$  of posterior book lungs.



Figs. 218–225. *Ischnothele goloboffi*. 218–222. Males. 218. Tibia and metatarsus I of holotype, retrolateral view. 219. Metatarsus and tarsus I of paratype, ventral view. 220. Tibia I apophysis of paratype, retrolateral view. 221, 222. Holotype. 221. Pedipalp, retrolateral view. 222. Palpal organ, retrolateral-ventral view. 223–225. Right spermathecae. 223. Zonanga. 224. Paratype. 225. Zonanga. Scale lines: 0.5 mm for figs. 218, 219, 221; 0.2 mm for figs. 220, 222; 0.1 mm for figs. 223–225.

**DISTRIBUTION:** Known only from the type locality and a neighboring locality both on the eastern slope of the Andes along a tributary of the Amazon River in northwestern Peru (map 3).

**MATERIAL EXAMINED:** PERU: Cajamarca: Puerto Picse, km 147 on road from Olmos to Bagua, Dec. 26, 1990 (Goloboff, Santisteban, McHugh; AMNH), 2 ♂, 2 ♀ (types); Zonanga, km 170 on road from Olmos to

Bagua, Dec. 26, 1990 (Goloboff, Santisteban, McHugh; AMNH), 1 ♂, 5 ♀.

**NATURAL HISTORY:** Both collections were made at elevations between 500 and 800 m in rather dry thorn forest high up on a river bank (Zonanga) and a road bank (Puerto Picse). At Zonanga, the *I. goloboffi* webs were constructed among many loose stones (among which large theraphosids also lived), and many of these webs contained adult males

and females of the kleptoparasite *Mysmenopsis ischnamigo* (Goloboff, personal commun.).

#### *ANDETHELE*, new genus

TYPE SPECIES: *Andethele huanca*, new species.

ETYMOLOGY: The generic name, which is feminine in gender, is derived from the name of the mountain range, the Andes, where this genus lives.

DIAGNOSIS: Numerous putative synapomorphies distinguish *Andethele* from all other ischnotheline genera. *Andethele* males exhibit the following unique features: (1) tibia I mating apophysis composed of a distal semiquadrata protuberance and a subdistal pointed one (figs. 226, 241, 265), (2) metatarsus I apophysis a pair of thick ridgelike keels positioned near the middle of the article (figs. 227, 242, 266), (3) metatarsus I proportionally short [IML(100)/CL = 43–46 vs. 49–78], and (4) cluster of weak bristles on cymbial apophysis tip. *Andethele* males and females both possess the following unique states: (1) proportionally small AMEs [female AMD(100)/CL = 1.5–3.0 vs. 2.6–5.4] (fig. 250), (2) proportionally short PLSs [female LSL3(100)/CL = 42–73 vs. 65–136] (fig. 251), and (3) inhabit cool (vs. warm) climates.

DESCRIPTION: Body size small to medium (CL = 3.0–6.5) (figs. 250, 251). Carapace with moderately dense covering of thin recumbent to semirecumbent hairs; usually 2 (but sometimes 3 or 4) long, strong foveal bristles; semierect setae on lateral edges of carapace short and thin. Pars cephalica elevated slightly or not at all above pars thoracica (fig. 251). Sternum not quite as wide as long. Palpal tarsus of female with 6–24 spines. Male palpal tibia (figs. 232, 248, 269) swollen throughout or primarily near proximal end; with long, slender, erect ventral bristles. No spines on prolateral surface of pedipalp patella. Cymbial apophysis (fig. 232) with 3 or 4 spines; cluster of weak bristles on very tip. Palpal organ with long gradually tapering and gently curving embolus (figs. 231, 249, 270). Male tarsus I integral (not pseudosegmented); 1–5 (male) or 0–9 (female) spines on tarsus I. Tibia I with two short spineless apophyses projecting forward from a longitudinal swell-

ing that occupies distalmost one-fourth to one-third of tibia on retrolateral aspect of its ventral surface (figs. 2, 26, 241, 265); distal apophysis heavily sclerotized, with prominent angular ventral projection; subdistal apophysis conical. Metatarsus I ventral apophysis (figs. 227, 242, 266) composed of strong pair of keels occupying middle one-third of article; 2 or 3 spines at distal end of metatarsus, often 1 spine ventrally between keels and distal end. Two spermathecae per side (figs. 233–240, 252–260, 271–277); stalks straight to curved or sinuous; lateral spermathecae lack bulbs or with weakly developed bulbs.

DISTRIBUTION: Andes Mountains of central Peru.

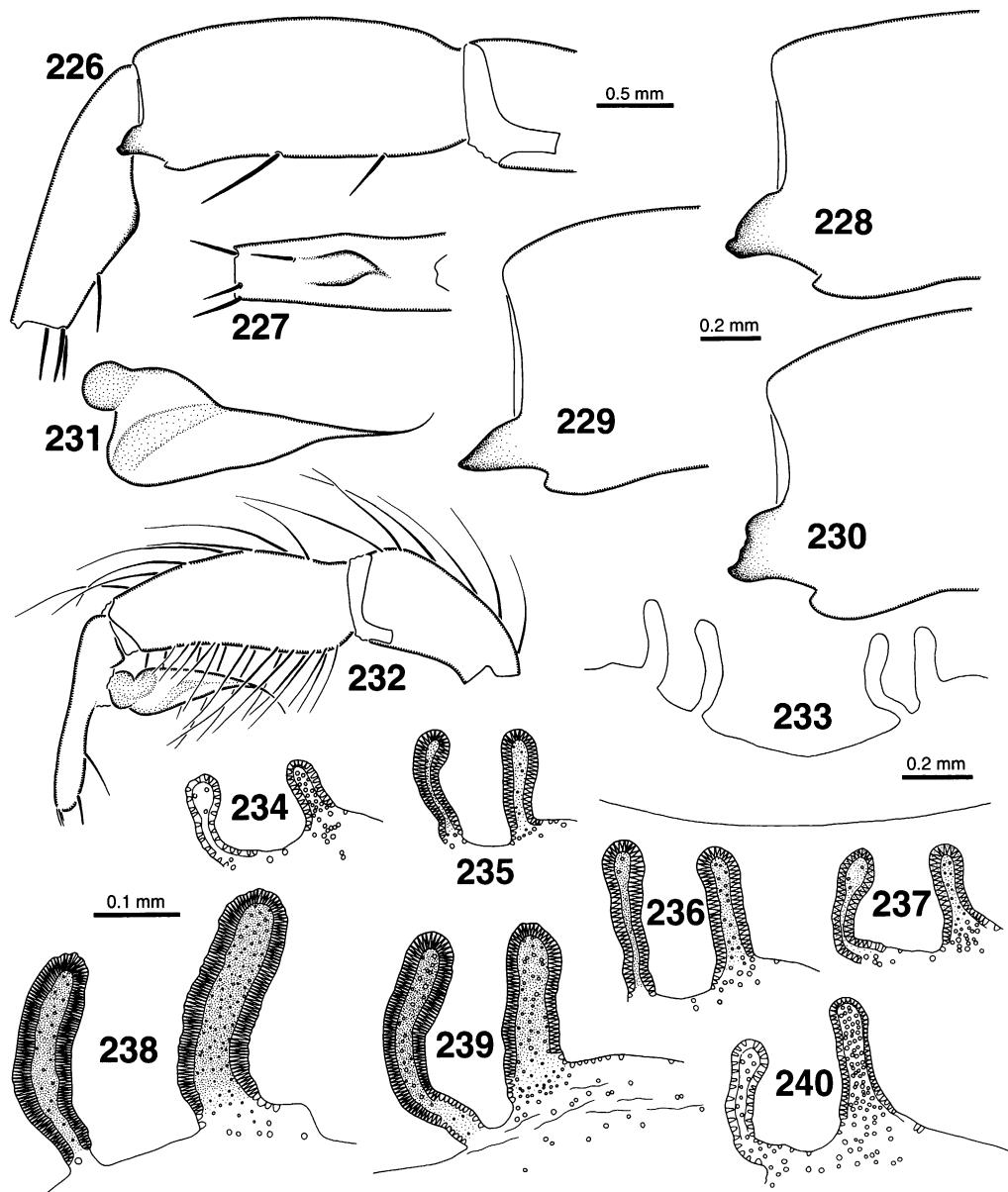
#### *Andethele lucma*, new species

Figures 226–240; Map 3

TYPES: Male holotype and two male and four female paratypes from an elevation of 2900–3250 m near Lucma-Lucma (Manzanailla), Huancavelica, Peru (Nov. 25–26, 1957; Koepcke and Koepcke), deposited in MHNL.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

DIAGNOSIS: Males of *A. lucma* can be distinguished from those of *A. huanca* and *A. tarma* by the following differences: (1) The palpal tibia is proportionally longer and thinner (fig. 232) than that of *A. huanca* and *A. tarma* (figs. 248, 269) [PTT(100)/PTL = 39–42 vs. 47–53 and 50–56, respectively]. (2) The cymbial apophysis is proportionally shorter (fig. 232) than that of *A. huanca* and *A. tarma* (figs. 248, 269) [CYAL(100)/CL = 17.8–19.1 vs. 21.9–23.5 and 22.2–22.6, respectively; CYAL(100)/PTL = 46–50 (47.7 ± 1.7) vs. 65–69 (66.7 ± 1.5) and 63–69, respectively]. (3) The palpal bulb is proportionally narrower (fig. 231) than that of *A. huanca* and *A. tarma* (figs. 249, 270) [PL(100)/BD = 267–286 vs. 224–255 and 233–252, respectively]. (4) In lateral view the base of the embolus is markedly more inflated (fig. 231) than in *A. huanca* and *A. tarma* (figs. 249, 270). (5) The tip of the subdistal apophysis on tibia I is much less sharp (figs. 228–230) than in *A. huanca* and *A. tarma* (figs. 244–247, 267, 268). Females of *A. lucma* differ most clearly from those of *A. tarma* by



Figs. 226–240. *Andethele lucma*. 226–232. Males. 226. Tibia and metatarsus I, retrolateral view, holotype. 227. Metatarsus I, ventral view, holotype. 228–230. Tibia I apophysis, retrolateral view. 228. Holotype. 229. Bosque de Zárate. 230. Paratype. 231. Palpal organ, retrolateral-ventral view, holotype. 232. Pedipalp, retrolateral view, holotype. 233. All spermathecae, Bosque de Zárate. 234–240. Right spermathecae. 234, 237, 240. Paratypes. 235, 236. Zárate. 238, 239. Bosque de Zárate. Scale lines: 0.5 mm for figs. 226, 227, 232; short 0.2 mm for figs. 228–231; long 0.2 mm for fig. 233; 0.1 mm for figs. 234–240.

the absence of the rudimentary spermathecal side branch that characterizes *A. tarma* (figs. 234–240 vs. 271–277). *Andethele lucma* females also usually have higher CDR(100)/CL

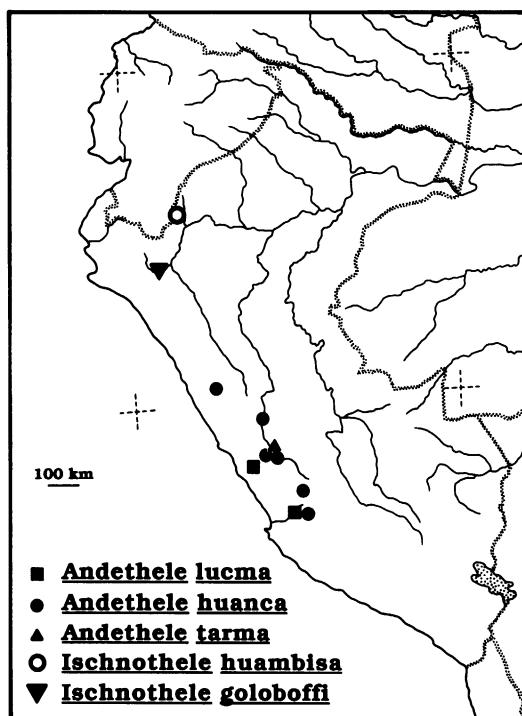
(415–853 vs. 279–422) and SW(100)/SL (83–92 vs. 78–87) values than do *A. tarma* females. It is more difficult to separate *A. lucma* females from those of *A. huanca*, but one or

more of the following characters should nearly always allow confident identification: (1) The spermathecae of *A. lucma* (figs. 233–240) are usually more heavily sclerotized than those of *A. huanca* (figs. 252–260). (2) The median spermathecae of *A. lucma* often lack bulbs or have only very rudimentary ones, whereas those of *A. huanca* usually have well-developed bulbs. (3) *Andethele lucma* females have higher CDR(100)/CL values (415–853) than do most *A. huanca* females (265–564).

**MALES:** Tables 5 and 7. Embolus (figs. 231, 232) swollen at base (lateral view) and strongly curving downward (lateral view) throughout much of its length; bulb relatively narrow. Cymbial apophysis (fig. 232) with 1 or 2 pro-lateral and 2 retro-lateral spines; several weak bristles on very tip. Palpal tibia (fig. 232) slightly swollen and relatively long. Distal apophysis of tibia I with gently rounded dorsal “corner”; subdistal apophysis a small blunt-tipped conical process (figs. 228–230). One (sometimes one-half) pair of long, strong foveal bristles. Carapace light to dark orange-tan with dark gray pigment along lateral edges; chelicerae slightly darker than carapace; pedipalps and legs like carapace; abdominal dorsum generally gray-brown (recumbent straw-yellow hairs over dark gray to purple-gray body wall), with very faint to rather prominent pale marks (anterior pair of spots followed by 3–7 pairs of obliquely transverse lines) in body wall; posterior book lungs without pigment.

**FEMALES:** Table 6. Two spermathecae per side (figs. 233–240), moderately to heavily sclerotized; median with straight to strongly curved stalk, bulb absent or weakly developed; lateral nearly as long as and usually straighter than median, without bulb. One pair long, strong foveal bristles. Similar in color to males except slightly lighter.

**VARIATION:** There are several noteworthy differences between the two known populations of this species. The one male from Bosque de Zárate has a proportionally thinner metatarsus I [IMD(100)/IML = 30 vs. 34–35], a more proximately positioned pair of metatarsal keels [MAD(100)/IML = 47 vs. 50–54], a relatively thinner palpal tibia [PTT(100)/CL = 14.6 vs. 15.6–16.2], and a much more nearly triangular distal apophysis



Map 3. Peru, showing distribution of *Ischnothele huambisa*, *I. goloboffi*, *Andethele lucma*, *A. huanca*, and *A. tarma*.

on tibia I (fig. 229) than do the three males from Lucma-Lucma (figs. 228, 230). The five measured females from Bosque de Zárate have proportionally fewer maxillary cuspules (MC/CL = 6.6–10.3 vs. 11.5–16.7), palpal tarsus spines (PTarS/CL = 1.4–2.0 vs. 2.4–3.2), and retro-lateral cheliceral denticles [CDR(100)/CL = 415–692 vs. 645–853] than do the three measured females from Lucma-Lucma. The Bosque de Zárate females have thicker-walled and more heavily sclerotized spermathecae and their median spermathecae are less likely to have an expanded (weakly bulbous) apex (figs. 233, 238, 239) than those of the females from Lucma-Lucma (figs. 234, 237, 240). And in the Bosque de Zárate specimens (both sexes) the pale marks in the dorsal body wall of the abdomen are usually more numerous (one pair of spots plus 5–7 pairs of obliquely transverse lines) and larger than in the Lucma-Lucma sample (one pair of spots and 3–5 pairs of lines). Because both of these samples are small, I suspect that these differences will diminish and eventually dis-

appear as larger samples are studied. Consequently, I prefer not to hypothesize that they are separate species.

**DISTRIBUTION:** Andes Mountains of central Peru (map 3).

**MATERIAL EXAMINED:** PERU: Huancavelica: Lucma-Lucma (Manzanalla), 2900–3250 m elev., Nov. 25–26, 1957 (Koepcke, Koepcke; MHNL), 3 ♂ (includes holotype), 4 ♀, juvs. Lima: Bosque de Zárate (Gatero), 2900 m elev., Feb. 9, 1977 (I. Francke, MHNL), 1 ♂, Dec. 10, 1977 (I. Francke, MHNL), 1 ♀, Jan. 14, 1980 (I. Francke, MHNL), 1 ♀, 2870 m elev., July 27, 1980 (I. Francke, MHNL), 1 ♀; Bosque de Zárate (Gigantón), 2900 m elev., Mar. 24, 1978 (I. Francke, MHNL), 1 ♀; Zárate, 3100–3150 m elev., Apr. 7, 1956 (H. and W. Noodt, MHNL), 3 ♀, 2350–2500 m elev., Apr. 6, 1956 (H. and W. Noodt, MHNL), 1 ♀, juv.

*Andethele huanca*, new species

Figures 13, 50, 241–262; Map 3

**TYPES:** Male holotype and 6 male and 30 female paratypes from rock outcrops along railroad in grassland at an elevation of 3900 m on the south edge of Santa Rosa de Sacco, Junin, Peru (March 27 and 29, 1988; F. Coyle, R. Bennett, J. Palmer, D. Smith), deposited in AMNH and MHNL.

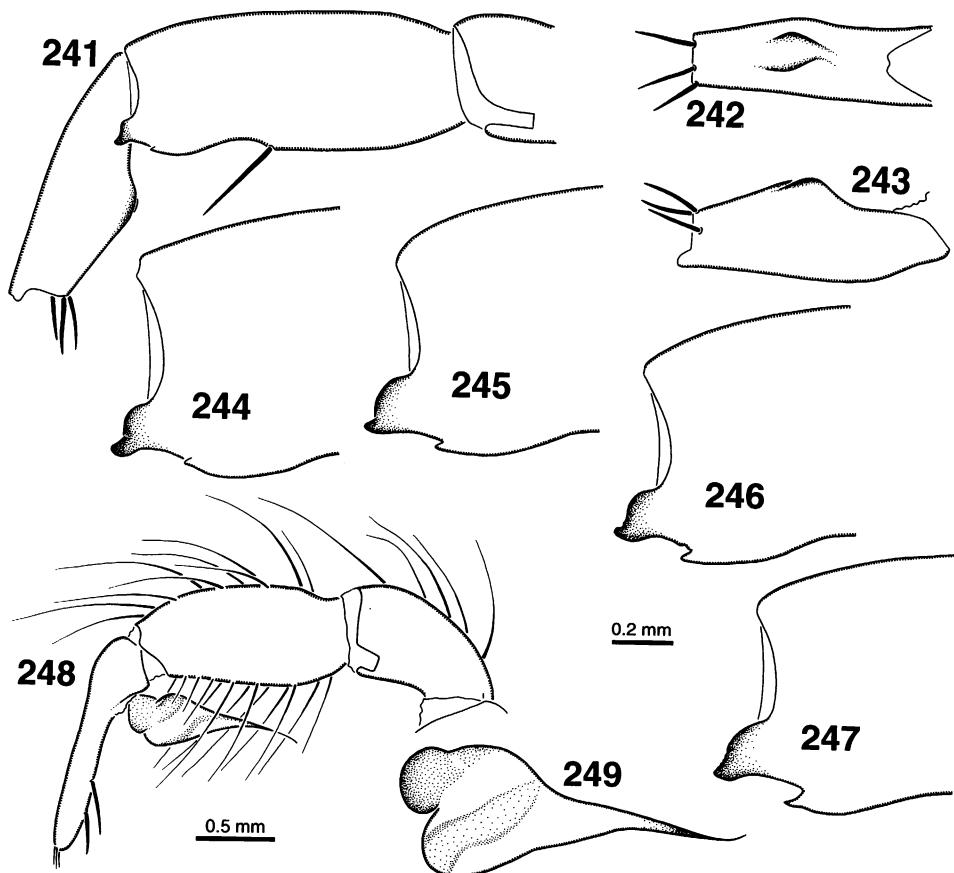
**ETYMOLOGY:** The specific name is derived from the Huanca Indian tribe of the central highlands of Peru.

**DIAGNOSIS:** Males of *A. huanca* can be distinguished from the two known males of *A. tarma* by the following differences: (1) Metatarsus I is proportionally thicker (fig. 241) than in *A. tarma* (fig. 265) [IMD(100)/IML = 37–39 ( $38.1 \pm 0.6$ ) vs. 34]. (2) The dorsal shoulder on the distal apophysis of tibia I is gently rounded (figs. 244–247) and not a sharp corner as in *A. tarma* (figs. 267, 268). (3) The subdistal apophysis of tibia I is smaller (figs. 244–247) than in *A. tarma* (figs. 267, 268). (4) Courtship involves bounce-walking rather than the leg-stamping of *A. tarma* (Coyle, in prep.). Females of *A. huanca* (figs. 252–260) lack the distinctive lateral spermathecal branch of *A. tarma* (figs. 271–277). In addition, *A. huanca* females usually have lower CS(100)/CW values (4.1–6.3) than do *A. tarma* females (6.1–6.8). See the diagnosis of *A.*

*lucma* for characters that distinguish *A. huanca* males and females from those of *A. lucma*.

**MALES:** Tables 5 and 7. Embolus curving down (lateral view) near tip (figs. 248, 249); bulb relatively broad. Cymbial apophysis (fig. 248) with 1 or 2 prolateral and 2 or 3 retro-lateral spines; 6–11 weak bristles on very tip. Palpal tibia (fig. 248) moderately swollen. Distal apophysis of tibia I with gently rounded dorsal "corner" (figs. 244–247); subdistal apophysis a small conical process. One (sometimes one and one-half) pair of long, strong foveal bristles. Carapace light to dark orange-tan with dark gray pigment along lateral edges; chelicerae orange-brown to dark red-brown; pedipalps and legs tan to orange-brown (tibia and metatarsus darkest); abdominal dorsum generally gray-brown (recumbent straw-yellow hairs over dark gray body wall), usually with faint, transverse, slightly recurved light brown bands (chevron-like and generally coincide with pale, thin obliquely transverse body wall markings typical of ischnothelines) alternating with darker brown; posterior book lungs with little or no dark pigment. Living spiders (fig. 261) with much darker chestnut-brown body wall throughout, but straw-yellow pilosity lightens some areas dorsally on appendages, carapace and abdomen; transverse chevron-like bands on abdomen a little more prominent on living than on preserved spiders. Bounce-walking courtship.

**FEMALES:** Table 6. Two spermathecae per side (figs. 252–260), unsclerotized to moderately heavily sclerotized; median with straight to strongly curved (or even sinuous) stalk and small bulb; lateral nearly as long as and straighter than median, usually broader at base, usually without bulb. One (sometimes one and one-half or two) pair of long, strong foveal bristles (figs. 250, 251). Carapace tan to dark orange-tan with dark gray pigment along lateral edges; chelicerae medium to dark orange-tan; pedipalps and legs similar to carapace (tan to orange-tan); abdominal dorsum (fig. 250) medium to dark gray-brown or purple-brown with recumbent straw-yellow hairs and pale, faint, obliquely transverse body wall marks creating subtle transverse banding less prominent than in males; posterior book lungs with little or no



Figs. 241-249. *Andethele huanca* males. 241. Tibia and metatarsus I, retrolateral view, holotype. 242, 243. Metatarsus I, holotype. 242. Ventral view. 243. Prolateral view. 244-247. Tibia I apophysis, retrolateral view. 244. Holotype. 245-247. Paratypes. 248. Pedipalp, retrolateral view, holotype. 249. Palpal organ, retrolateral-ventral view, holotype. Scale lines: 0.5 mm for figs. 241-243, 248; 0.2 mm for figs. 244-247, 249.

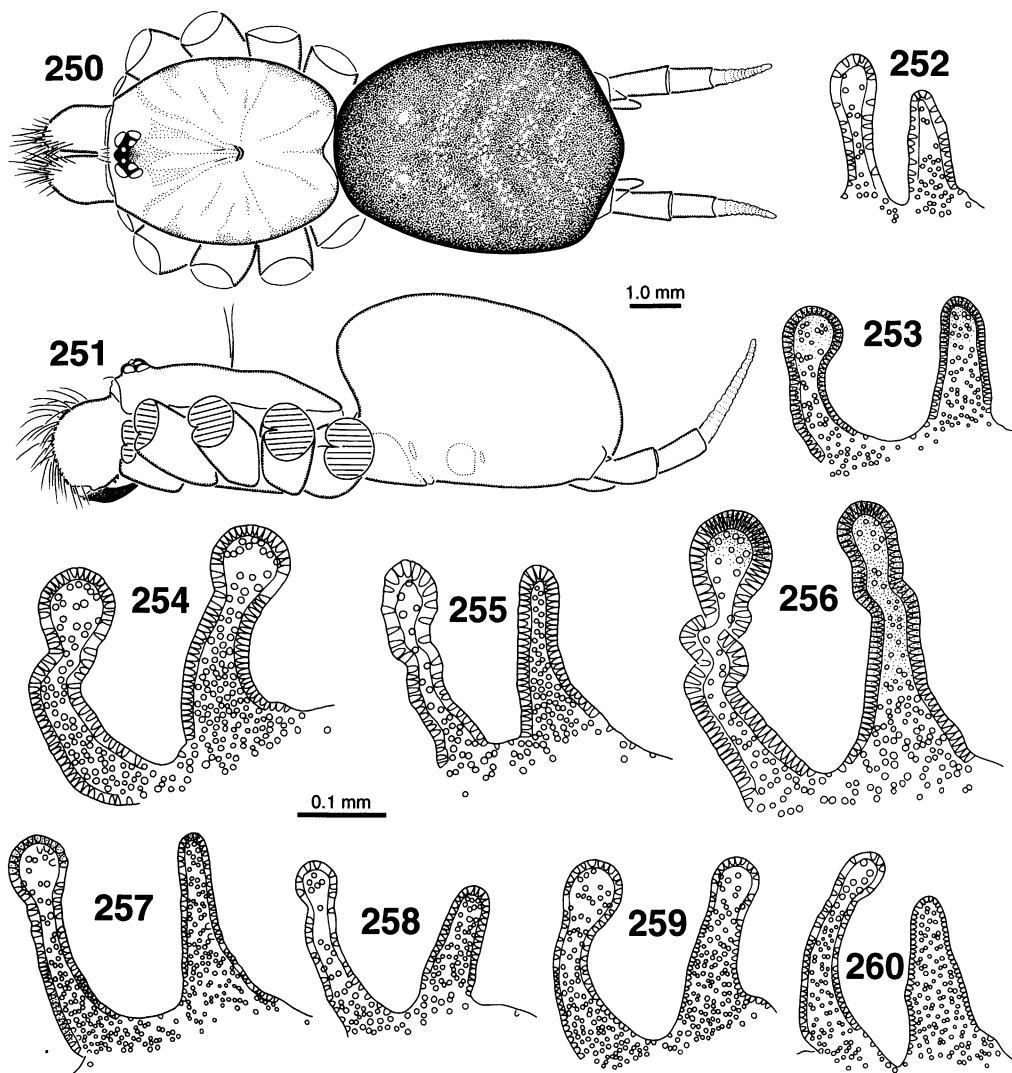
pigment. Living females colored like males except dorsal abdominal bands usually less conspicuous (fig. 262).

**VARIATION:** There is no marked discontinuous or clinal variation in either the male or female samples of *A. huanca*. Figures 244-247 illustrate the range of variation in the size and shape of the male tibia I apophyses; all specimens not illustrated have a less prominent dorsal "corner" on the distal apophysis than that illustrated in figure 244, and a smaller subdistal apophysis than that illustrated in figure 247. Females from the Cordillera Blanca tend to have more sinuous spermathecae (figs. 255, 256) than those from other localities. Small juveniles of *A. huanca*

have far more prominent pale markings in the wall of the dorsal surface of the abdomen than do older juveniles and adults; these are the typical ischnotheline markings consisting of an anterior pair of spots followed by 7 pairs of oblique transverse marks, the last 2 or 3 of which are joined medially.

**DISTRIBUTION:** Andes Mountains of central Peru (map 3).

**MATERIAL EXAMINED:** PERU: Ancash: Cordillera Blanca, above 10,000 ft elev., Aug. 1988 (V. and B. Roth, AMNH), 7 ♀, juvs. Huancavelica: Canchina, 3080-3400 m elev., Nov. 22, 1957 (Koepche, Koepche; MHNL), 1 ♀; Huancavelica, 3700 m elev., Feb. 1950 (F. Blancas, MHNL), 1 ♂, 2 ♀; Pampa Machei,

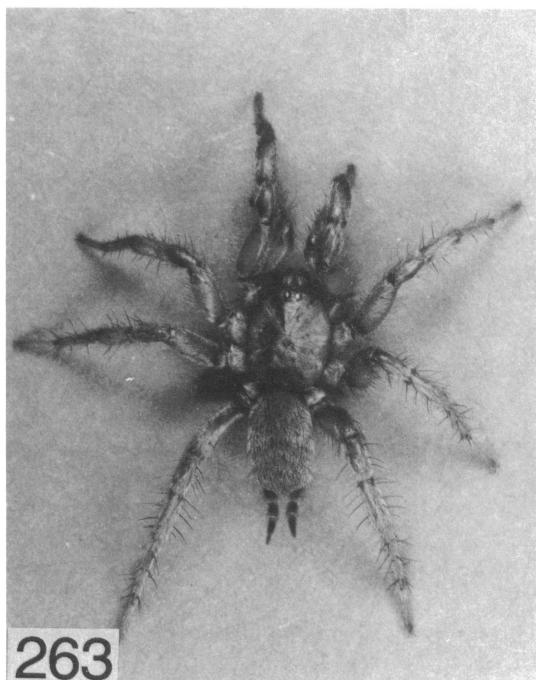


Figs. 250–260. *Andethele huanca* females. 250, 251. Whole body, paratype, 1.0 mm scale. 250. Dorsal view. 251. Lateral view. 252–260. Right spermathecae, 0.1 mm scale. 252. Pampa Machai. 253, 254. Acolla. 255, 256. Cordillera Blanca. 257, 258. 6 mi S La Oroya. 259. Huancavelica. 260. Paratype.

4400 m elev., Feb. 1947 (Brecht, AMNH), 1 ♀. Junin: Acolla, Aug. 1966 (F. Blancas, MHNL), 1 ♂, 3 ♀; Acolla, Catalina Blanca, Mar. 18, 1962 (MHNL), 3 ♀, juvs.; Acolla (near Jauja), 3460 m elev., Apr. 1950 (F. Blancas, MHNL), 1 ♀, juvs., Aug. 4, 1953 (F. Blancas, MHNL), 1 ♀, juvs.; Acolla (Pampalca), Aug. 1, 1965 (F. Blancas, MHNL), 1 ♀; Huancayo, 3200 m elev., Aug. 1940 (W. Weyrauch, AMNH), 1 ♀; 6 mi S La Oroya, Mar. 10, 1951 (Ross, Michelbacher; CAS), 1 ♂, 4 ♀, juvs.; S edge Santa Rosa de Sacco, rock outcrops along

railroad in grassland, 3900 m elev., Mar. 27 and 29, 1988 (Coyle, Bennett, Palmer, Smith; AMNH and MHNL), 7 ♂ (includes holotype), 30 ♀, juvs. Pasco: 5 mi NE Cerro de Pasco, Dec. 29, 1954 (Schlinger, Ross; CAS), 2 ♀; 12 mi S Huarica, Aug. 15, 1954 (Schlinger, Ross; CAS), 1 ♀.

**NATURAL HISTORY:** Because the known elevation of this species is 3000–4400 m, it may be restricted to alpine grassland habitat like that at the type locality (fig. 13). Here, the great majority of webs were located at the



Figs. 261-264. Live *Andethele huanca* and *Andethele tarma*. 261, 262. *A. huanca*. 261. Paratype male. 262. Paratype female. 263, 264. *A. tarma*. 263. Holotype male. 264. Paratype female.

base of rock outcrops with retreats extending deep into dense mats of stems and roots of grasses and other plants growing at the soil/rock interface. The population was dense, with

as many as seven adult webs per linear meter of this microhabitat. We searched without success for ischnothelines on and around rock outcrops at several high (above 4100 m)

grassland sites west of La Oroya and between Tarma and Junin, but the rocks appeared much harder and the climate cooler and wetter than at the type localities of *A. huanca* and *A. tarma*.

The exposed capture web of one or more fine-meshed silk sheets attached closely to rock, plant, or soil surfaces was connected with the hidden tubular silk retreat via one to three tubular passageways. These capture webs were markedly smaller than those of *Ischnothelinae* species (Coyle and Ketner, 1990). No symbionts were found in the webs. Prey remains found in the trash present in retreat walls consisted almost entirely of parts of beetle and ant exoskeletons (Coyle and Ketner, 1990). Prey capture behavior is described in Coyle and Ketner (1990). Nine of the 10 males examined were collected in February and March; all 7 collected at the type locality were living in their own webs (at least there were no females with them). Courtship and mating behavior has been studied by Coyle (in prep.).

*Andethela tarma*, new species

Figures 4, 263–277; Map 3

**TYPES:** Male holotype and 1 male and 17 female paratypes from rock outcrop along highway in grassland at an elevation of 3600 m near Cochas Bajo, 11 km west of Tarma, Junin, Peru (March 28, 1988; F. Coyle, R. Bennett, J. Palmer, D. Smith), deposited in AMNH and MHNL.

**ETYMOLOGY:** The specific name is derived from the name of the Tarma Indian tribe of the central highlands of Peru.

**DIAGNOSIS:** See the diagnoses of *A. huanca* and *A. lucma* for characters that distinguish *A. tarma* from these other species of *Andethela*.

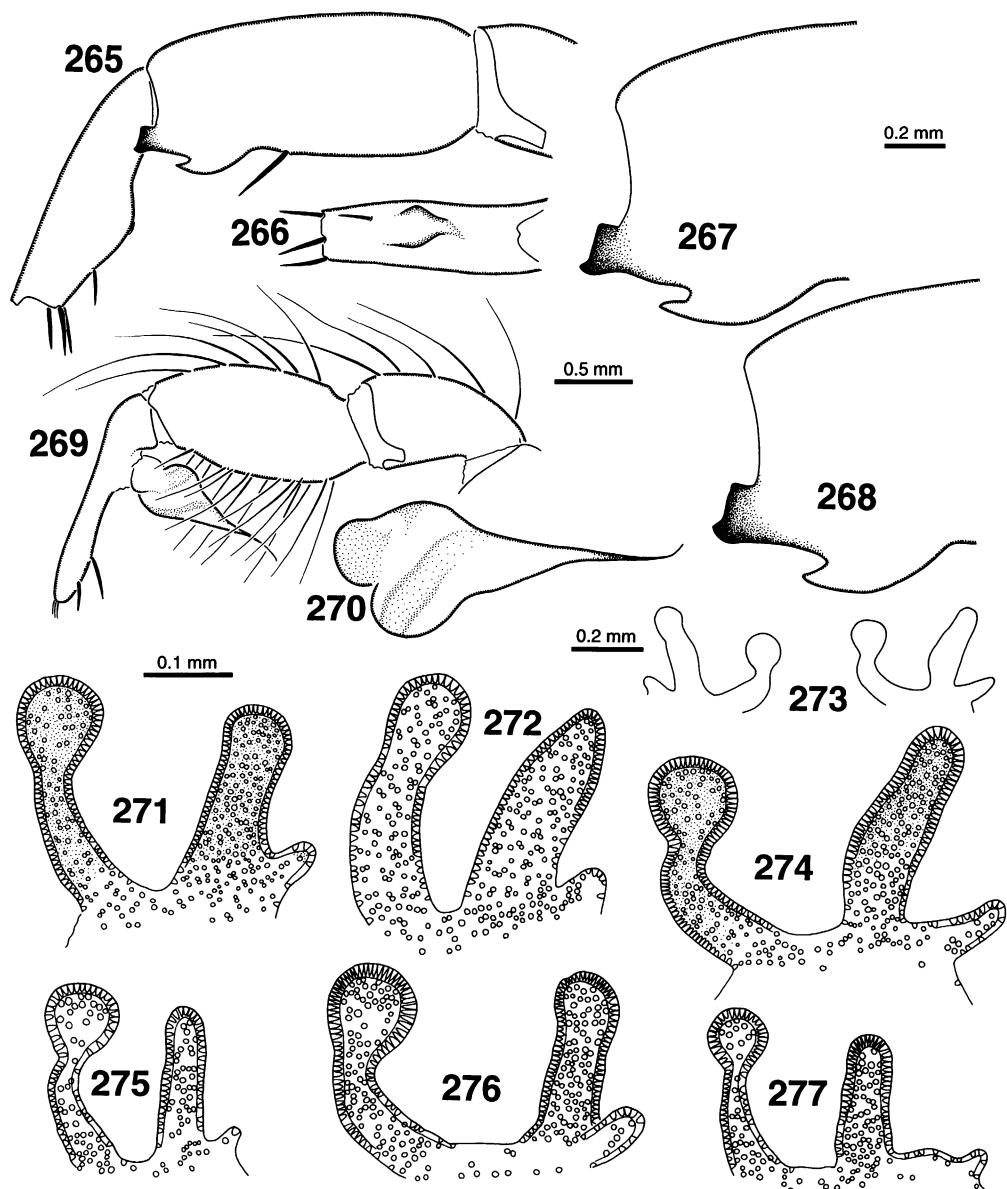
**MALES:** Tables 5 and 7. Embolus curving downward (lateral view) (figs. 269, 270); bulb relatively broad. Cymbial apophysis (fig. 269) with 1 or 2 prolateral and 2 retrolateral spines; several weak bristles on very tip. Pedipalp tibia (fig. 269) moderately swollen. Distal apophysis of tibia I with sharply angular dorsal corner (figs. 267, 268); subdistal apophysis a moderately large conical process. One pair of long, strong foveal bristles. Carapace tan to orange-tan with dark gray pigment

along lateral edges; chelicerae orange-tan; pedipalps and legs like carapace; abdominal dorsum generally gray-brown (recumbent straw-yellow hairs over dark gray body wall), with very faint, transverse slightly recurved light brown bands (chevron-like and generally coincide with pale, thin obliquely transverse body wall markings typical of ischnothelinines) alternating with darker brown; posterior book lungs with little or no dark pigment. Living spiders (fig. 263) with darker chestnut-brown body wall throughout, but straw-yellow pilosity lightens some areas dorsally on appendages, carapace, and abdomen; transverse chevron-like bands on abdomen less prominent than on *A. huanca*. Leg-stamping courtship.

**FEMALES:** Table 6. Two primary spermathecae per side (figs. 271–277), unsclerotized to weakly sclerotized; median with straight to strongly curved stalk and usually relatively wide bulb; lateral nearly as long as and straighter than median, bulb absent or rudimentary; very short lateral spermathecal branch at or near base of lateral spermatheca. One (sometimes two) pair of long, strong foveal bristles. Carapace tan to dark orange-tan with dark gray pigment along lateral edges; chelicerae medium to dark orange-tan; pedipalps and legs similar to carapace (tan to orange-tan); abdominal dorsum medium to dark gray-brown or purple-brown with recumbent straw-yellow hairs sparser than on males, body wall markings (anterior pair of pale spots followed by 4–6 pairs of pale obliquely transverse marks) faint to fairly prominent; posterior book lungs with little or no dark pigment. Living females colored like males except dorsal abdomen darker and banding inconspicuous (fig. 264).

**VARIATION:** Figures 271–277 illustrate the considerable intrademe variation in the size and shape of the small lateral spermathecal branch.

**REMARKS:** Because this population and the type population of *A. huanca* are morphologically so similar and are in very similar habitats only 30 km apart, I was surprised to discover the male courtship, male leg I, and spermathecal differences (see diagnosis of *A. huanca*) that distinguish this population. The courtship behavior difference (leg-stamping in *A. tarma* vs. bounce-walking in *A. huanca*)



Figs. 265-277. *Andethela tarma*. 265-270. Holotype male (except fig. 268, paratype). 265. Tibia and metatarsus I, retrolateral view. 266. Metatarsus I, ventral view. 267, 268. Tibia I apophysis, retrolateral view. 269. Pedipalp, retrolateral view. 270. Palpal organ, retrolateral-ventral view. 271-277. Spermathecae, paratypes. 271, 272, 274-277. Right spermathecae. 273. All spermathecae, same specimen as fig. 274. Scale lines: 0.5 mm for figs. 265, 266, 269; short 0.2 mm for figs. 267, 268, 270; long 0.2 mm for fig. 273; 0.1 mm for figs. 271, 272, 274-277.

is especially striking and may be an important reproductive isolating mechanism (Coyle, in prep.), but that remains to be determined. Although I observed courtship in only one *A. tarma* male (the holotype), this male consis-

tently performed leg-stamping in all four courtships and none of the five *A. huanca* males performed leg-stamping in their courtships. It is possible that, when more and larger samples of *Andethela* are studied, these few

differences will disappear and *A. tarma* may become a synonym of *A. huanca*.

**DISTRIBUTION:** Known only from the type locality in the Andes Mountains of central Peru (map 3).

**MATERIAL EXAMINED:** Only the type specimens.

**NATURAL HISTORY:** The habitat at the type locality was similar to that of *A. huanca*. Webs were abundant on the rock outcrops and steep rocky slope surrounded by grassland and cultivated fields. Herbs and some cacti grew on the treeless rocky slope. The webs (fig. 4), prey remains, and prey capture behavior are similar to those of *A. huanca* (Coyle and Kettner, 1990). The two males were found alone in especially small webs, presumably their own. Courtship and mating behavior has been studied by Coyle (in prep.).

### LATHROTHELE Benoit

*Lathrothele* Benoit, 1964: 417 (nomen nudum).

*Lathrothele* Benoit, 1965: 113 (type species by original designation *Lathrothele grabensis* Benoit). — Raven, 1983b: 552; 1985a: 78. — Platnick, 1989: 80; 1993: 90.

*Latrothele* (spelling error): Brignoli, 1983: 126.

**DIAGNOSIS:** One putative synapomorphy, an especially slender palpal organ [PL(100)/BD = 277–483] (figs. 279, 311, 322), helps distinguish *Lathrothele* males from all other ischnotheline males (150–291). In addition, *Lathrothele* males can be distinguished from *Ischnothelinae* males by the absence of spines on the tibia I apophysis, from *Andethelinae* males by the tapered nonbifid shape of this apophysis, from *Indothele* males by the form of the metatarsus I mating apophysis (which is either a double keel or a single and proximal keel), and from *Thelechoris* males by the large size and subterminal position of the tibia I apophysis and the presence of a mating apophysis on metatarsus I. *Lathrothele* females can be separated from nearly all *Ischnothelinae* females by a proportionally large number of retrolateral cheliceral denticles [CDR(100)/CL = 476–1576 vs. 0–536] and by rarely having more than two spines on tarsus I and never more than one or two spermathecae per side, from *Andethelinae* females by their proportionally longer appendages [ITL(100)/CL = 43–57 vs. 38–42] and longer

thicker carapace edge setae [CS(100)/CW = 7.4–20.4 vs. 4.1–7.0], and from both other Old World genera, *Indothele* and *Thelechoris*, by a relatively large number of retrolateral cheliceral denticles [CDR(100)/CL = 476–1576 vs. 14–332].

**DESCRIPTION:** Body size small to medium (CL = 2.2–6.3) (figs. 283, 284). Carapace with moderately dense covering of thin recumbent to semirecumbent hairs; usually 2 (rarely 1, 3, or 4) foveal bristles; semierect setae on lateral edges of carapace long and strong. Pars cephalica elevated slightly to moderately above pars thoracica (fig. 284). Sternum not quite as wide as long. Palpal tarsus of female with 6–16 spines. Male palpal tibia (figs. 278, 312, 321) semicylindrical or slightly swollen ventrally and proximally; erect ventral bristles vary in length and position. Cymbial apophysis (figs. 278, 312, 321) with 3–6 spines; tip without bristles. Palpal organ elongate; embolus long, gradually tapering, and upcurved. Male tarsi pseudosegmented; tarsus I with 0–2 (males) or 0–5 (females) spines. Male tibia I approximately cylindrical or considerably swollen dorsally, with spineless pointed mating apophysis ventrally at distal end (figs. 280, 310, 320). Metatarsus I with large double-keeled or small angular apophysis ventrally (figs. 280, 281, 309, 310, 320). One or two spermathecae per side; stalks not looped or coiled (figs. 287–302, 313–316, 325–329). Genital plate normal (fig. 282) or enlarged posteriorly (fig. 324).

**DISTRIBUTION:** Central and western equatorial Africa.

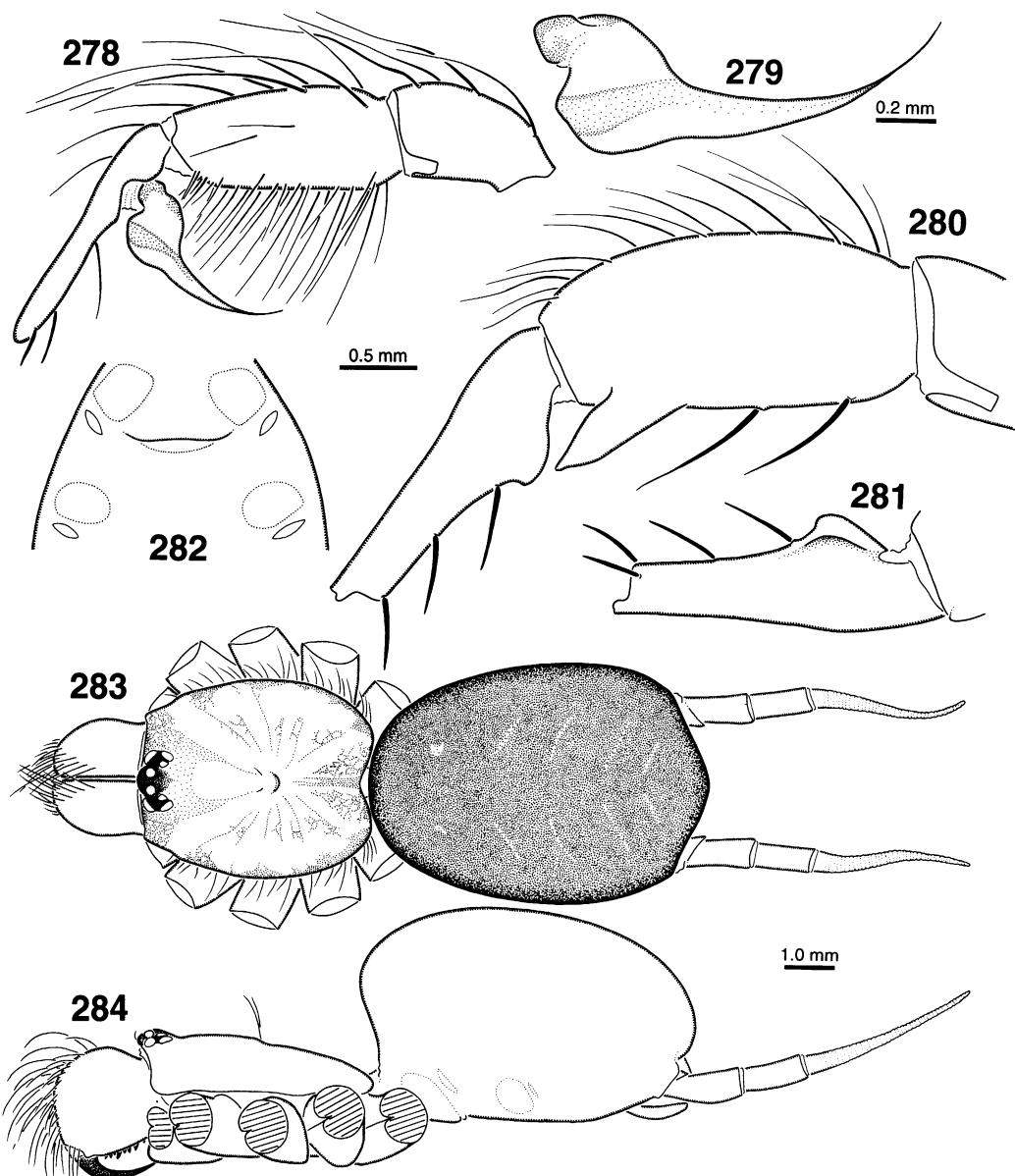
#### *Lathrothele grabensis* Benoit

Figures 41, 45, 51, 54, 278–308, 318, 319; Map 4

*Lathrothele grabensis* Benoit, 1965: 115, figs. 1, 2 (male holotype from Katondi, Territory Lubero, Kivu, Zaire, and allotype from source of the Talia River, Lubero, Kivu, Zaire, both in MRAC, both examined). — Raven, 1983b: 553, pl. I (figs. 3, 4), pl. II (fig. 2).

*Lathrothele marmoratus* Benoit, 1965: 122, fig. 8 (female holotype and female paratype from Nyundo, Rwanda, in MRAC, examined). NEW SYNONYMY.

**DIAGNOSIS:** To distinguish *L. grabensis* adults from those of *L. cavernicola* (its sister



Figs. 278–284. *Lathrothele grabensis*. 278–281. Holotype male. 278. Pedipalp, retrolateral view. 279. Palpal organ, retrolateral-ventral view. 280. Tibia and metatarsus I, retrolateral view. 281. Metatarsus I, prolateral view. 282. Anterior half of female abdomen, ventral view, *Lathrothele marmoratus* holotype. 283, 284. Whole body views of female, 9–38 km N of Kanyabayongo, Zaire. 283. Dorsal view. 284. Lateral view. Scale lines: 0.5 mm for figs. 278, 280, 281; 0.2 mm for fig. 279; 1.0 mm for figs. 282–284.

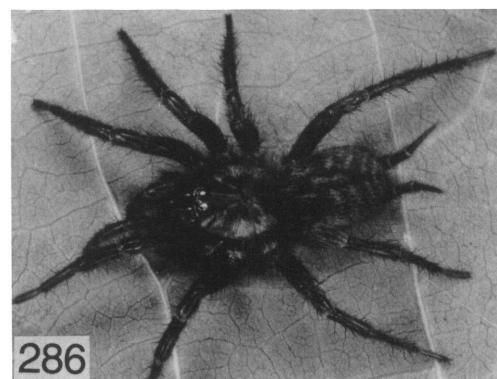
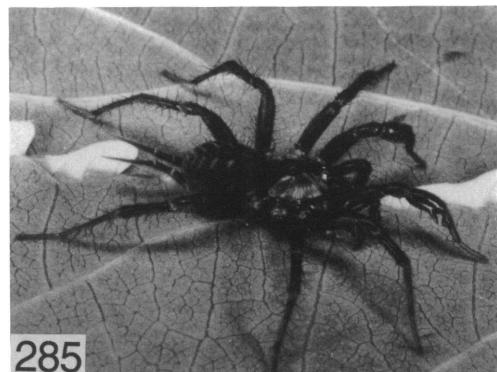
species) and the other two *Lathrothele* species, see the diagnoses of those species.

**MALES:** Tables 5 and 7. Palpal organ (figs. 279) with moderately large pyriform bulb and long, gradually tapering, up-curved embolus.

Cymbial apophysis very weakly constricted proximally, with 1–3 prolateral and 0–5 retrolateral spines (fig. 278). Palpal tibia with slight proximal swelling ventrally (fig. 278). Tibia I (fig. 280) swollen; dorsal profile arched;

mating apophysis strong, flattened, and tapering to tip (fig. 280). Metatarsus I (figs. 280, 281) with large keel occupying much of proximal  $\frac{2}{5}$ – $\frac{1}{2}$  of article on retrolateral aspect of ventral surface; smaller, moderately well-developed, ventral keel may or may not be present on prolateral side of this keel. Tarsus I semiflexible. Usually one pair of foveal bristles (rarely only one foveal bristle or 2 pairs). Carapace centrally light orange-tan (holotype) to medium brown; pale (holotype) to medium tan peripherally except for purple-brown along edges; dark brown to black around AMEs and between lateral eyes and PME on each side of ocular quadrangle. Chelicerae same as central carapace or a little darker orange-tan than central carapace (holotype); pedipalps and legs like carapace. Abdominal dorsum medium to dark brown, often (as in holotype) with 5 pairs of moderately prominent pale oblique marks resembling chevrons and one anterior pair of pale spots. Median  $\frac{1}{3}$ – $\frac{1}{2}$  of each posterior lung cover dark colored. Color of living specimens (from Kodachrome slides of spiders collected in eastern Zaire) (fig. 285): Carapace shiny dark ebony brown except for broad band of gold pilosity (recumbent gold hairs) on each side over lighter (gray-brown) part of carapace. Chelicerae, pedipalps, and legs like central carapace except for gold pilosity on leg coxae and medium brown color of tarsi. Abdominal dorsum very dark, dull, charcoal gray except for light gold-brown pilosity positioned just as the pale markings described above and as a thin, anterior median longitudinal band. The gold pilosity, prominent on live spiders, is not visible on preserved specimens observed under alcohol.

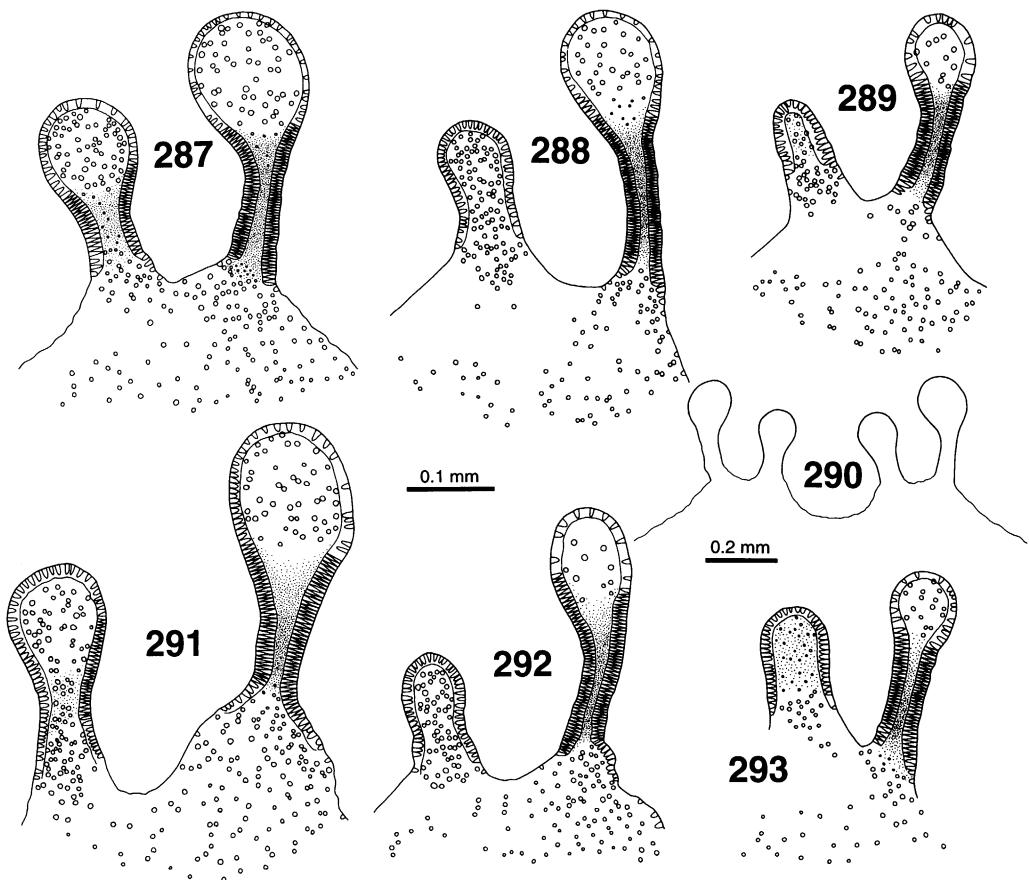
**FEMALES:** Table 6. Two spermathecae per side (figs. 287–302); lateral spermatheca long, straight to weakly bent, with strong to weakly swollen bulb; median spermatheca short to long and usually at least slightly swollen distally. Genital plate not expanded posteriorly (fig. 282); genital lip unsclerotized and well forward of posterior lung cover. Carapace centrally light orange-tan to medium amber-brown; lighter pale to medium tan peripherally except for purple-brown pigment along edges; ocular quadrangle dark brown to black as in males. Chelicerae darker than carapace; dark orange to dark amber-brown. Pedipalps



Figs. 285, 286. Live *Lathrothele grabensis* from 9–38 km N of Kanyabayongo, Zaire. 285. Male. 286. Female.

and legs similar to carapace, often mottled with light and dark areas. Abdominal dorsum (fig. 283) medium brown to dark purple-brown, sometimes with faint pale markings positioned as in males. Median  $\frac{1}{3}$ – $\frac{2}{3}$  of each posterior lung cover dark colored. Color of living females from eastern Zaire very similar to that of males (figs. 286, 308).

**REMARKS:** The allotype and all paratypes of *L. grabensis* are juveniles, not adult females as Benoit (1965) implied. None of the characters used by Benoit (1965) to distinguish his *L. marmoratus* sample from *L. grabensis* actually do distinguish this sample when the larger samples of *L. grabensis* available to me from eastern Zaire are studied. Particularly noteworthy are the observations that Benoit's *L. marmoratus* paratype carapace lacks the marked anterior angles of the holotype (Benoit's fig. 8) and that in some of the *L. grabensis* females from north of Kanyabayango this angle is prominent while in



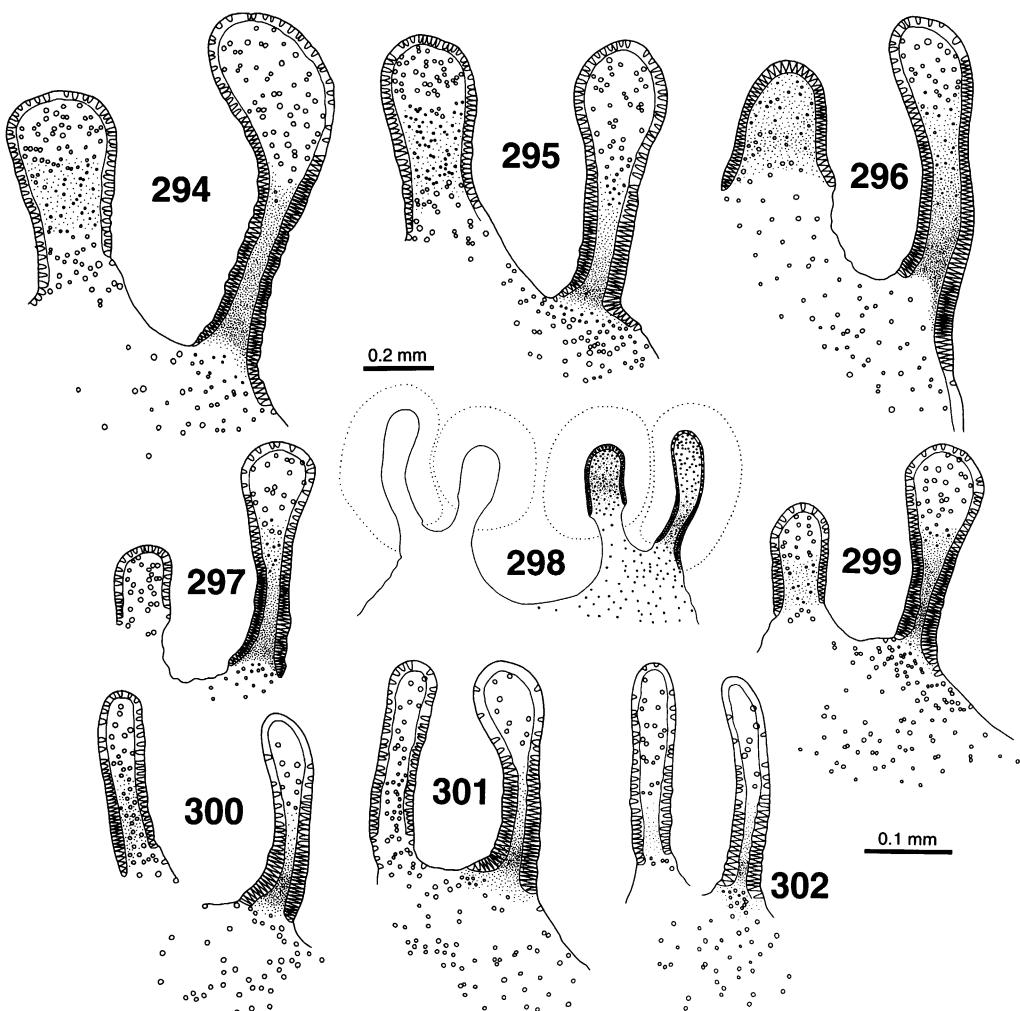
Figs. 287–293. *Lathrothele grabensis* from Zaire and Burundi, right spermathecae (except fig. 290, all spermathecae). 287–290. 9–38 km N Kanyabayongo, Zaire. 291, 292. *Lathrothele marmoratus* types. 291. Holotype. 292. Paratype. 293. 15 mi SE Bururi, Burundi. Scale lines: 0.1 mm for all but fig. 290.

others it is reduced. Similarly undiagnostic is Benoit's ratio of anterior spinneret length to anterior spinneret separation, a character that varies widely with abdominal size and, therefore, nutrition. Although Benoit stated that his *L. marmoratus* specimens lacked abdominal chevrons, faint ones are present, just as in most *L. grabensis* adult females from eastern Zaire observed in alcohol. Figures 287–293 illustrate the similarity of spermathecal form in the *L. marmoratus* sample and the *L. grabensis* sample collected near the type locality of *L. grabensis*.

**VARIATION:** Whereas the population samples of *L. grabensis* from eastern Zaire and neighboring Rwanda and Burundi are anatomically quite similar to one another, those

from Cameroon (map 4) are heterogeneous and some of these differ from the eastern populations in some characters. Figure 303 illustrates this rather common pattern of heterogeneity for one character, ITL/CL; the sample of females from Cameroon varies widely and overlaps both the eastern sample of *L. grabensis* and the sample of *L. caveronica*, which are distinctively different from each other.

Some Cameroon samples can be assigned to one of two somewhat distinctive morphs. One morph occurs in the mountains of western Cameroon and is represented by females (from Mt. Cameroon and the Manengouba Mtns.) with exceptionally long median spermathecae and reduced lateral spermathecal



Figs. 294–302. *Lathrothele grabensis* from Cameroon, right spermathecae (except fig. 298, all spermathecae). 294, 295. Metet. 296. Mbulai. 297. Hinterland, Jaunde-Stat. 298. Bosum. 299. Mban Mtn. 300, 301. Mt. Cameroon. 302. Manengouba Mtns. Scale lines: 0.2 mm for fig. 298; 0.1 mm for all other figs.

bulb diameters (figs. 300–302) and males (from the Manengouba Mtns., the Bamboutos Mtns., and Chabal Mbabo) that, although very similar to males from eastern Zaire in nearly all characters, are distinguished by the absence or vestigial nature of the prolaternal metatarsal keel. The other morph is represented by the only other available Cameroon male (from Hossere Vokre, which is farther north and much lower in elevation than the other males' localities). This male has, like the eastern Zaire males, a well-developed prolaternal metatarsal keel; however, some of

its character states are the same or much closer to those of *L. cavernicola* than to those of all other known *L. grabensis* males. For example, like *L. cavernicola*, it has proportionally long and slender appendages (fig. 304), so that its PTT(100)/PTL values (37.5) and IMT(100)/IML values (23.3) are like those of *L. cavernicola* (36.0–38.6; 24.1–24.2) but different from those of all other *L. grabensis* males (41.4–50.0; 28.0–35.8).

Many of the females from Cameroon cannot be confidently distinguished from the females of eastern Zaire, Rwanda, and Burun-

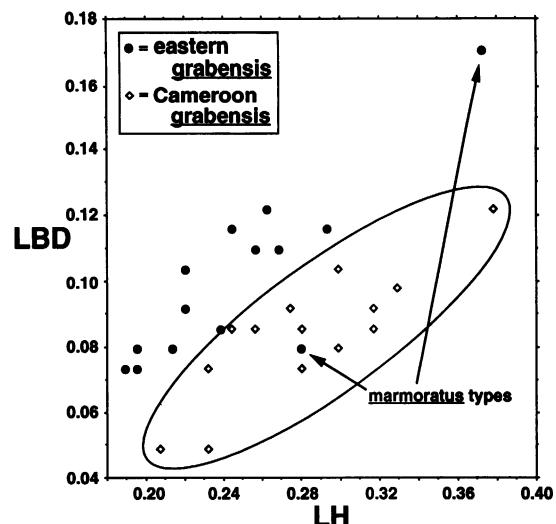
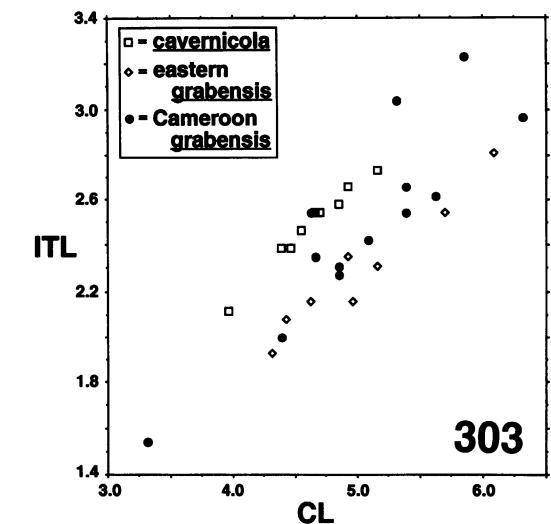
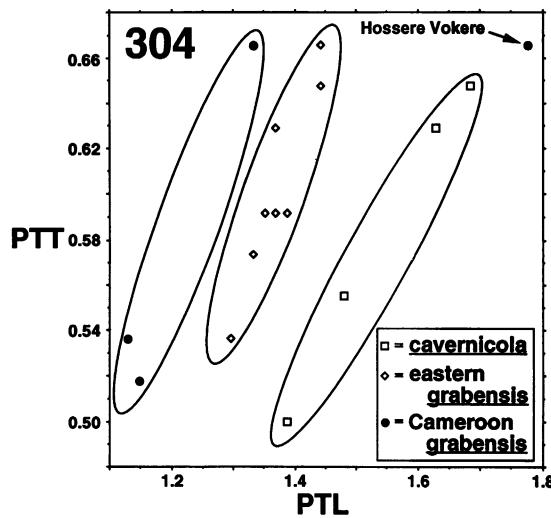


Fig. 305. Scattergram of LBD plotted against LH for females of *Lathrothele grabensis*. Measurements in mm.



Figs. 303, 304. Scattergrams of characters that vary geographically among *Lathrothele grabensis* and *Lathrothele cavernicola*. Measurements in mm. 303. ITL plotted against CL for females. 304. PTT plotted against PTL.

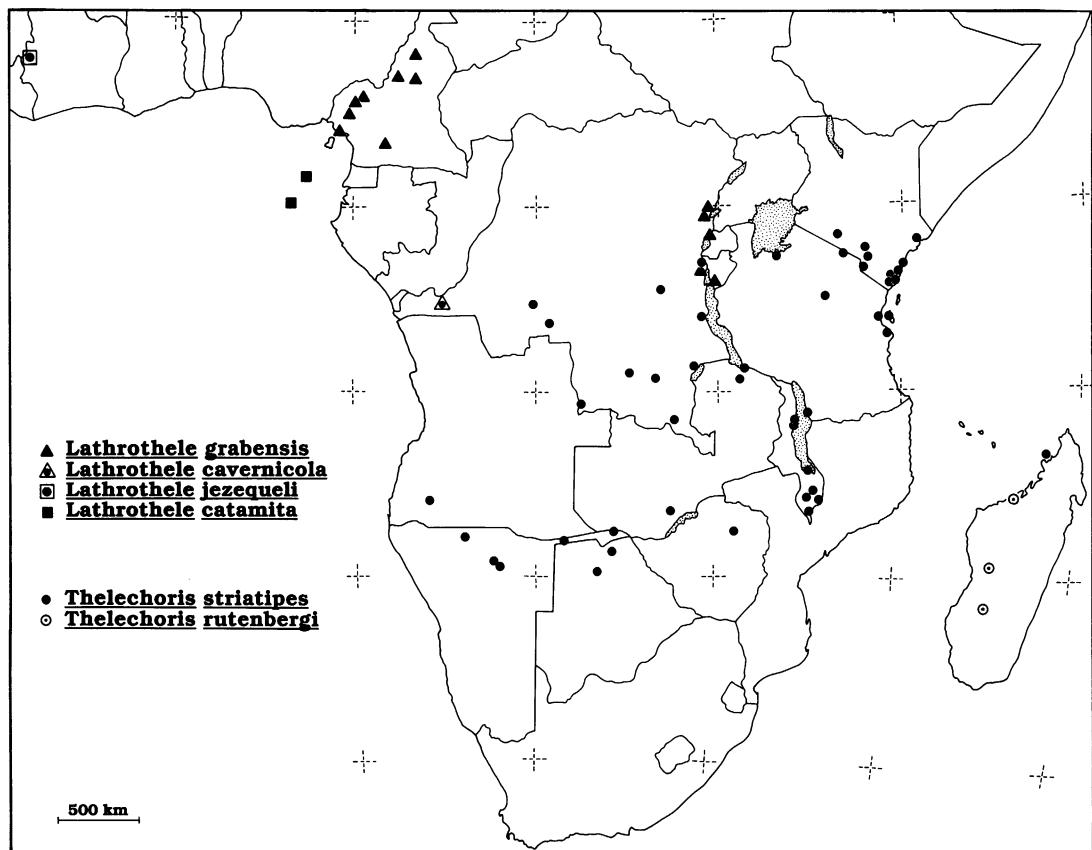
di, even by spermathecal morphology (figs. 294–302 vs. 287–293), although one ratio of spermathecal dimensions, LBD(100)/LH, does distinguish the great majority of the 14 observed females from Zaire, Rwanda, and Burundi (fig. 305) ( $28.48 [40.7 \pm 5.3]$ ) from the 14 Cameroon females ( $21.35 [29.5 \pm 4.2]$ ). Whereas all the males from Zaire have moderately well-developed abdominal chevrons when observed under alcohol, three of

the Cameroon males lack dorsal abdominal markings and the fourth (from Chabal Mbabo) has only weakly developed chevrons. The great majority of Cameroon females and about half of the females from Zaire, Rwanda, and Burundi lack chevrons (juveniles from Zaire have moderately to strongly developed chevrons); the rest have faint chevrons.

More collecting is clearly needed in Cameroon and the vast region between Cameroon and eastern Zaire before sound conclusions can be made about the taxonomic status of the *Lathrothele* populations of Cameroon. With more data, these may well prove to constitute one or more distinct species.

**DISTRIBUTION:** Known from the mountains of eastern Zaire, Rwanda, and Burundi, and from the uplands and mountains of Cameroon (map 4).

**MATERIAL EXAMINED:** **BURUNDI:** 15 mi SE Bururi, 1850 m elev., Jan. 8, 1958 (E. Ross, R. Leech; CAS) 2 ♀. **CAMEROON:** Bamboutos Mtns., 2180 m elev., montane grassland, Jan. 16, 1983 (Bosmans, Van Stalle; MRAC 162.292), 1 ♂; Bosum, Apr. 23, 1914 (Tessmann; ZMB 9435, 9434, 9438), 2 ♀, juvs.; Chabal Mbabo, SW slope, 1250 m elev., gallery forest, pitfall, Apr. 7–13, 1983 (Bosmans, Van Stalle; MRAC 162.298), 1 ♂; Hinterland, Jaunde-Stat. (Zenker, ZMB 9439), 1



Map 4. Africa and Madagascar, showing distribution of *Lathrothele grabensis*, *L. cavernicola*, *L. jezequeli*, *L. catamita*, *Thelechoris rutenbergi*, and *T. striatipes*.

♀; Hossere Vokre, W slope, 600 m elev., dry grassland, riverbank, pitfall, Apr. 19–24, 1983 (Bosmans, Van Stalle; MRAC 162.256), 1 ♂; Kongola-Uboa, Aug. 18, 1914 (Tessmann, ZMB 9437), 1 ♀, juv.; Manengouba Mtns., Woman's Lake, 1900 m elev., pitfall, Feb. 17, 1983 (Bosmans, Van Stalle; MRAC 162.282), 1 ♂, 2000 m, grassland, Feb. 17–20, 1983 (Bosmans, Van Stalle; MRAC 162.273), 1 ♀; Mbam Mtn. area near Koutouni, west slope, gallery forest, Mar. 31, 1983 (Bosmans, Van Stalle; MRAC 162.263), 1 ♀; Mbulai, Aug. 24, 1914 (Tessmann, ZMB 9436), 1 ♀; Metet, 3°24'N, 11°46'E (G. Schwab, MCZ), 2 ♀; Mt. Cameroon, near Buea, 2800 m elev., giant heather zone, pitfalls, Mar. 21, 1981 (Bosmans, Van Stalle; MRAC 162.533), 1 ♀, Buea slope, 10,000 ft elev., May 15, 1949 (B. Malkin, CAS), 4 ♀, juvs.; 28 mi S Ngaoundéré, 1250 m elev.,

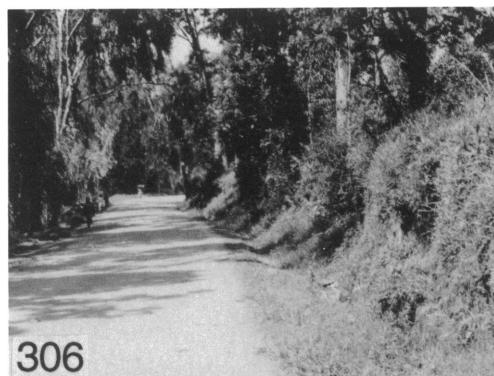
Oct. 1, 1966 (Ross, Lorenzen; CAS), juv. RWANDA: Mukokole marsh, Rugege Forest, 2250 m elev., Aug. 11–17, 1949 (R. Laurent, MRAC 66576), juv.; Nyundo, 2250 m elev., May 1964 (Van der Heyde; MRAC 126767, 127117), 2 ♀ (includes *L. marmoratus* holotype). ZAIRE: Kivu: Itombwe, Terr. Mwenga, head of source of Bukundji, 2250 m elev., Jan. 1957 (N. Leleup, MRAC 91735), juv.; Lubero, source of N Talia R., 2500 m elev., Oct. 9, 1952 (R. Bergmans, MRAC 73862), juv. (allotype); Lubero, Kimbulu, June 1, 1954 (R. Celis, MRAC 79008), juv.; above Lubero, Mt. Kasongwere, NW slope, 2500 m elev., Aug. 22, 1963 (R. Celis, MRAC 125812), juv.; Lubuka, Uvira, 2200 m elev., Aug. 29, 1950 (R. Laurent, MRAC 69591), juv.; Lukanga, Lubero-Butembo, 2000 m elev., Dec. 1974–Jan. 1975 (Lejeune, MRAC 166.201), 1 ♀; 9, 20, 29, and 38 km N Kan-

yabayongo toward Lubero, 1800–2000 m elev., road banks, Apr. 10, 1989 (Coyle, Bennett; AMNH), 7 adult ♂ and 2 penult. ♂ (which became adult in June), 17 ♀, juvs.; 1 km S Kanyabayongo, 1700–1900 m elev., road bank, Apr. 10, 1989 (Coyle, Bennett; AMNH), 1 ♀, juv.; Katondi, Terr. Lubero, 2200 m elev., Dec. 9, 1951 (N. Leleup, MRAC 92267), 1 male (holotype).

**NATURAL HISTORY:** Except for the final paragraph, this section refers only to the populations of *L. grabensis* I observed near Kanyabayongo in eastern Zaire in April 1989. Although we searched in several habitats between Goma and the Kanyabayongo area (shrubby meadow at 2000 m, roadbanks and wet forest near Rutshuru at 1200 m, dry scrub forest near Katanda at 950 m, savanna near Rwindi at 1000 m, and dry eastern mountain slopes below Kanyabayongo), we found *L. grabensis* only on road banks in open *Eucalyptus* forest between 1700 and 2000 m (fig. 306). This collecting trip and other records suggest that the eastern populations of *L. grabensis* may be restricted to elevations above 1700 m and are most common at 1800–2500 m. Webs were never found on shrubs or tree trunks, but only on road banks where retreat tubes penetrated crevices and other deep depressions in the soil or (occasionally) small rock outcrops.

The webs (fig. 307) resemble *Ischnothele* webs. The tubular silk retreat may be 20 or more cm long and is sometimes two-branched. The retreat mouth opens either directly onto the capture web or by two or three short access tunnels. The capture web consists principally of a roughly horizontal, often somewhat bowl- or hammock-shaped, irregular sheet lying on exposed roots, leaves, and other substrates, often with a few semivertical support strands attached to objects above. A typical adult-size web may cover 250 cm<sup>2</sup>; the largest web covered about 900 cm<sup>2</sup>.

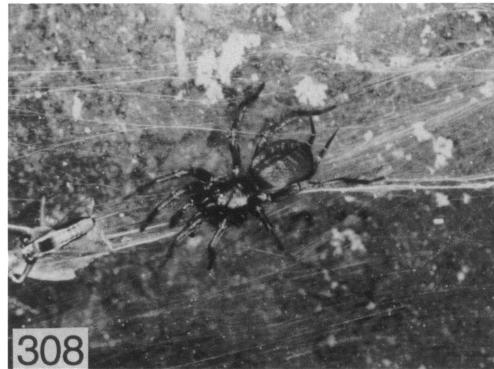
These spiders were reluctant to capture live prey placed in their webs during the daytime; however, when they did attempt to capture prey (fig. 308), they performed the same advance-pause approach as *Ischnothele* (Coyle and Ketner, 1990), except that the pauses seemed unusually brief. Although they accepted small grasshoppers, these spiders rejected formicine ants, which were common



306



307



308

Figs. 306–308. *Lathrothele grabensis* population at 9–38 km N of Kanyabayongo, Zaire. 306. Road bank habitat in open *Eucalyptus* forest. 307. Web. 308. Female approaching prey on capture sheet.

near their webs. No symbionts were detected in any webs.

Courtship and mating, which will be described elsewhere (Coyle, in prep.), were apparently occurring in these populations at the time of collection (April) since two of the seven adult males collected were in webs with females. Breeding may also occur at other

times of year, since the holotype male was collected in December and a penultimate male I collected in April molted to adulthood two months later in captivity.

Two females had, in their retreats, spiderlings that had emerged from the egg sac. Egg sacs containing second instar spiderlings were in the retreats of two other females; these spiderlings were all unpigmented and had rudimentary fangs, eyes, tarsal claws, and spigots as illustrated by Holm (1954: figs. 4–6) for *Thelechoris striatipes* and by Galiano (1972: figs. 3–11, 14, 18) for *Ischnothelus guianensis*, and the extremely thin and fragile cuticle of the first postembryonic instar was attached to many of the shed chorions. Ninety and 112 offspring were in each of these two egg sacs. Brood sizes of the six egg sacs constructed in captivity between April 18 and 24 by six females ranged from 42 to 99 (mean =  $69.5 \pm 21.3$ ). The mean diameters of 10 eggs (measured after 2.5 years in 80% ethanol) from each of four of these broods are 1.03, 1.05, 1.07, and 1.08 mm (range of all 40 eggs = 0.98–1.13). *Lathrothele grabensis* egg sacs are similar to those of *Ischnothelus* and *Thelechoris* in shape, structure, and placement.

Most of the Cameroon *L. grabensis* specimens accompanied by habitat data were collected from elevations between 1900 and 3050 m. The distinctive male from Hossere Vokre was collected at an unusually low (600 m) and dry (dry grassland) site; other samples were collected in gallery forest (1250 m), montane grassland (2180 m), and giant heather (2800 m) zones.

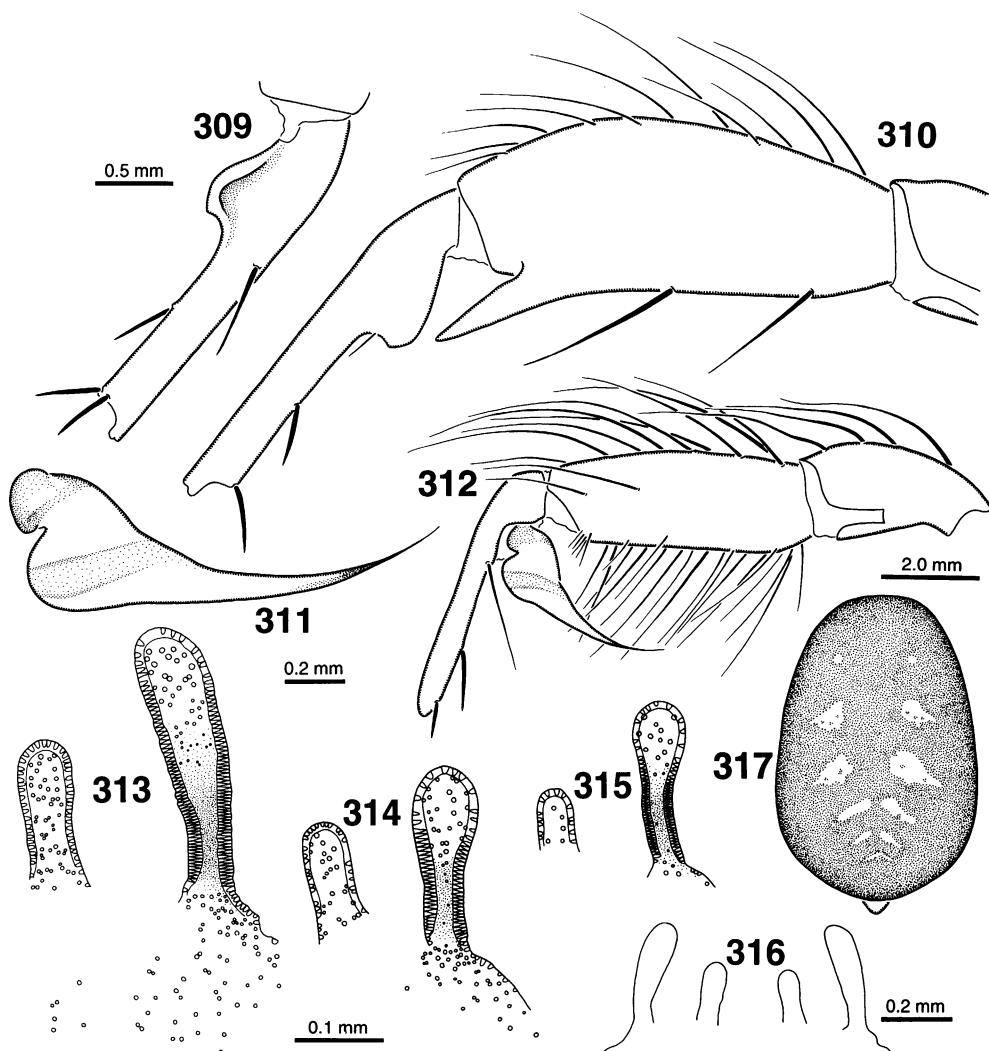
*Lathrothele cavernicola* Benoit  
Figures 303, 304, 309–319; Map 4

*Lathrothele cavernicola* Benoit, 1965: 117, figs. 3, 4 (male holotype and female allotype from grotto near Thysville [about 100 km SW Kinshasa], Zaire, in MRAC, examined).

**DIAGNOSIS:** See the diagnosis of *L. jezequelii* for many differences that distinguish males of that species from *L. cavernicola* males. Although there are several differences between *L. cavernicola* males and males of its sister species, *L. grabensis*, which have been collected in eastern Zaire, most of these differ-

ences vanish when the variant males from Cameroon are included in the *L. grabensis* sample. Only the following features separate the four known *L. cavernicola* males from all these *L. grabensis* males: (1) Tibia I of *L. cavernicola* is proportionally thinner proximally and has a distinctive dorsal hump distally (fig. 310) so that its ITT(100)/ITTP value is greater (114–120 [ $116.5 \pm 3.2$ ] vs. 100–105 [ $103.7 \pm 1.2$ ]) (fig. 318) and its ITTP(100)/ITL value is less (34–35 [ $34.7 \pm 0.7$ ] vs. 40–55 [ $43.4 \pm 3.9$ ]) than those of *L. grabensis*. (2) Adults of both sexes of *L. cavernicola*, when observed under alcohol, have prominent abdominal chevrons (fig. 317), which are often absent or faint in preserved *L. grabensis* adults. *Lathrothele cavernicola* females can also be distinguished from *L. grabensis* females by their proportionally large number of retrolateral cheliceral denticles [CDR(100)/CL = 1001–1258 vs. 476–853] (fig. 319), proportionally long legs [ITL(100)/CL = 53–55 vs. 43–57], and proportionally wide sternum [SW(100)/SL = 86–96 vs. 79–88]. See the *L. jezequelii* and *L. catamita* diagnoses for important differences between their females and *L. cavernicola* females.

**MALES:** Tables 5 and 7. Palpal organ (fig. 311) with moderately large pyriform bulb and long, gradually tapering, up-curved embolus. Cymbial apophysis not clearly constricted proximally, with 2 or 3 prolateral and 2 or 3 retrolateral spines (fig. 312). Palpal tibia with slight proximal swelling ventrally (fig. 312). Tibia I (fig. 310) swollen distally, relatively narrow proximally, dorsal profile arched; mating apophysis relatively long, flattened, and tapering gradually to tip. Metatarsus I (figs. 309, 310) with large keel occupying much of proximal  $\frac{2}{5}$  of article on retrolateral aspect of ventral surface; smaller, well-developed, ventral keel on prolateral side of this keel. Tarsus I semiflexible. Usually one pair of foveal bristles (rarely only one bristle). Carapace centrally orange-tan; pale tan peripherally except for purple-brown along edges; dark brown to black around AMEs and between lateral eyes and PME on each side of ocular quadrangle. Chelicerae, pedipalps, and legs same color as carapace. Abdominal dorsum medium brown, with 5 pairs of prominent pale oblique marks resembling chevrons and one anterior pair of pale spots. Median



Figs. 309–317. *Lathrothele cavernicola*. 309–312. Holotype male. 309. Metatarsus I, prolateral view. 310. Tibia and metatarsus I, retrolateral view. 311. Palpal organ, retrolateral-ventral view. 312. Pedipalp, retrolateral view. 313–317. Allotype and paratype females. 313–315. Right spermathecae. 316. All spermathecae. 317. Abdominal dorsum. Scale lines: 0.5 mm for figs. 309, 310, 312; short 0.2 mm for fig. 311; long 0.2 mm for fig. 316; 2.0 mm for fig. 317; 0.1 mm for figs. 313–315.

$\frac{1}{3}$ – $\frac{1}{2}$  of each posterior lung cover dark colored.

**FEMALES:** Table 6. Two spermathecae per side (figs. 313–316); lateral spermatheca long, narrow, and nearly straight with weakly to moderately swollen bulb; median spermatheca well separated from lateral, much shorter than lateral, and not swollen distally. Genital plate not expanded posteriorly; genital lip unsclerotized and well forward of posterior lung cover. One pair of foveal bristles. Carapace centrally orange-tan to light brown;

laterally pale tan except for purple-brown pigment along edges; ocular quadrangle colored as in males. Chelicerae, pedipalps, and legs like carapace. Abdominal dorsum (fig. 317) medium to dark purple-brown with 4 or 5 pairs of rather prominent oblique marks resembling chevrons and one anterior pair of pale spots. Posterior lung covers as in males.

**REMARKS:** The differences between *L. cavernicola* and *L. grabensis* are not as great as Benoit (1965) indicated. In particular, the following characters, believed by Benoit to be

diagnostic, are not diagnostic even for the samples examined by Benoit: number of cheliceral teeth, density of hairs on carapace, and length vs. separation of median spinnerets. His characterization of the tibia I apophysis of *L. cavernicola* as four times longer than wide at the base is inaccurate (see fig. 310).

**DISTRIBUTION:** Known only from the type locality in western Zaire (map 4).

**MATERIAL EXAMINED:** ZAIRE: Kele, grottos near Thysville, 5°16'S, 14°53'E, 1938 (M. Bequaert; MRAC 127109, 127110, 655–664, 675–684, 685–700, 650–654, 701), 4 ♂ (holotype and paratypes), 12 ♀ (allotype and paratypes), juvs.

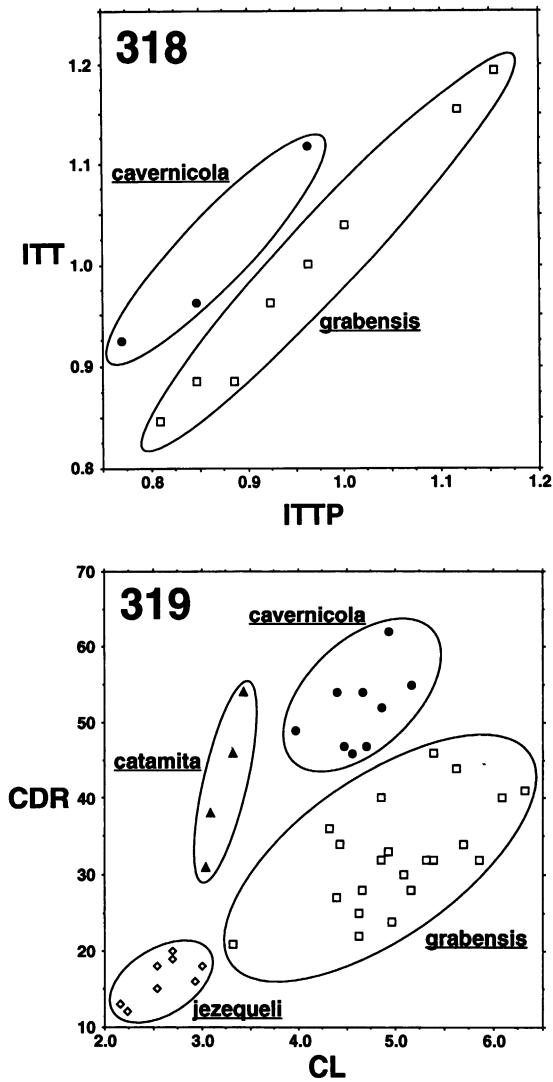
**NATURAL HISTORY:** It is not known whether this species was collected in (or simply near) the caves (actually "grottes") cited on the locality labels. Although the appendages are proportionally longer than those of *L. grabensis* specimens from eastern Zaire, they are not proportionally longer than those of some of the (apparently epigean) *L. grabensis* specimens from Cameroon (fig. 303). Other than these slightly elongate appendages, *L. cavernicola* possesses no character states (such as reduced pigmentation or reduced eyes) that cave-adapted diplurids commonly exhibit (Coyle, 1988); *L. cavernicola* is clearly not a troglobite.

#### *Lathrothele jezequelei* Benoit

Figures 319–329; Map 4

*Lathrothele jezequelei* Benoit, 1965: 120, figs. 5–7 (male holotype and female allotype from station Pa 88, Mount Nimba, Ivory Coast, in MNHN, examined).

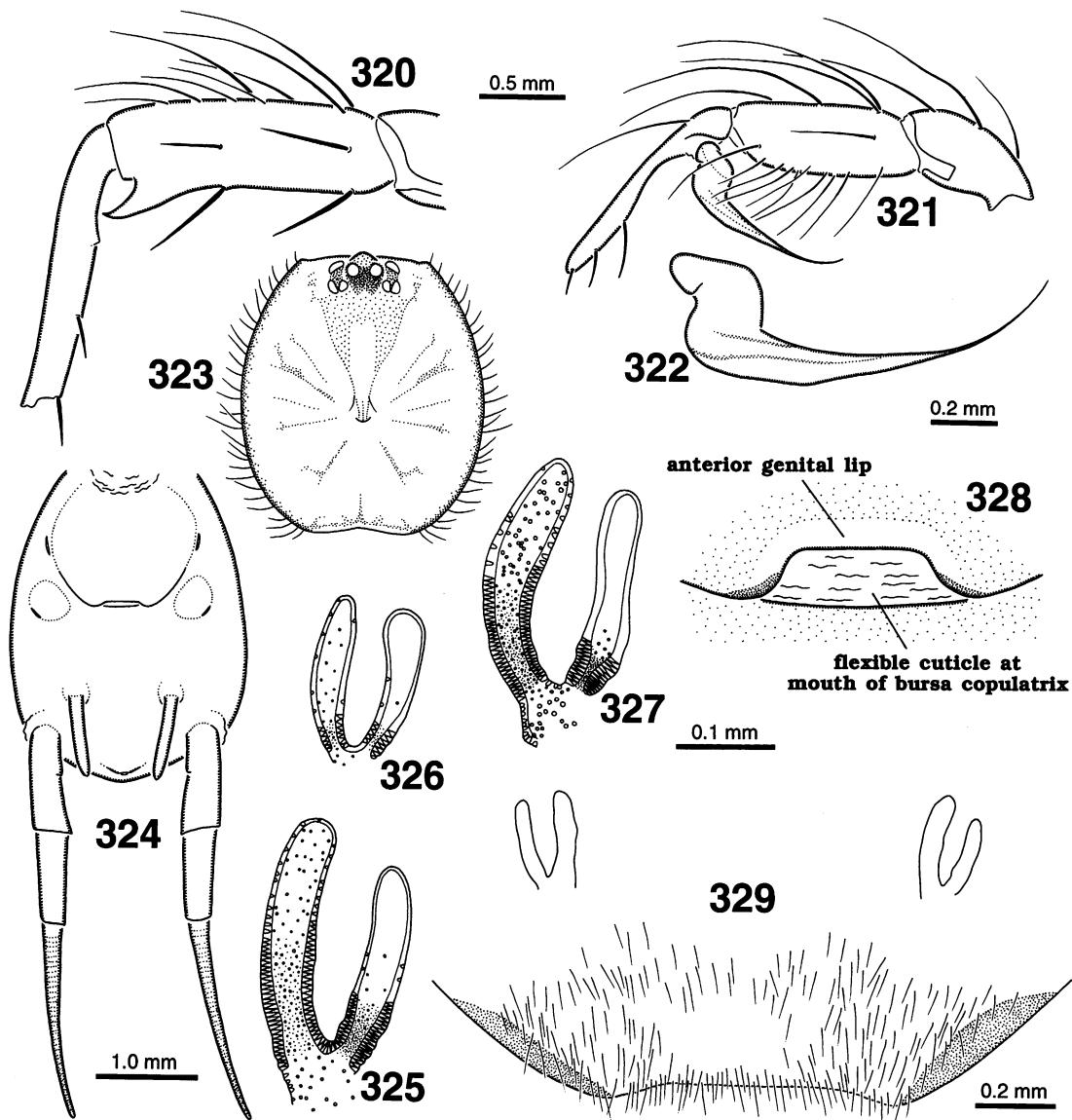
**DIAGNOSIS:** The two known males of *L. jezequelei* differ from those of the other species of *Lathrothele* for which males are known (*L. grabensis* and *L. cavernicola*) by (1) the small size and upcurved tip of the tibia I apophysis (fig. 320; TAL = 0.26–0.28 vs. 0.50–0.83), (2) the diminutive cone-shaped metatarsal apophysis (fig. 320), (3) the proportionally long metatarsus I [fig. 320; IML(100)/ITL = 113–116 vs. 79–100], (4) the proportionally long cymbial apophysis [fig. 321; CYAL(100)/CL = 36.7–37.1 vs. 24.3–28.2], (5) the proportionally long and slender palpal organ [fig. 322; PL(100)/BD = 386–483 vs. 277–367], and (6) small body size (CL = 2.54–2.77 vs. 3.16–4.77). *Lathrothele jezequelei* females dif-



Figs. 318, 319. Scattergrams for characters that distinguish *Lathrothele cavernicola* from other species of *Lathrothele*. Measurements in mm. 318. ITT plotted against ITTP for *L. cavernicola* and *L. grabensis*. 319. CDR plotted against CL for females of all *Lathrothele* species.

fer from other *Lathrothele* females by their (1) distinctive spermathecae (figs. 325–329) (closely paired, fingerlike, without swollen bulbs, and medians as long or longer than laterals), (2) large genital plate that extends back to the posterior book lungs (fig. 324), (3) small body size (CL = 2.16–3.00 vs. 3.04–6.31), and (4) small CDR value (12–20 vs. 21–62).

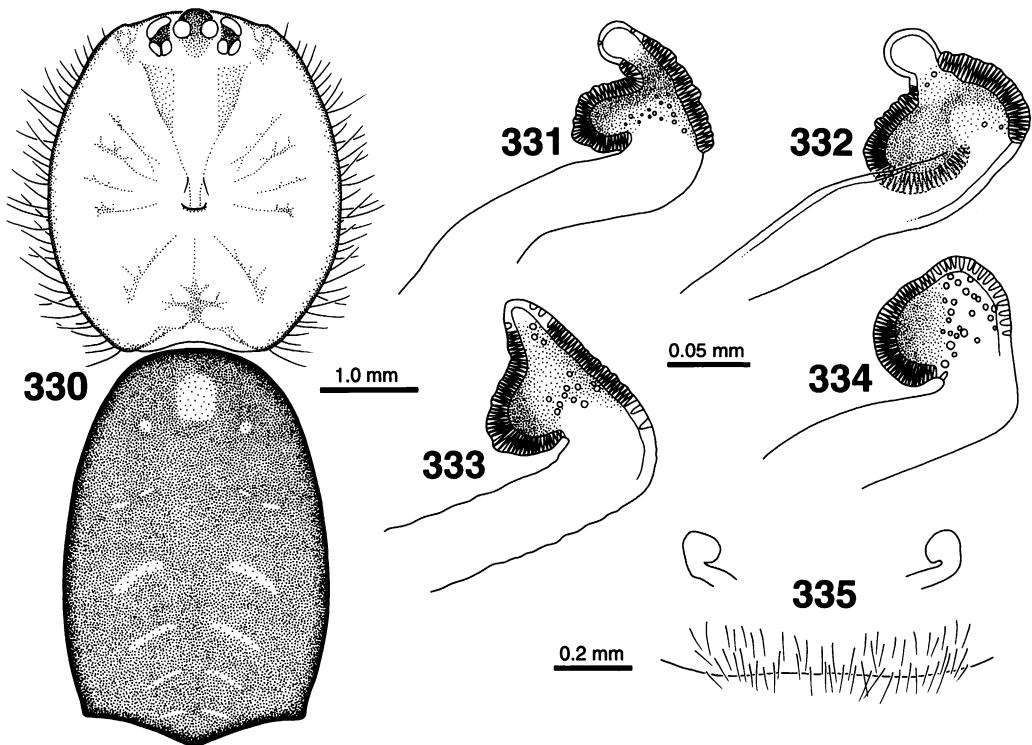
**MALES:** Tables 5 and 7. Palpal organ (figs.



Figs. 320-329. *Lathrothele jezequeli*. 320-322. Holotype male. 320. Tibia and metatarsus I, retrolateral view. 321. Pedipalp, retrolateral view. 322. Palpal organ, retrolateral-ventral view. 323-329. Female paratypes. 323. Carapace, dorsal view. 324. Abdomen, ventral view. 325-327. Right spermathecae. 328. Genital opening, posterior-ventral view. 329. All spermathecae and anterior genital lip showing hairs on floor of bursa copulatrix. Scale lines: 0.5 mm for figs. 320, 321; 1.0 mm for figs. 323, 324; short 0.2 mm for figs. 322, 328; long 0.2 for fig. 329.

322) with proportionally small, sharply bent bulb and long, slender, gradually tapering embolus curving upward. Cymbial apophysis (fig. 321) proportionally long and proximally constricted, with 3 or 4 prolateral and 2-4 retrolateral spines. Palpal tibia (fig. 321) semicylindrical. Tibia I (fig. 320) roughly cy-

lindrical; mating apophysis tapers evenly to pointed upturned tip. Metatarsus I (fig. 320) with very small angular apophysis on retrolateral aspect of ventral surface about  $\frac{1}{5}$  distance from proximal to distal end of metatarsus. Tarsus I semiflexible. One pair of foveal setae. Carapace light brown with many



Figs. 330–335. *Lathrothele catamita* females. 330. Carapace and abdomen, dorsal view, lectotype, 1.0 mm scale. 331–334. Right spermatheca, 0.05 mm scale. 331. Roca Zampalma. 332. Makambrera. 333. Paralectotype. 334. Lectotype. 335. Both spermathecae, lectotype, 0.2 mm scale.

dark recumbent hairs in central region bordered on both sides by band of white or clear hairs; black (and purple-brown) inside ocular quadrangle. Chelicerae, pedipalps, and legs colored like carapace. Abdominal dorsum homogeneous medium brown to purple-brown. Posterior lung plates without pigment.

**FEMALES:** Table 6. Right and left pairs of spermathecae widely separated (fig. 329). Two spermathecae per side (figs. 325–329); both elongate, joined at base, straight or slightly curved, and unswollen or only very weakly swollen distally; median spermatheca longer or as long as lateral; distal  $\frac{2}{3}$  of lateral spermatheca unsclerotized and with few or no pores. Genital plate large and extends back to level of posterior book lungs (fig. 324); sclerotized patches on each side of genital lip (figs. 328, 329). One pair of foveal bristles. Carapace centrally light brown to medium brown with dark radiating and anastomosing areas/lines of pigment (fig. 323); laterally

lighter except for purple-brown pigment along very edges; abundant dark recumbent hairs centrally; lateral region of pale hairs; dark brown or black between eyes. Chelicerae orange to orange-tan. Pedipalps and legs tan with many areas of light to medium brown pigment. Abdominal dorsum homogeneous medium brown to dark purple-brown; a few specimens with extremely faint pale chevrons.

**REMARKS:** Benoit (1965) erred in reporting two or three teeth on the lateral claws of tarsus I of the holotype male and no teeth on the median claw; there are actually six teeth on each lateral claw and two teeth on the median claw. The color of the holotype has become much lighter since it was first described (Benoit, 1965).

**DISTRIBUTION:** Known only from the type locality in western Ivory Coast (map 4).

**MATERIAL EXAMINED:** IVORY COAST: Mount Nimba, low prairie and high prairie (stations Pa. 16, 17, 32, 39, 40, 52, 76, 86,

88, 128; Pb. 16, 18, 28, 91, 123; Pc. 91; Pf. 86; Ph. 14, 76; Pj. 14), 1963 (J. Jezequel, MNHN; MRAC 127114, 127115, 127116), 2 ♂ (holotype from Pa. 88, MNHN, and paratype), 24 ♀ (allotype from Pa. 88, MNHN, and paratypes), juvs.

*Lathrothele catamita* (Simon)

Figures 319, 330–335; Map 4

*Ischnothele catamita* Simon, 1907: 226 (female lectotype from São Tomé, in MNHN, examined).

*Lathrothele catamita*: Benoit, 1965: 119.

**DIAGNOSIS:** *Lathrothele catamita* females differ from all other ischnotheline females in spermathecal morphology; they have only two widely spaced spermathecae, each with a distinctive heavily sclerotized chamber (figs. 331–335). These females also differ from all other *Lathrothele* females by high CDR(100)/MC values (110–150 vs. 16–69) and high LSL3(100)/CL values (100–130 vs. 65–100), from *L. jezequelei* females by high CDR values (31–54 vs. 12–20) and high CDR(100)/CL values (1019–1576 vs. 537–742) (fig. 319), from *L. cavernicola* and *L. grabensis* females by low MC values (22–40 vs. 77–168) and small size (CL = 3.04–3.45 vs. 3.31–6.31), and from *L. grabensis* females by high CDR(100)/CL values (1019–1576 vs. 476–853) (fig. 319).

**MALES:** Unknown.

**FEMALES:** Tables 6 and 7. Two widely separated spermathecae (fig. 335); each with long unsclerotized poreless “stalk” that extends laterally and bends abruptly to form a short sclerotized chamber that commonly has a small terminal unsclerotized lobe or bulb (figs. 331–335). One pair of foveal bristles (fig. 330). Carapace (fig. 330) centrally tan to orange tan with brown lines radiating out to slightly paler tan outer region; narrow band of brown along edge of carapace. Chelicerae tan to orange-tan. Pedipalps and legs tan with faint bands of pale brown. Abdominal dorsum (fig. 330) light to medium purple-brown with faint to prominent pattern of 4 or 5 pairs of pale transverse stripes forming chevrons and usually one pair of pale spots (often with pale area between them) at anterior end of abdomen. Posterior lung plates entirely pale yellow or with medium brown pigment on median one-third.

**REMARKS:** The vial containing Benoit’s lectotype label contains two adult females of similar size. The specimen with a broken fang (which probably broke when Benoit was counting cheliceral teeth) is presumably the lectotype.

**DISTRIBUTION:** Probably restricted to the island of São Tomé, and possibly the nearby island of Príncipe, near the western coast of Africa (map 4). I have not been able to examine Simon’s (1907) Príncipe Island specimens. Simon (1907) also included a specimen from Cameroon and Lessert (1930) and Benoit (1965) included specimens from the Congo in this species. I have not examined these specimens; however, because neither Simon nor Benoit found reliable species-diagnostic characters for *Lathrothele* females, I suspect that these specimens belong to one or more other species.

**MATERIAL EXAMINED:** SÃO TOMÉ: (L. Fea, MNHN 9086), 2 ♀ (includes lectotype); Makambrera, 4000 ft elev., Aug. 10, 1949 (B. Malkin, CAS), 1 ♀; Roca Zampalma, 2500 ft elev., Aug. 5–10, 1949 (B. Malkin, CAS), 1 ♀.

**INDOTHELE**, new genus

**TYPE SPECIES:** *Ischnothele dumicola*, Pocock.

**ETYMOLOGY:** The generic name, which is feminine in gender, is derived from the name of the subcontinent, India, where most species of this genus live.

**DIAGNOSIS:** Only one synapomorphy—the dorsal upturned “lip” at the base of each spermathecal stalk (figs. 343–345, 355–358, 362–365, 369, 370)—appears to support the hypothesis that this genus is monophyletic. In addition, *Indothele* females differ from nearly all *Ischnothele* females by having only 0–2 spines on tarsus I (vs. rarely fewer than 3) and only two spermathecae per side, from *Andethele* females by their proportionally larger AMEs [AMD(100)/CL = 3.2–5.4 vs. 1.5–3.0] and proportionally longer PMSSs [LSL3(100)/CL = 74–102 vs. 42–73], from *Lathrothele* females by the relatively small number of retrolateral cheliceral denticles [CDR(100)/CL = 60–330 vs. 480–1580], and from *Thelechoris* females by the narrower sternum [SW(100)/SL = 80–90 vs. 92–104] and median spermathecal stalks that are not

spiraled. *Indothele* males, unlike those of *Ischnothele* and *Andethele*, have a single tapered tibia I mating apophysis that lacks spines. *Indothele* males differ from those of *Lathrothele* by either having a single, long metatarsus I apophysis positioned midway along the article [MAD(100)/IML = 52 vs. 36–42] (fig. 347) or by lacking this apophysis (fig. 336). *Indothele* males differ most from those of *Thelechoris* in palpal morphology and sternum shape; the diagnosis of *Thelechoris* lists these differences.

**DESCRIPTION:** Body size small to medium (CL = 2.9–5.5) (figs. 341, 342, 361). Carapace with moderately dense covering of thin recumbent to semirecumbent hairs; 2 (rarely 1 or 3) foveal bristles; semierect setae on lateral edges of carapace relatively long. Pars cephalica elevated slightly above pars thoracica (fig. 342). Sternum not quite as wide as long. Palpal tarsus of female with 6–10 spines. Male palpal tibia (figs. 339, 350) strongly inflated or semicylindrical; with long, slender, erect ventral bristles. No spines on prolateral surface of palpal patella. Cymbial apophysis (figs. 339, 350) with 3–6 spines; no spines or bristles on tip. Palpus with long gradually tapering embolus curving upward (figs. 338, 351). No (male) or 0–2 (female) spines on tarsus I. Tibia I apophysis spineless and gradually tapering to narrow tip (figs. 336, 347). Metatarsus I with or without ventral apophysis (figs. 336, 347). Two spermathecae per side (figs. 343–346, 355–359, 362–366, 369, 370); base of each stalk usually upturned dorsally to form a lip. Females of at least some species have an enlarged genital lobe that extends back to the posterior lung covers (figs. 342, 367).

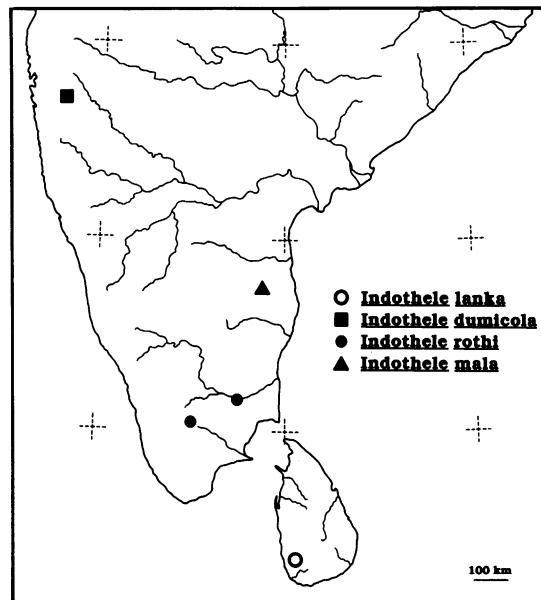
**DISTRIBUTION:** Southern India and Sri Lanka.

#### *Indothele lanka*, new species

Figures 336–346; Map 5

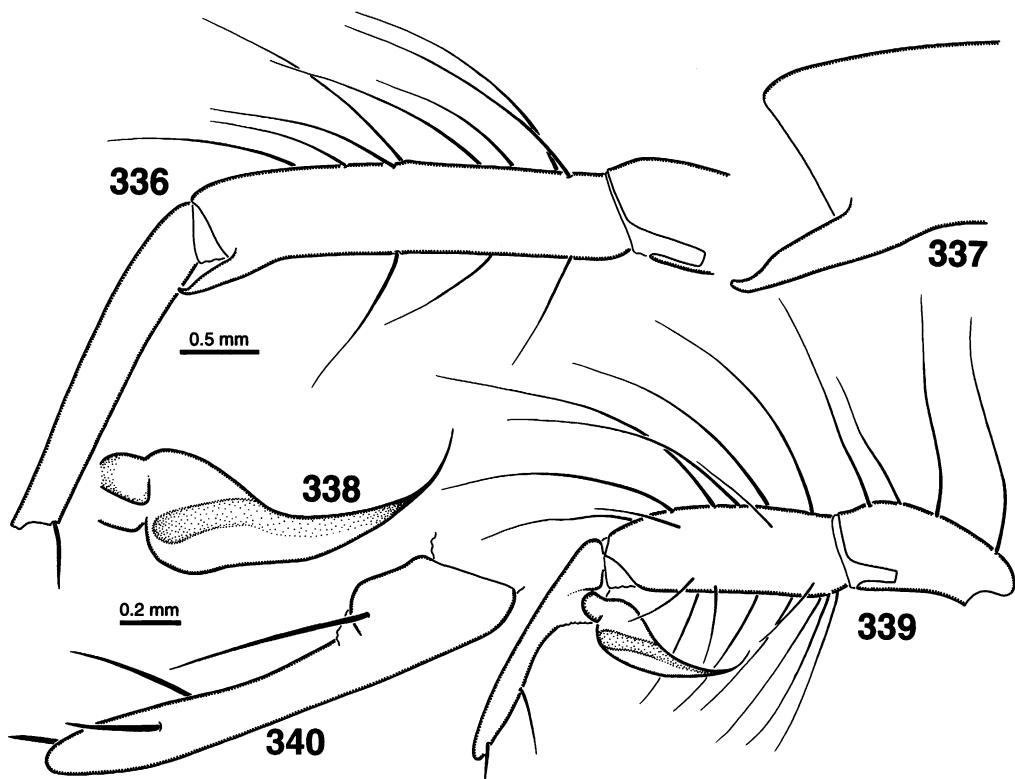
**TYPES:** Male holotype and one male and six female paratypes from roadbanks in Morapitiya Forest Reserve, Kalutara District, in southwestern Sri Lanka (March 14, 1987; L. Weeratunge), deposited in AMNH and NMSL.

**ETYMOLOGY:** The specific name is a noun in apposition taken from the country name, Sri Lanka.



Map 5. Southern India and Sri Lanka, showing distribution of *Indothele lanka*, *I. dumicola*, *I. rothi*, and *I. mala*.

**DIAGNOSIS:** The two males of *I. lanka* differ from the male of *Indothele dumicola* by having (1) no keels or other protuberances on metatarsus I (fig. 336) rather than a ventral keel at midpoint and a tiny sharp keel distally on the prolateral aspect of the ventral surface (figs. 347–349), (2) more elongate leg articles (fig. 336 vs. fig. 347) [ITT(100)/ITL = 21–22 vs. 35; IML(100)/CL = 63–69 vs. 53], (3) a more elongate and less swollen pedipalp tibia (fig. 339 vs. fig. 350) [PTT(100)/PTL = 37–38 vs. 55], (4) a proportionally longer cymbium (fig. 339 vs. fig. 350) [CYAL(100)/CL = 27.5–28.4 vs. 21.6], (5) a more elongate palpal organ (fig. 338 vs. fig. 351) [PL(100)/BD = 280–285 vs. 240] with a more strongly curved embolus, and (6) proportionally larger AMEs [AMD(100)/CL = 6.9 vs. 4.3]. *Indothele lanka* females have distinctive spermathecae (figs. 343–346) with much longer, more heavily sclerotized, and more sinuous stalks and many fewer pores in the distal portion of the bulbs than those of any other *Indothele* species (figs. 355–359, 362–366, 369, 370). *Indothele lanka* females also have proportionally longer carapace edge setae (figs. 20, 341), proportionally larger AMEs, and a proportionally wider ocular quadrangle than



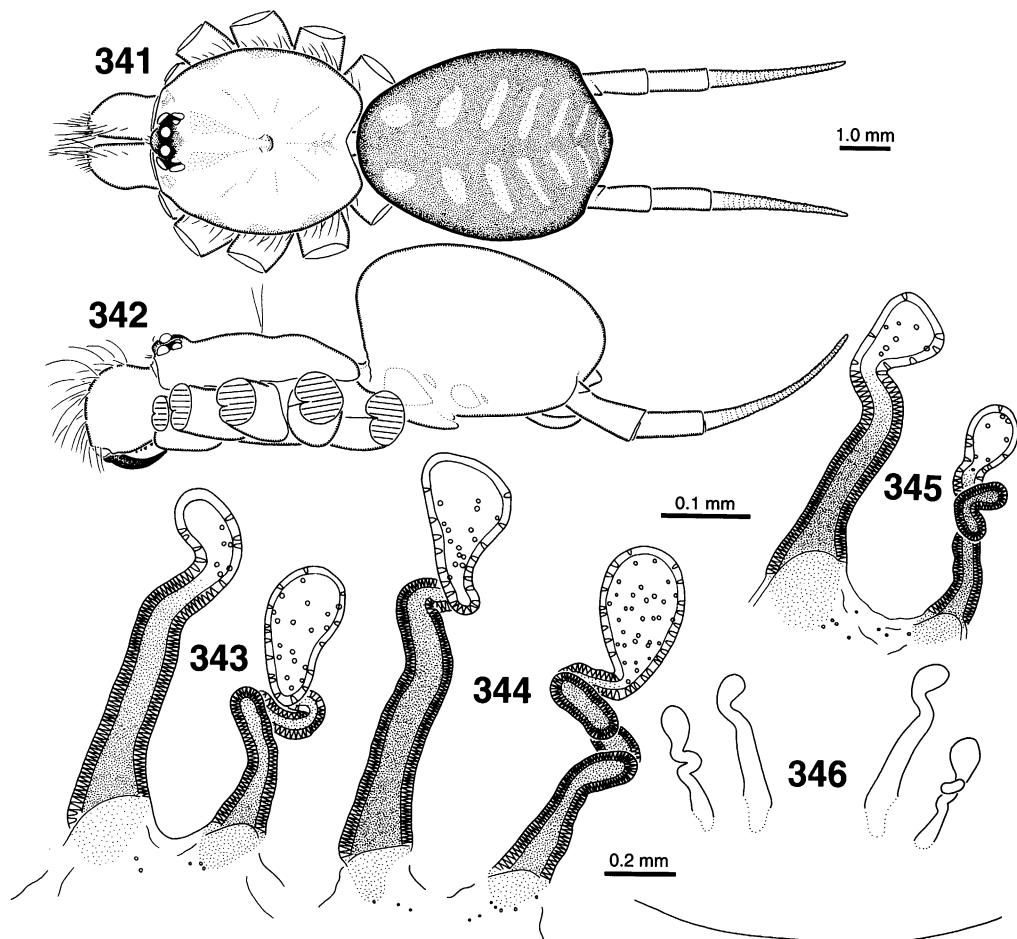
Figs. 336–340. *Indothele lanka*, holotype male. 336. Tibia and metatarsus I, retrolateral view. 337. Tibia I apophysis, retrolateral view. 338. Palpal organ, retrolateral-ventral view. 339. Pedipalp, retrolateral view. 340. Cymbium, prolateral view. Scale lines: 0.5 mm for figs. 336, 339; 0.2 mm for figs. 337, 338, 340.

other *Indothele* females [see CS(100)/CW, AMD(100)/CL, and OQW(100)/CL values in table 6].

**MALE:** Tables 5 and 7. Palpal organ (fig. 338) with long gradually tapering embolus curving strongly upward and inward. Cymbial apophysis (fig. 339) with 1–3 prolateral and 2 retrolateral spines; no spines or bristles on tip. Palpal tibia (fig. 339) semicylindrical with no ventral swelling. Tibia I apophysis (figs. 336, 337) spineless, long, tapering, with upturned tip. Metatarsus I (figs. 336) straight and lacking protuberances. Tarsus I pseudosegmented (semiflexible). One pair of foveal bristles. Carapace tan to very light brown, lateral edges darker gray, black inside ocular quadrangle. Chelicerae, pedipalps, and legs like carapace. Abdominal dorsum medium purple-brown to dark gray-brown with 8 pairs of light markings as in females.

**FEMALES:** Table 6. Two spermathecae per

side (figs. 343–346). Median stalk long, well sclerotized, widest at base and narrowing gradually to neck of bulb, proximal half (or more) nearly straight, distal half weakly sinuous to looped (no more than 1 loop); bulb 1–2 times diameter of distal end of stalk, bulb with few pores distally. Lateral stalk long and well sclerotized, narrower than median stalk, widest at base, more strongly looped than median, loops asymmetrical; bulb usually as large or larger than lateral bulb, with fewer pores distally than proximally. Dorsal wall at base of each spermathecal stalk slightly upturned to form a faint lip. One to 3 foveal bristles. Carapace tan to orange-tan except dark gray on lateral edges and black inside ocular quadrangle. Chelicerae, pedipalps, and legs like carapace. Sternum with dark median longitudinal band. Abdominal dorsum (fig. 341) dark purple-brown or gray-brown with 7 or 8 pairs unpigmented whitish markings,



Figs. 341–346. *Indothelus lanka*, paratype females. 341, 342. Whole body, 1.0 mm scale. 341. Dorsal view. 342. Lateral view. 343–345. Right spermathecae, 0.1 mm scale. 346. All spermathecae, 0.2 mm scale.

anterior pair elongate-oval, rest obliquely transverse and becoming thinner and more nearly joined medially as one moves posteriorly.

**DISTRIBUTION:** Known only from two neighboring localities in southwestern Sri Lanka (map 5).

**MATERIAL EXAMINED:** Type specimens and **SRI LANKA:** Sinharaja Forest, Ratnapura District, Aug. 19, 1983 (L. Weeratunge, NMSL), 1 ♀.

**NATURAL HISTORY:** All specimens were collected in lowland evergreen rain forest at almost 150 m elevation. The collecting label with the type specimens reads "funnel webs with burrows in roadbanks."

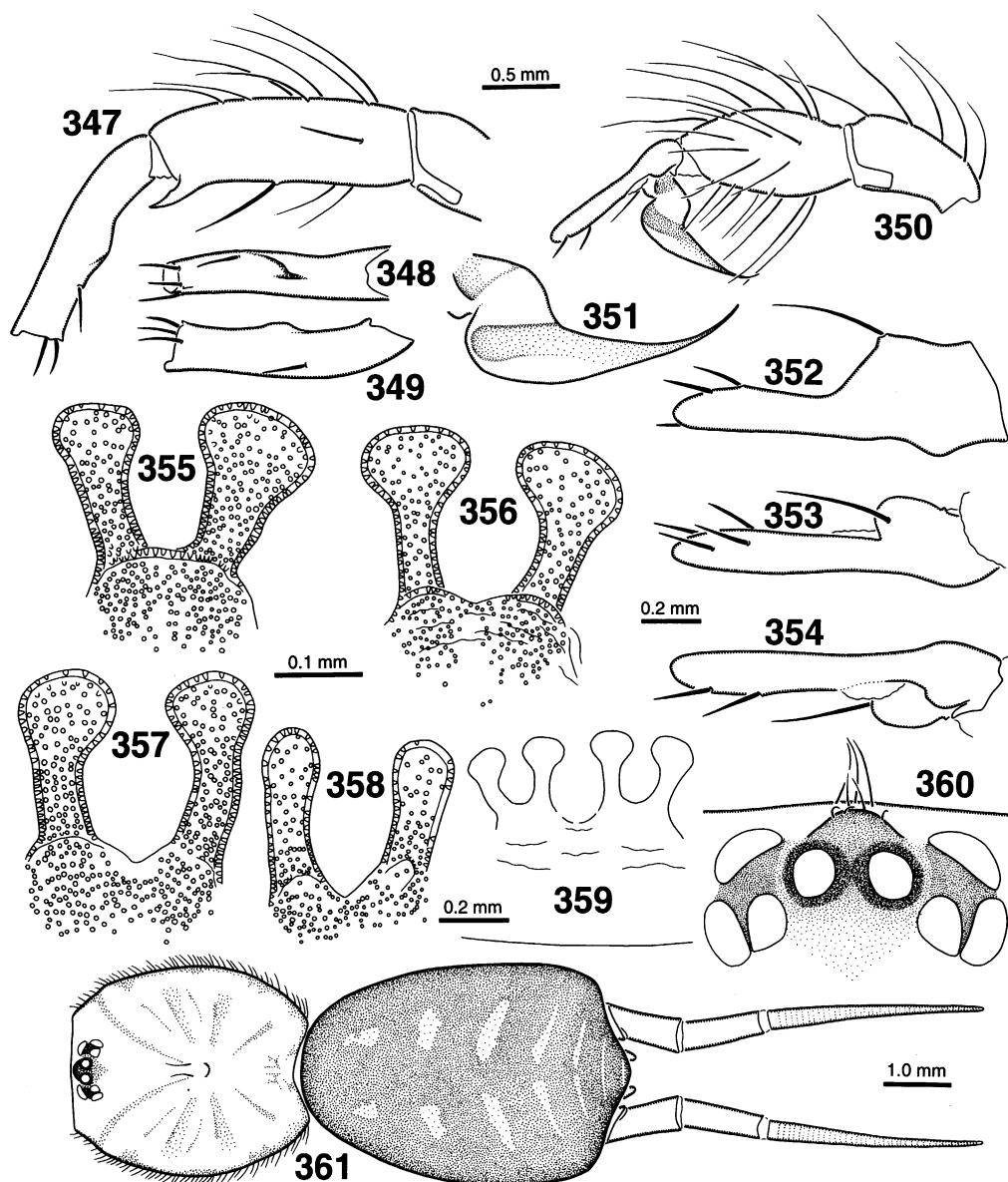
*Indothelus dumicola* (Pocock),  
new combination

Figures 347–361; Map 5

*Ischnothelus dumicola* Pocock, 1900: 171, fig. 55 (male lectotype, here designated, and three female paralectotypes from Pune, Maharashtra, India, in BMNH, examined). — Simon, 1903: 968. — Gravely, 1936: 72.

*Ischnothelus domicola* (spelling error): Tikader, 1968: 160.

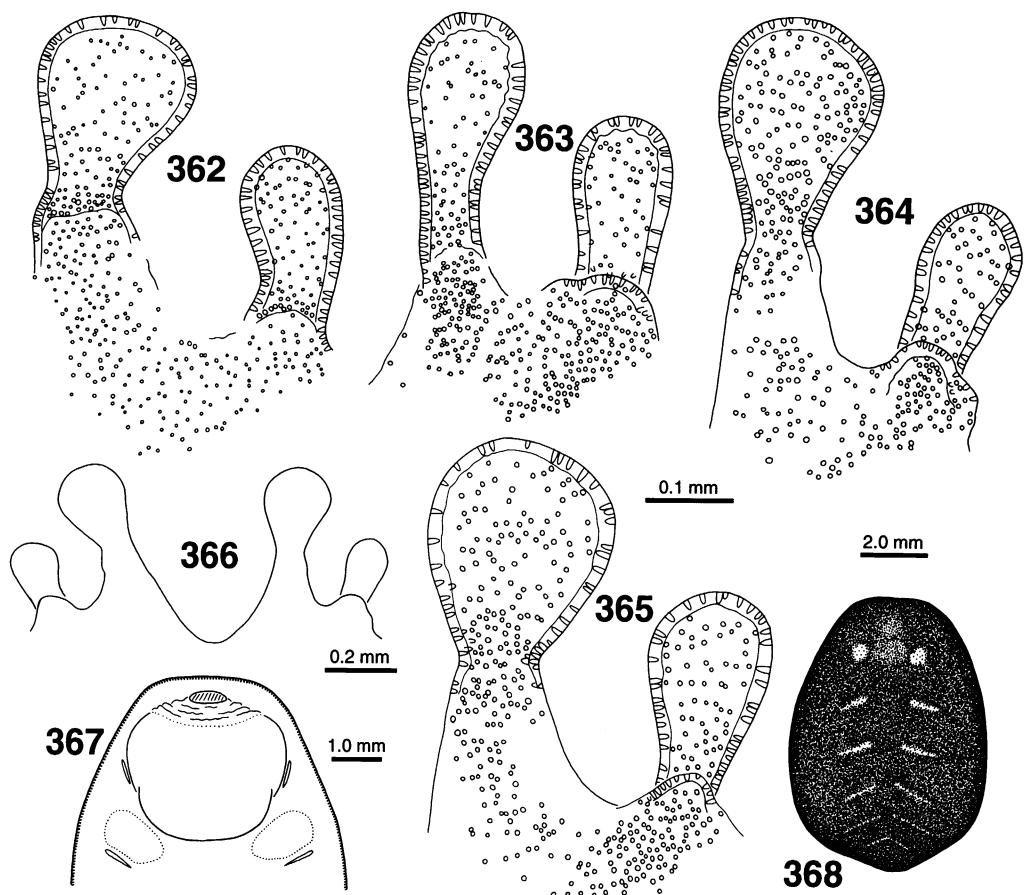
**DIAGNOSIS:** See the diagnosis of *I. lanka* for characters that best distinguish the only known *I. dumicola* male (figs. 347–354) from *I. lanka* males. *Indothelus dumicola* females have distinctive spermathecae (figs. 355–359)



Figs. 347–361. *Indothele dumicola*. 347–354. Lectotype male. 347. Tibia and metatarsus I, retrolateral view. 348, 349. Metatarsus I. 348. Ventral view. 349. Prolateral view. 350. Pedipalp, retrolateral view. 351. Palpal organ, retrolateral-ventral view. 352–354. Cymbium. 352. Dorsal view. 353. Prolateral view. 354. Retrolateral view. 355–361. Paralectotype females. 355, 356. Right spermathecae. 357. Left spermathecae of fig. 355 specimen. 358. Right spermathecae. 359. All spermathecae of fig. 356 specimen. 360. Ocular quadrangle. 361. Whole body, dorsal view. Scale lines: 0.5 mm for figs. 347–350; short 0.2 mm for figs. 351–354, 360; long 0.2 mm for fig. 359; 0.1 mm for figs. 355–358; 1.0 mm for fig. 361.

with much longer stalks than those of *Indothele mala* (figs. 369, 370), much more nearly equal-size medial and lateral spermathecae than those of *Indothele rothi* (figs. 362–366), and much shorter and straighter stalks than those of *I. lanka* (figs. 343–346).

The first legs of *I. dumicola* females are proportionally shorter [ $ITL(100)/CL = 42–43$ ] than those of *I. rothi* (47–52) and *I. lanka* (48–53) females. For other diagnostically useful female characters, see the diagnosis of *I. rothi*.



Figs. 362–368. *Indothele rothi* females. 362–365. Right spermathecae. 362. Tiruchirappalli. 363. Above Kodaikanal. 364. Paratype. 365. Holotype. 366. All spermathecae, same specimen as fig. 364. 367. Anterior half of abdomen, ventral view, Tiruchirappalli. 368. Abdominal dorsum, holotype. Scale lines: 0.1 mm for figs. 362–365; 0.2 mm for fig. 366; 1.0 mm for fig. 367; 2.0 mm for fig. 368.

**MALE:** Tables 5 and 7. Palpal organ (fig. 351) with moderately long gradually tapering embolus curving gently upward. Cymbial apophysis (figs. 350, 352–354) with 2 prolateral and 2 retrolateral spines; no spines or bristles on tip. Palpal tibia (fig. 350) markedly swollen. Tibia I apophysis (fig. 347) spineless and gradually tapering to narrow tip. Metatarsus I ventral apophysis (figs. 347–349) at midpoint and consists of low retrolateral keel that is thin and sharp proximally but thick and rounded distally; distal end of metatarsus with tiny sharp keel on prolateral aspect of ventral surface. One pair of foveal bristles. Carapace light orange-brown, black within ocular quadrangle. Chelicerae like carapace; pedipalps and legs tan. Abdominal dorsum medium purple-brown with longitudinal se-

ries of pale unpigmented spots, anterior pair faint and roughly round, rest whiter and becoming thinner as in females (insect pin penetrates posterior of abdomen and obscures posterior markings).

**FEMALES:** Table 6. Two weakly sclerotized spermathecae per side (figs. 355–359). Lateral and median spermathecae roughly equivalent in size and shape. Stalks moderately long and nearly straight; bulb usually much wider than stalk; dorsal wall at stalk base slightly upturned to form a lip. Foveal bristles as in male. Carapace dark orange-tan, black within ocular quadrangle (fig. 361). Chelicerae darker than carapace; pedipalps and legs like carapace. Abdominal dorsum (fig. 361) dark purple-brown with longitudinal series of 7 pairs of cream-white spots,

anterior pair roughly elongate-oval, rest obliquely transverse and becoming thinner and more nearly joined medially as one proceeds posteriorly.

**REMARKS:** Gravely (1936) indicated that his two specimens might not be *I. dumicola*. I was not able to examine these specimens (both deposited in the Madras Museum); however, judging from their localities (near Chittoor west of Madras and near Tirunelveli at the southern tip of India), they probably belong to another one or two species of *Indothele*.

**DISTRIBUTION:** Known only from the type locality in western India (map 5).

**MATERIAL EXAMINED:** Only the type specimens.

#### *Indothele rothi*, new species

Figures 362–368; Map 5

**TYPES:** Female holotype and four female paratypes from roadbank at an elevation of 5500 ft, 10 km downhill from Kodaikanal, Tamil Nadu, India (December 31, 1989; V. and B. Roth), deposited in AMNH.

**ETYMOLOGY:** The specific name is a patronym in honor of Vince and Barbara Roth, collectors of the type series.

**DIAGNOSIS:** In *I. rothi* the median spermathecae are clearly longer and their bulbs wider than the lateral spermathecae (figs. 362–366); these features distinguish *I. rothi* from the other *Indothele* species of India, *I. dumicola* (figs. 355–359) and *I. mala* (figs. 369, 370). The following characters also help distinguish *I. rothi* females: (1) Femur I of *I. rothi* is relatively more slender [IFT(100)/IFL = 34–38 ( $36.7 \pm 1.3$ )] than that of *I. dumicola* [ $42-44$  ( $42.8 \pm 0.9$ )] or *I. mala* (43, 45). (2) The entire first leg is proportionally longer [ITL(100)/CL = 47–52] than in *I. dumicola* (42–43) or *I. mala* (44, 45). (3) There are proportionally fewer CDR [CDR(100)/CL = 55–182] than in *I. dumicola* (202–332) or *I. mala* (243, 260). See the *I. lanka* diagnosis for characters that distinguish *I. rothi* females from those of *I. lanka*.

**MALES:** Unknown.

**FEMALES:** Tables 6 and 7. Two weakly sclerotized spermathecae per side (figs. 362–366); median spermatheca longer than lateral one, median bulb wider than lateral bulb.

Median bulb much wider than its stalk, lateral bulb only slightly wider than its stalk. Dorsal wall at base of lateral stalk slightly upturned to form a lip. One pair of foveal bristles. Carapace tan to orange-tan or light olive-brown, lateral edges gray, dark brown to black within ocular quadrangle. Chelicerae dark orange-tan to medium brown; pedipalps and legs like carapace. Abdominal dorsum (fig. 368) medium gray-brown to dark brown with longitudinal series of 5–7 pairs of pale unpigmented spots, anterior pair round to elongate oval, rest obliquely transverse and becoming thinner and more nearly joined as one proceeds posteriorly, posterior 1 or 2 pairs extremely thin and difficult to see.

**DISTRIBUTION:** Known from only two areas about 150 km apart in southern India (map 5).

**MATERIAL EXAMINED:** INDIA: Tamil Nadu: Kodaikanal, above city,  $10^{\circ}15'N$ ,  $73^{\circ}31'E$ , about 7000 ft elev., Dec. 31, 1989 (V. and B. Roth; AMNH), 1 ♀; 10 km downhill from Kodaikanal, elev. 5500 ft, on roadbank, Dec. 31, 1989 (V. and B. Roth; AMNH), 5 ♀ (types); Tiruchirappalli (= Trichinopoly), (NMNH 21317), 3 ♀.

#### *Indothele mala*, new species

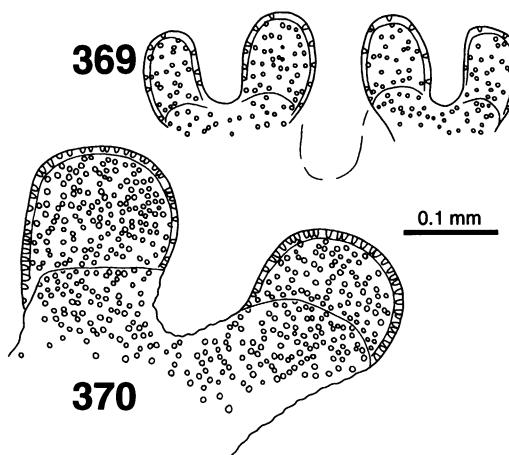
Figures 369, 370; Map 5

**TYPES:** Female holotype and one female paratype from an elevation of 780 m at Tirumala, Pradesh, India (April 19, 1962; E. S. Ross and D. Q. Cavagnaro), deposited in CAS.

**ETYMOLOGY:** The short, wide, very weakly sclerotized, pocketlike spermathecae (figs. 369, 370) distinguish *I. mala* from all other *Indothele* species. See the *I. rothi* diagnosis for other characters that help separate *I. mala* from *I. rothi*.

**MALES:** Unknown.

**FEMALES:** Tables 6 and 7. Two short, wide, weakly sclerotized spermathecae per side with stalks reduced or absent (figs. 369, 370); dorsal wall of each spermatheca is quite short so that each bulb resembles a pocket, especially in the holotype, which is larger (and probably older) than the paratype. One pair of foveal bristles. Carapace tan to orange-tan, lateral edges gray, dark brown to black within ocular



Figs. 369, 370. *Indothele mala* spermathecae. 369. All spermathecae, paratype. 370. Right spermatheca, holotype.

quadrangle. Chelicerae orange-tan, darker than carapace; pedipalps and legs like carapace except paratype has pronounced dark bands near each end of femur, tibia, and metatarsus. Abdominal dorsum medium to dark gray-brown with longitudinal series of 8 pairs of pale unpigmented spots, anterior pair elongate oval, rest obliquely transverse and becoming thinner and more nearly joined as one proceeds posteriorly.

**DISTRIBUTION:** Known only from the type locality in southern India (map 5).

**MATERIAL EXAMINED:** Only the type specimens.

**NATURAL HISTORY:** Tirumala is a sacred temple atop a hill in a very arid region with a scrubby, *Acacia*-dominated plant community (Ross, personal commun.).

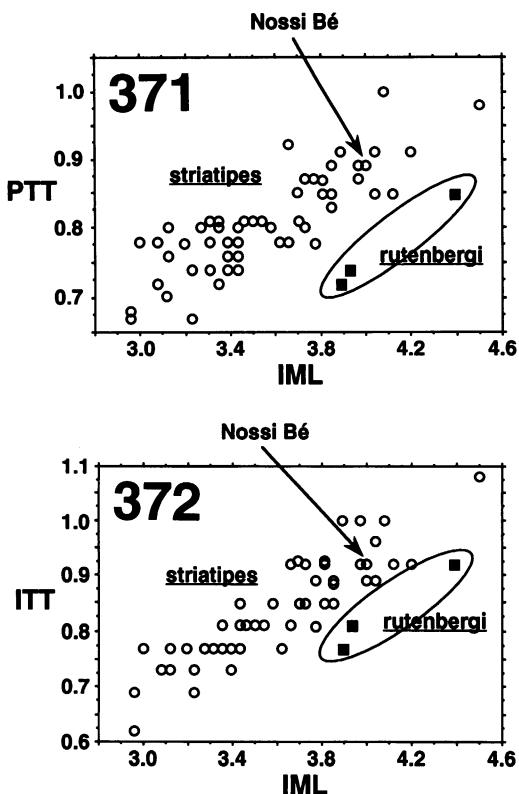
#### THELECHORIS Karsch

*Thelechoris* Karsch, 1881: 196 (type species by original description *Thelechoris rutenbergi* Karsch). — Bonnet, 1957: 2306; 1959: 4420. — Benoit, 1964: 422. — Brignoli, 1983: 127. — Raven, 1983a: 347; 1985a: 77. — Platnick, 1989: 82, 1993: 91.

**DIAGNOSIS:** The seven putative synapomorphies of *Thelechoris* (tables 2, 4) make it easy to distinguish members of this genus from other ischnothelins; five of these synapomorphies (characters 18, 20, 23, 24, and

26) are unique among ischnothelins. *Thelechoris* males have a unique palpal organ (figs. 36–38, 378–380) with a distinctive sharp extension on the embolus tip, a more abrupt transition from the bulb to embolus, and a flatter and proportionally longer embolus than in other ischnotheline genera. *Thelechoris* males also have more CAS (6–24) (figs. 405–407) than virtually all other ischnothelins (0–9). *Thelechoris* males and females can be distinguished from all other ischnothelins by the proportionally broad sternum (fig. 417 vs. fig. 155) [female SW(100)/SL = 92–104 vs. 78–96]. No other ischnothelins have median spermathecae like those of *Thelechoris* females, with coiled stalks that are nearly as long as those of the lateral spermathecae (figs. 386, 387). *Thelechoris* also differs from the other African ischnotheline genus, *Lathrothele*, in the following ways: (1) male tibia I apophysis small and terminal (fig. 374) vs. larger and subterminal (figs. 280, 310, 320), (2) male metatarsus I straight and smooth (fig. 374) vs. modified with ventral protuberances (figs. 280, 310, 320), (3) CDR(100)/CL = 14–297 vs. 476–1576, and (4) spermathecal stalks spiraled (figs. 386, 387) vs. straight. Unlike *Thelechoris*, *Indothele* females do not have spiraled stalks on the median spermathecae. Unlike *Thelechoris*, *Ischnothele* males have spines on the tibia I mating apophysis and have one or more protuberances on metatarsus I.

**DESCRIPTION:** Body size medium (CL = 3.9–7.5) (figs. 415, 416). Carapace with moderately dense covering of thin recumbent to semirecumbent hairs; 1–3 (usually 2, side by side) foveal bristles; semierect setae on lateral edges of carapace relatively short and thin. Pars cephalica moderately elevated above pars thoracica. Sternum almost as wide or as wide as long (fig. 417). Palpal tarsus of female with 12–27 spines. Male palpal tibia (figs. 381, 403, 404) nearly cylindrical with long, slender, nearly straight, erect ventral bristles. Cymbial apophysis (figs. 403–407) with 4–14 prolateral and 2–10 retralateral spines; no spines or bristles on tip. Bulb of palpal organ roughly heart-shaped, abruptly constricted at base of embolus (figs. 36–38, 378–380, 408–414); embolus long, flattened, and gently curved with sharp tip extending beyond orifice of sperm duct. Male tarsi integral (not



Figs. 371, 372. Scattergrams of male characters that help distinguish *Thelechoris rutenbergi* from *Thelechoris striatipes*. Measurements in mm. Arrows point to data points for *T. striatipes* lectotype from Nossi Bé. 371. PTT plotted against IML. 372. ITT plotted against IML.

pseudosegmented); 0–4 spines on tarsus I (both sexes). Male tibia I cylindrical, with spineless thornlike mating apophysis ventrally at distal end (figs. 374, 391); metatarsus I straight and without protuberances. Spermathecal stalks weakly to moderately sclerotized, moderately to very long, usually regularly and tightly spiraled; bulbs unsclerotized and roughly spherical to elongate-oval (figs. 382–387, 421–436).

**DISTRIBUTION:** Southern Africa and Madagascar.

#### *Thelechoris rutenbergi* Karsch Figures 371–387; Map 4

*Thelechoris rutenbergi* Karsch, 1881: 196, figs. C–C2 (female holotype from Madagascar, in ZMB, no. 3687, examined). — Simon, 1892: 187. — Benoit, 1964: 424. — Raven, 1983a: 347; 1983b: 553.

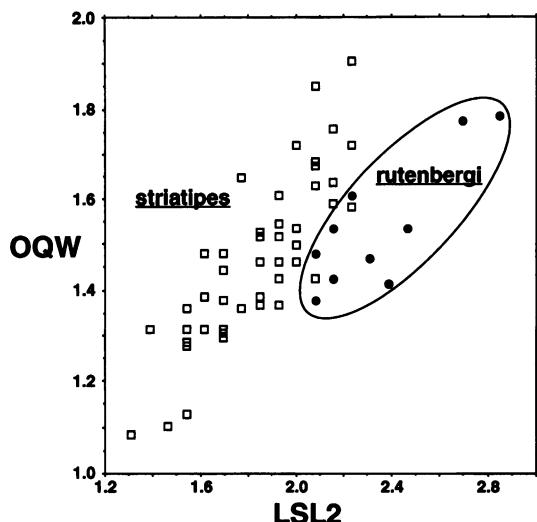


Fig. 373. Scattergram of OQW plotted against LSL2 for *Thelechoris rutenbergi* and *Thelechoris striatipes* females. Measurements in mm.

*Ischnothele rutenbergi*: Simon, 1902: 513. — Strand, 1907: 263 (in part); 1908: 456.

**DIAGNOSIS:** The two species of *Thelechoris* are very similar and may eventually prove to be one (see "Remarks" section under *T. striatipes*). The three *T. rutenbergi* males I have examined have proportionally thin palpal and leg I tibiae and proportionally long leg I articles, so that they have lower PTT(100)/IML (18.5–19.4 [ $18.9 \pm 0.4$ ]) and ITT(100)/IML (19.8–21.0 [ $20.5 \pm 0.6$ ]) values (figs. 371, 372) than do all (or most) known *T. striatipes* males [PTT(100)/IML = 20.6–26.0 (22.7  $\pm$  1.2); ITT(100)/IML = 20.9–25.7 (23.2  $\pm$  1.1)]. The tibia I mating apophyses of these *T. rutenbergi* males (figs. 374–377) are rougher and more wrinkled than those of the great majority of *T. striatipes* males (figs. 391–402). I have discovered only two female characters that help distinguish these species. The 10 examined females of *T. rutenbergi* have proportionally longer lateral spinneret articles (especially LSL2), a proportionally narrower OQW, and proportionally fewer maxillary cuspules than most or many of the *T. striatipes* females examined; consequently, 90% of all *T. striatipes* females examined have larger OQW(100)/LSL2 values (69–95 [ $80 \pm 6$ ]) than do the *T. rutenbergi* females (59–72 [ $66 \pm 4$ ]) (fig. 373), and 62% of the *T. striatipes* females have higher MC/LSL2 values

(44–136 [86 ± 19]) than do the *T. rutenbergi* females (24–82 [63 ± 17]).

**MALES:** Table 5. Palpal tibia, cymbium, palpal organ, and leg I articles as in generic description, except tibia I apophysis consistently rough and wrinkled (figs. 374–381). One pair of foveal bristles. Carapace with pars cephalica red-brown, pars thoracica orange to tan, lateral edges dark gray, dark brown to black around AMEs and between PMEs and lateral eyes. Chelicerae colored like pars cephalica; pedipalps and legs like pars thoracica. White hairs on carapace and patellae, as in females. Abdominal dorsum medium gray-brown with pale markings as described for females; abdominal venter as in females.

**FEMALES:** Tables 6 and 7. Spermathecal stalks (figs. 382–387) long, narrow, and usually with regular tight spirals; median stalk usually with fewer spirals (1.5–3.5) and slightly narrower than its lateral partner (2–4 spirals). Spermathecal bulbs roughly spherical to elongate-oval; median bulb usually a little larger than lateral bulb. Two or 3 foveal bristles. Carapace with pars cephalica orange to orange-tan, pars thoracica lighter orange to pale tan, lateral edges dark gray, dark brown to black around AMEs and between PMEs and lateral eyes. Chelicerae moderate to dark orange, pedipalps and legs orange-tan to pale tan. Fragile white hairs (many have probably worn off) clustered on lateral carapace and distal end of patellae. Abdominal dorsum with background color of light brown to dark brown spots and mottled areas; anterior pair of pale spots followed by 6–7 pale chevrons, anterior few wider and interrupted in middle, posterior ones thinner and complete. Abdominal venter pale with scattered brown spots; small area of dark brown pigment covers up to the medianmost 25% of each posterior lung cover. The colors of the holotype (Karsch, 1881) have become much lighter after more than 100 years in alcohol; all traces of the "yellow-brown" chevrons (Karsch, 1881) on the abdominal dorsum have disappeared.

**VARIATION:** One of the three females from Majunga (fig. 382) has spermathecal stalks with much weaker and less regular spirals and bulbs that are more elongate than those of the other *T. rutenbergi* specimens examined (figs. 383–387).

**DISTRIBUTION:** Madagascar (map 4).

**MATERIAL EXAMINED: MADAGASCAR:** (Rutenberg, ZMB 3687), 1 ♀ (holotype); Berevo, 21°29'S, 45°29'E, Jan. 1948 (B. Lasne, MRAC 142.969), 3 ♂, 4 ♀, juvs.; central Madagascar (ZMB 9442), 1 ♀; Majunga (= Mojanga), May 1896 (MNHN), 1 ♀, 1893 (Voeltzkow; ZMB 9440, 9441), 2 ♀, juv.; Manandaza, June 1969 (A. Lambillion, MRAC 142.961), 1 ♀, juv.

**NATURAL HISTORY:** Strand (1908) reported that females were collected from funnelwebs attached to tree trunks near Marovoay.

#### *Thelechoris striatipes* (Simon)

Figures 5, 8, 9, 31, 36–39, 42, 46, 52, 55, 371–373, 388–442; Map 4

*Entomothele striatipes* Simon, 1889a: 236 (male lectotype, here designated, and female paralectotype from Nossi Bé, off the NE coast of Madagascar; lectotype in MNHN, no. 7008, examined; paralectotype not examined); 1891a: 329.

*Thelechoris rutenbergi* (misidentification): Lenz, 1891: 153. – Strand, 1916: 54.

*Thelechoris karschi* Bösenberg and Lenz, 1894: 27, figs. 31–31b (one adult female lectotype, here designated, and five juvenile paralectotypes from Mbusine, East Africa, in ZMH, examined). – Pavesi, 1897: 170. – Benoit, 1964: 424; 1971: 147. – Raven, 1983a: 346, figs. 1–7, pl. I (figs. 1, 2); 1983b: 553. – Coyle and O'Shields, 1990: 281. – Coyle and Meigs, 1992: 289. NEW SYNONYMY.

*Ischnothele mashonica* Pocock, 1901: 337 (male lectotype, here designated, and six female paralectotypes from Mazoe, Zimbabwe, in BMNH, examined). – Benoit, 1964: 425.

*Ischnothele karschi*: Strand, 1907: 263. – Berland, 1914: 51, figs. 8–10; 1932: 18, fig. 403. – Lessert, 1936: 207. – Holm, 1954: 199, figs. 1–6, pl. I. – Coyle, 1986: 279, fig. 10.7. – Forster and Murphy, 1986: 29. – Baert and Murphy, 1987: 194.

*Ischnothele rutenbergi* (misidentification): Strand, 1907: 263 (in part).

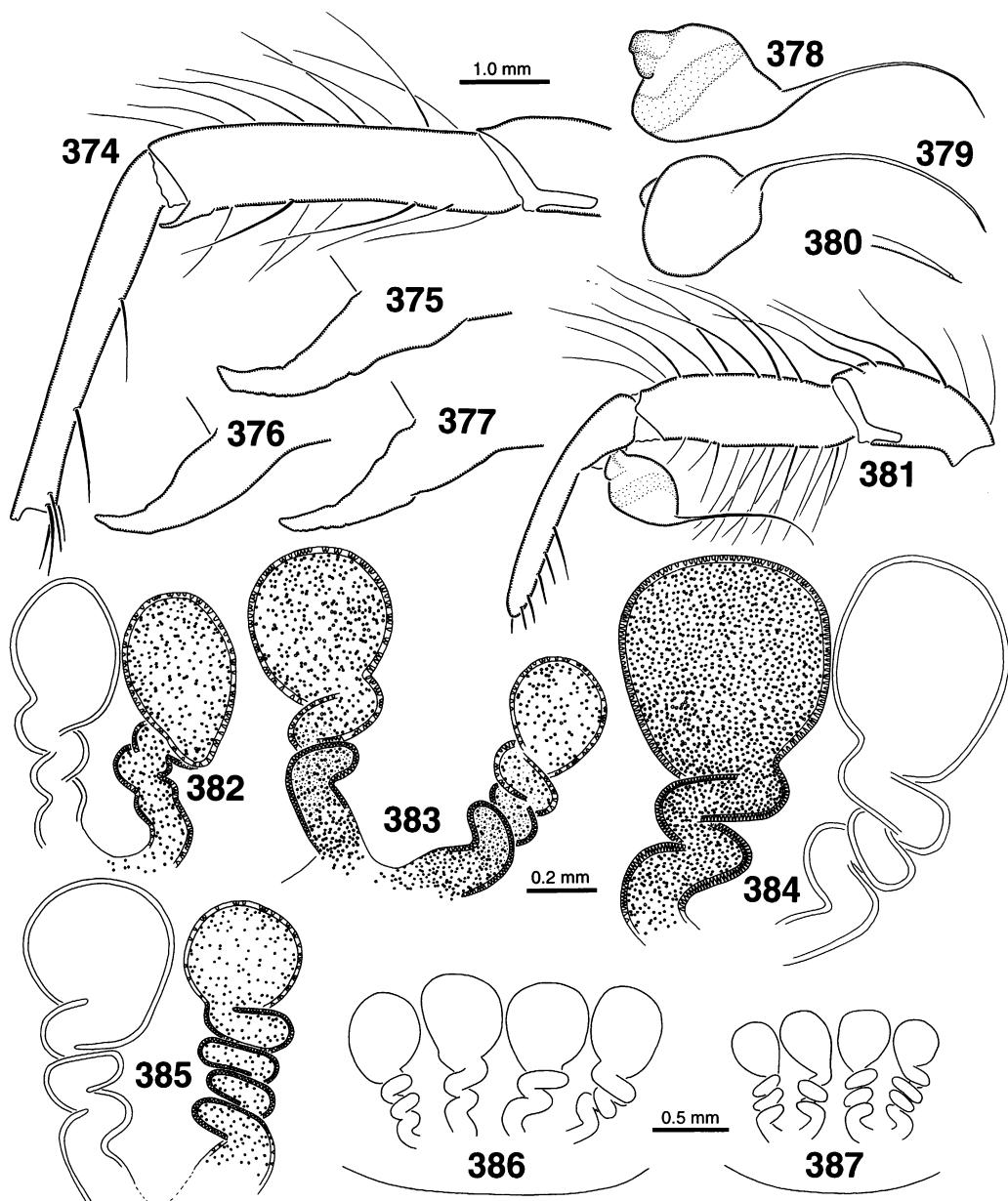
*Ischnothele gracilis* Tucker, 1917: 123, fig. 10 (male holotype from East Africa, in SAM, no. 491 or 8500, examined). – Lessert, 1936: 207. – Benoit, 1964: 425.

*Ischnothele cassetti* Tucker, 1920: 444 (female holotype from Pemba, Zambia, in SAM, no. 492 or B4666, examined). – Benoit, 1964: 425.

*Thelechoris striatipes*: Willey and Coyle, 1992: 151.

**DIAGNOSIS:** See the diagnosis of *T. rutenbergi*.

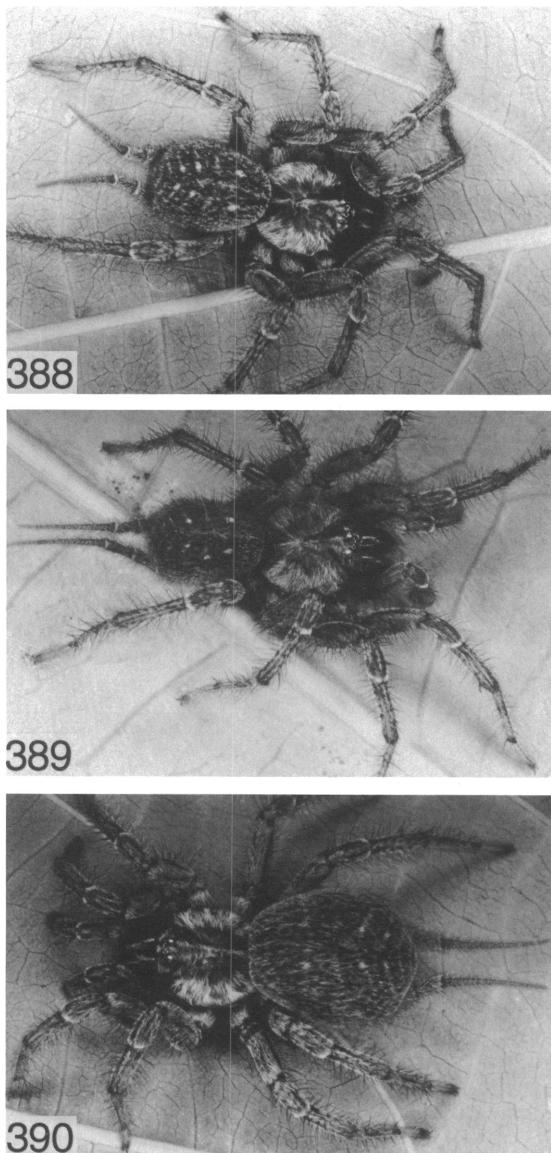
**MALES:** Tables 5 and 7. Palpal tibia, cymbium, palpal organ, and leg I articles as in



Figs. 374-387. *Thelechoris rutenbergi*. 374-381. Males from Berevo. 374. Tibia and metatarsus I, retrolateral view. 375-377. Tibia I apophysis, retrolateral view. 378-380. Palpal organ. 378. Retrolateral-ventral view. 379, 380. Ventral view. 380. Embolus tip magnified 2× fig. 379. 381. Pedipalp, retrolateral view. 382-385. Right spermathecae. 382. Majunga. 383. Berevo, 384. Holotype. 385. Berevo. 386, 387. All spermathecae. 386. Holotype. 387. Berevo. Scale lines: 1.0 mm for figs. 374, 381; 0.2 mm for figs. 375-377, 382-385; 0.5 mm for figs. 378, 379, 386, 387.

generic description (figs. 391-414). Two (rarely 1 or 3) foveal bristles. Carapace with pars cephalica orange-tan to dark chestnut brown, pars thoracica lighter (tan to medium

brown centrally, pale cream-yellow to light brown laterally), lateral edges brown or gray, dark brown to black around AMEs and between PMEs and lateral eyes. Color of che-



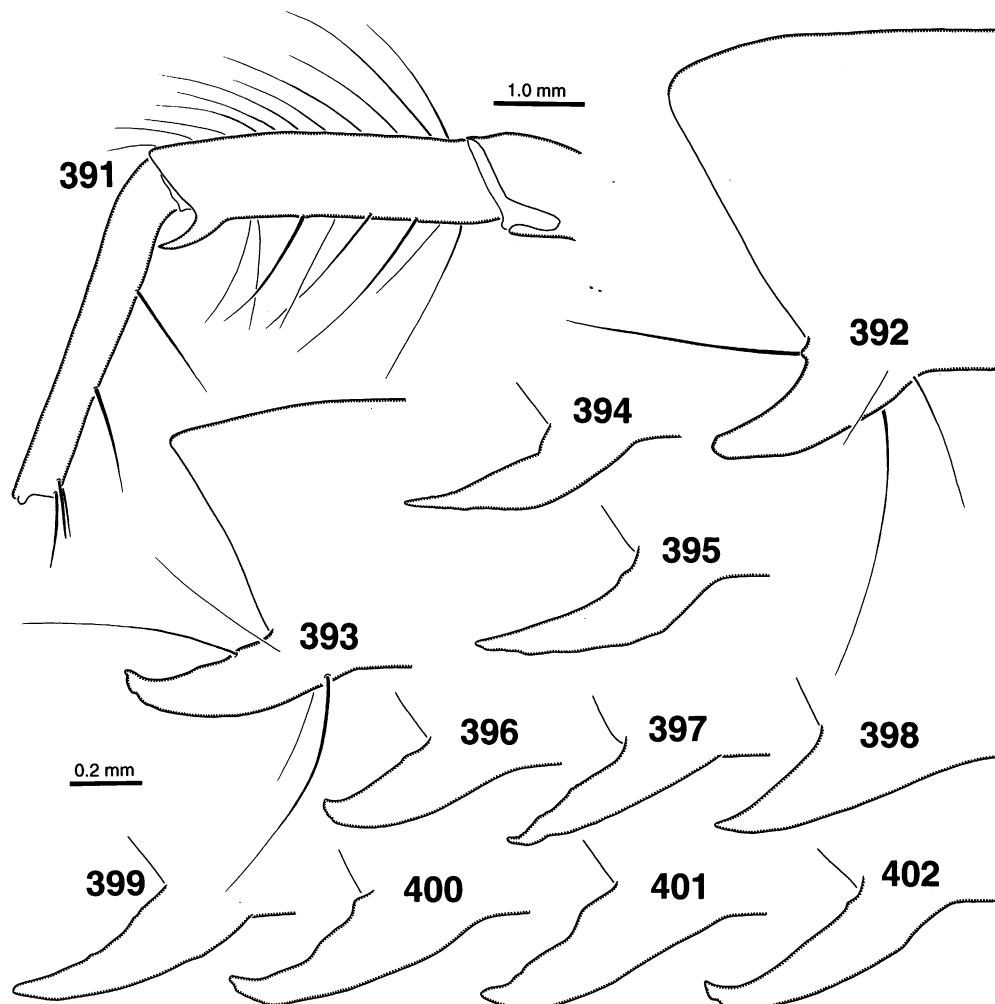
Figs. 388–390. Live *Thelechoris striatipes*. 388. Male from Tsavo West National Park, Kenya. 389. Male from Shimba Hills, Kenya. 390. Female from Tsavo West National Park.

licerae like (or a little darker than) pars cephalica; pedipalps and legs like pars thoracica. Abdominal dorsum light brown to dark gray, sometimes with anterior pair of pale spots followed by series of 6–8 pale chevron-like markings as in figure 419. Abdominal venter pale (with scattered brown spots) to dark gray; brown spot occupies medianmost

20–35% of each posterior lung cover. Color of living spiders (from Kodachrome slides) (figs. 388, 389, 418): Pars cephalica cuticle dark chestnut brown; pars thoracica cuticle dark brown (sometimes a lighter orange-brown or amber-pink laterally), but covered with recumbent white hairs laterally that make the color lighter and silvery; chelicerae like pars cephalica; pedipalps and legs medium to dark gray-brown except tibia to tarsus and sometimes coxa lighter orange-brown or amber-pink and patella with prominent white distal borders formed by dense patches of recumbent white hairs; cymbium and palpal organ orange-amber to dark brown; abdominal dorsum medium to dark gray with 2–4 pairs of white spots, 4 or 5 faint white chevrons, and a weak median longitudinal white strip (figs. 388, 389, 418) (white markings on dorsum are formed by clusters of recumbent white hairs; first and third pair of markings usually more conspicuous than second and fourth).

**FEMALES:** Table 6. Spermathecae (figs. 421–436) with moderately long to very long stalks usually regularly and tightly spiraled; median stalk usually with slightly fewer spirals (1.5–4) than its lateral partner (2–4.5); bulbs roughly spherical to elongate-oval. Two (rarely 1 or 3) foveal bristles (figs. 415, 416). Carapace with pars cephalica tan to chestnut brown, pars thoracica lighter at least laterally (pale cream-yellow to medium brown), lateral edges brown or gray, dark brown to black around AMEs and between PMEs and lateral eyes. Chelicerae orange-tan to dark chestnut brown. Pedipalps and legs like pars thoracica or slightly darker. Abdominal dorsum and venter as in males. Color of live spiders similar to that of males but slightly lighter (fig. 390).

**REMARKS:** After consulting with Lenz, and one year after describing *E. striatipes*, Simon (1891a) noted that *E. striatipes* should be a junior synonym of *T. rutenbergi*. Bösenberg and Lenz (1894) pointed out how “very similar” their *T. karschi* was to *T. rutenbergi*, but observed that it was much darker, had more prominent chevrons on the abdominal dorsum, and had larger spots on the posterior book lung covers than did *T. rutenbergi*. Beaufort (1964), the only other author to actually describe differences between *T. karschi* and

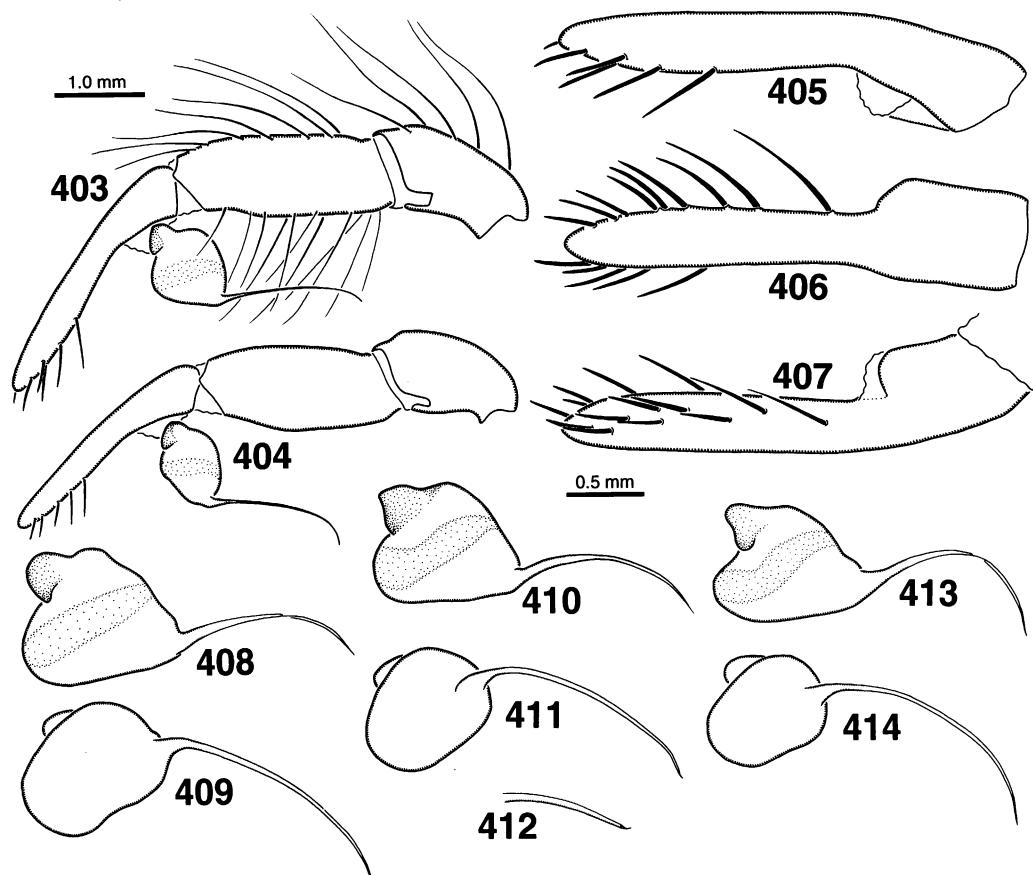


Figs. 391-402. *Thelechoris striatipes* males, leg I. 391. Tibia and metatarsus, retrolateral view, 9 km N Kilifi, Kenya, 1.0 mm scale. 392-402. Tibia I apophysis, retrolateral view, 0.2 mm scale; setae included only in figs. 392, 393. 392. Lectotype. 393. *Ischnothele mashonica* lectotype. 394, 395. Tsavo West National Park, Kenya. 396-398. Dar es Salaam, Tanzania. 399. 9 km N Kilifi, Kenya. 400. Katanga, Kisenge, Zaire. 401. 8 mi W Luanza, Zaire. 402. Katima Mulilo, Zaire.

*T. rutenbergi*, likewise emphasized their close similarity, but indicated that males of the two species could be separated by differences in abdominal coloration, labium shape, and maxillary setation. My analysis reveals that none of these previously cited characters distinguish the African *Thelechoris* samples from the Madagascar samples or the Nossi Bé sample (which includes the type of *E. striatipes* Simon).

Indeed, the only characters I have found that appear to distinguish any *Thelechoris*

population or group of populations from the rest are the male palpal tibia and leg I dimensions cited in the diagnosis of *T. rutenbergi* and which distinguish the three Madagascar males from all other *Thelechoris* males. The paucity and small size of these differences, the absence of genital or mating clasper differences, and the small sample size from Madagascar taken together suggest that the African populations may not be reproductively isolated from those on Madagascar. If the differences I have discovered disappear

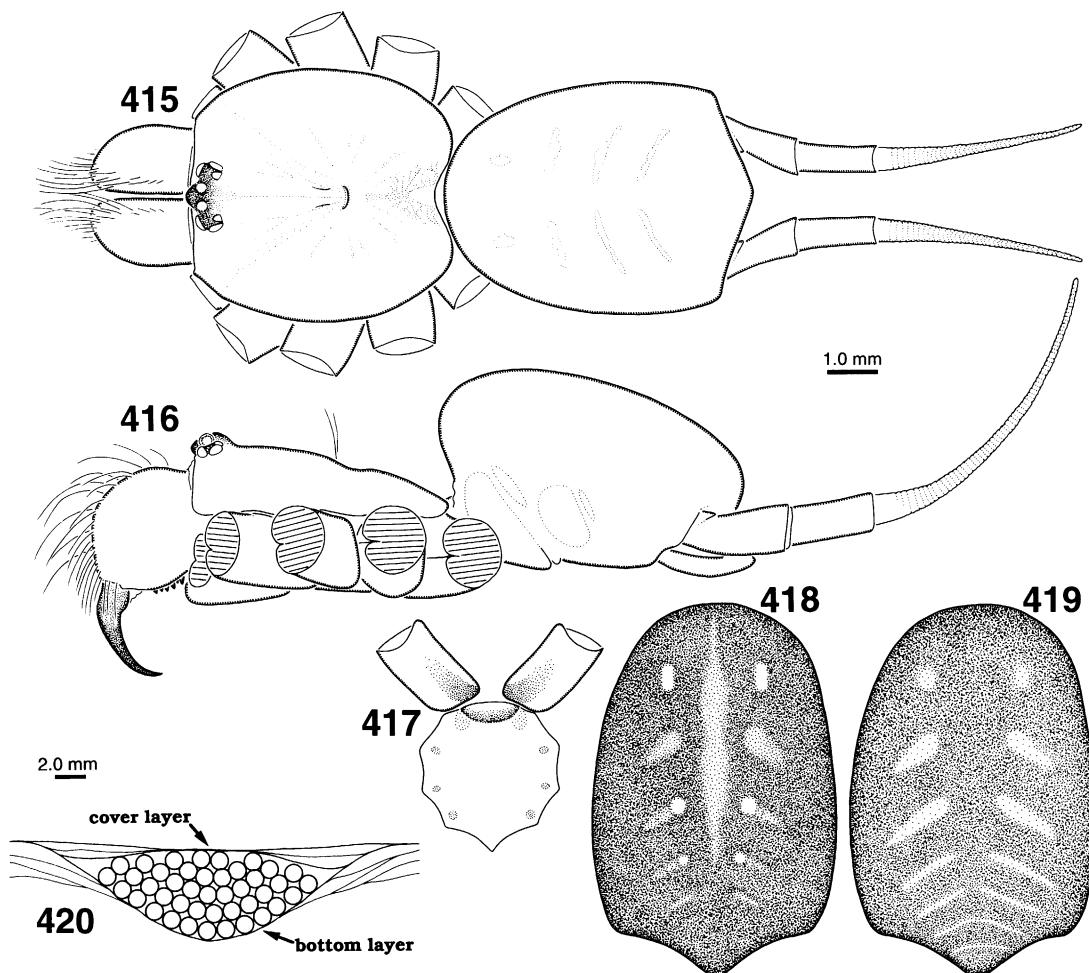


Figs. 403–414. *Thelechoris striatipes* males. 403, 404. Pedipalp, retrolateral view. 403. 9 km N Kilifi, Kenya. 404. Tsavo West National Park, Kenya; representative bristles not included. 405–407. Cymbium, 9 km N Kilifi. 405. Retrolateral view. 406. Dorsal view. 407. Prolateral view. 408–414. Palpal organ. 408, 409. 9 km N Kilifi. 408. Retrolateral-ventral view. 409. Ventral view. 410–412. Lectotype. 410. Retrolateral-ventral view. 411. Ventral view. 412. Embolus tip, magnified 2× fig. 411. 413, 414. Tsavo West National Park. 413. Retrolateral-ventral view. 414. Ventral view. Scale lines: 1.0 mm for figs. 403, 404; 0.5 mm for figs. 405–414 (except fig. 412).

with increased sample size or if cross-mating experiments with proper controls demonstrate the absence of reproductive isolation, then it will be necessary to synonymize *T. striatipes* with *T. rutenbergi*.

The surprising finding that the one male (the lectotype of *E. striatipes*) from Nossi Bé, which is geographically so close to Madagascar, resembles the African males in all characters studied, including those that are diagnostic for the Madagascar males, leads me to conclude—contrary to Simon (1891a), Lenz (1891), and Strand (1916)—that *T. karschi* is the junior synonym of *T. striatipes*.

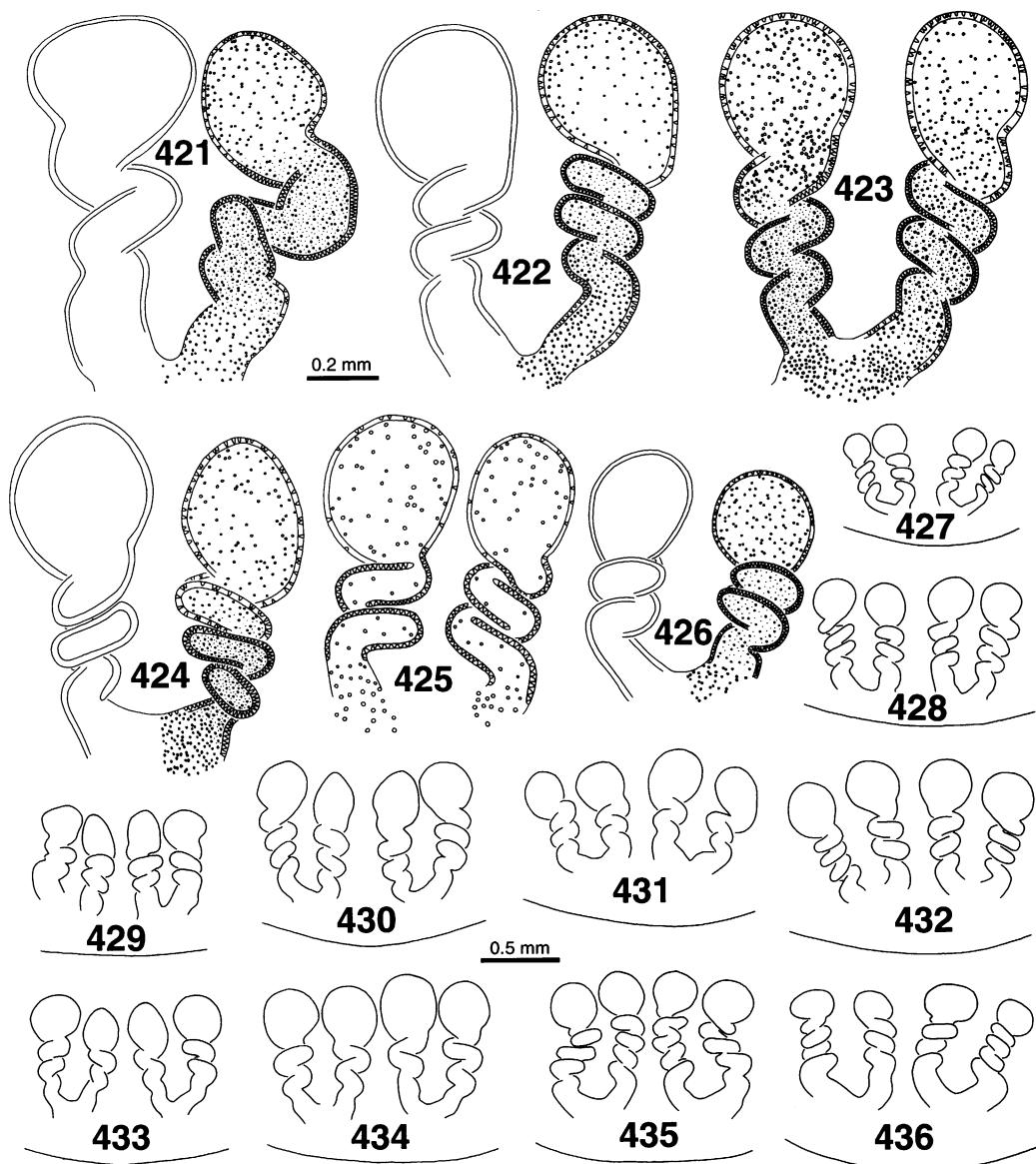
**VARIATION:** In all live material examined, whether from coastal or interior populations, the abdominal dorsum was medium to dark gray with two to four pairs of white spots, four or five faint white chevrons, and a weak median longitudinal white strip (figs. 388–390). These white markings are formed by clusters of short recumbent white hairs, not by pale areas in the body wall proper; if these pale body wall areas (spots or chevrons) are present, they are masked in life by hairs. On the other hand, specimens viewed under alcohol are lighter than when alive and the pigmentation of the abdominal body wall be-



Figs. 415-420. *Thelechoris striatipes*. 415-417. Female from Shimba Hills, Kenya. 415, 416. Whole body. 415. Dorsal view. 416. Lateral view. 417. Sternum, labium, and maxillae. Dots on maxillae represent cuspules. 418, 419. Abdominal dorsum. 418. Coloration of live male from 9 km N Kilifi, Kenya, drawn from color photo; all white markings are produced by clusters of white hairs. 419. Coloration of another male from 9 km N Kilifi after preservation; when viewed under alcohol, coloration is determined solely by distribution of pigment in body wall. 420. Longitudinal section through egg sac. Scale lines: 1.0 mm for figs. 415-419; 2.0 mm for fig. 420.

comes dominant over hair color. Preserved specimens from the coastal region of Kenya and Tanzania and from Nossi Bé differ in color from all other African specimens examined, including those from Tsavo West and Kibwezi, which are only 200-250 km inland from the coastal populations. Coastal specimens are generally lighter, the abdominal dorsum in particular is lighter and has dorsal pale chevron-like markings (fig. 419), and the abdominal venter between the pos-

terior book lungs is pale with only scattered dark spots. In all other preserved African adults the abdominal dorsum is dark gray and lacks the pale chevron markings, and the abdominal venter between the posterior book lungs is dark gray. It is interesting that the populations of coastal East Africa and Nossi Bé closely resemble *T. rutenbergi* in these color characteristics. What is even more remarkable is that, unlike the geographic color variation exhibited by preserved specimens,



Figs. 421–436. *Thelechoris striatipes* spermathecae. 421–426. Right spermathecae, 0.2 mm scale. 421, 422. Kaswabilinga R., Lufira, Zaire. 423. Konde Unuha, East Africa. 424. Kalemie (Albertville), Zaire. 425. *Thelechoris karschi* lectotype. 426. *Ischnothelina mashonica* paralectotype. 427–436. All spermathecae, 0.5 mm scale. 427. Dar es Salaam, Tanzania. 428. Katanga, Lubumbashi, Zaire. 429, 430. 9 km N Kilifi, Kenya. 431. Kisenge, Dililo, Zaire. 432. Neuhelgoland, near Liuli, Tanzania. 433. Shimba Hills, Kenya. 434. Near Likkubula R., base of Mt. Mulanje, Malawi. 435. *Ischnothelina cassetti* holotype. 436. Kitani Lodge, Tsavo West National Park, Kenya.

there are virtually no abdominal dorsum color or differences between live coastal spiders and live spiders from the interior of Africa. Living adults from Kilifi and other coastal sites were often salmon-red on the lateral carapace and

coxae; interior specimens (Kitani and Malawi) were not.

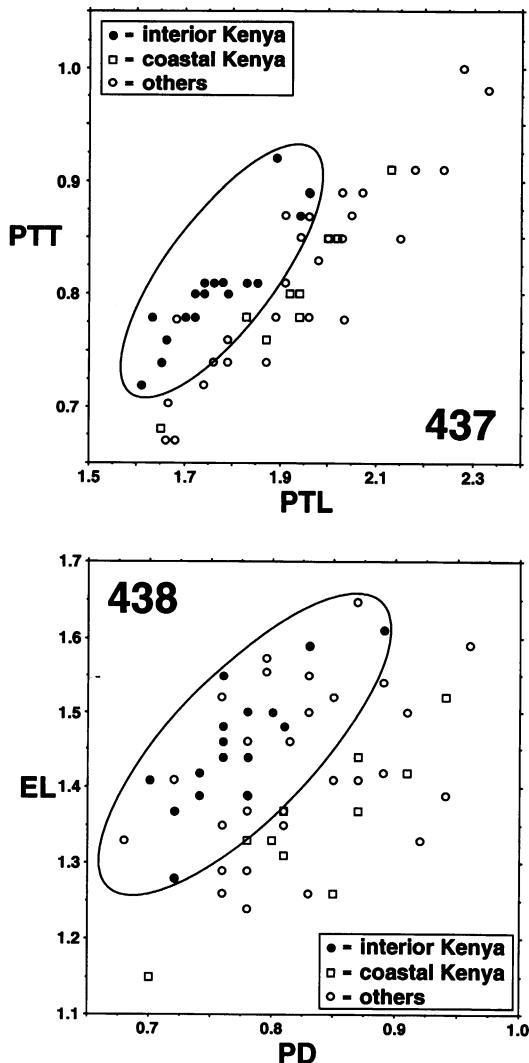
There is marked variation in some quantitative morphological characters, but no population sample is distinctively different.

The most variant populations are the two from the interior of Kenya (Kitani and Kibwezi), which have, on average, proportionally shorter and thicker male palpal tibiae (fig. 437) and proportionally longer emboli (fig. 438) than other populations. It is particularly interesting that all of the specimens ( $N = 10$ ) from the coastal region of Kenya—which are geographically close to these interior populations—have lower EL/PD values than the interior specimens ( $N = 18$ ) (figs. 437, 438). The shape of the male tibia I mating apophysis varies within and among populations such that no population is distinctive (figs. 391–402); a few specimens (figs. 397, 400, 401) exhibit some of the rough/wrinkled surface characteristic of the *T. rutenbergi* specimens examined (figs. 374–377). There is considerable but continuous variation in spermathecal form with no sample being distinctive (figs. 421–436); smaller, probably younger, specimens (fig. 429) tend to have fewer stalk spirals than do larger members (fig. 430) of the same population.

In summary, the analysis of variation does not support the hypothesis that there is more than one species of *Thelechoris* in Africa. Results of mating behavior studies (Coyle and O'Shields, 1990)—the absence of courtship behavior differences among populations from the coast and interior of Kenya and from Malawi, and the apparent success of mating attempts by Kenya coastal males with Kenya interior females and by Kenya interior males with Kenya coastal and Malawi females—are also consistent with the hypothesis that only one widespread species of *Thelechoris* occurs in Africa. The absence of geographic variation in the host-specific kleptoparasite *Kilifia inquilina* is also consistent with this hypothesis (Coyle and Meigs, 1992).

**DISTRIBUTION:** Southern Africa from Namibia and Angola east and north to Mozambique, Tanzania, and Kenya; also on Nossi Bé off the NW coast of Madagascar (map 4).

**MATERIAL EXAMINED: ANGOLA:** 26 mi S Chibemba, elev. 1170 m, Dec. 15, 1966 (E. Ross, K. Lorenzen; CAS), 1 ♀. **BOTSWANA:** Chobe Dist., Tsotsoroga Pan, 1930 (Fitzsimons, TM), juv.; Kgwebe Hills, N Maun, Mar. 30–31, 1976 (F. Wanless, A. Russell-Smith; MRAC 154.427, 154.435), juvs.; Maun, garden of government camp, Nov.



Figs. 437, 438. Scattergrams of male characters that vary geographically in *Thelechoris striatipes*. Measurements in mm. All data points from interior of Kenya included in ellipses. 437. PTT plotted against PTL. 438. EL plotted against PD.

10, 1975 (Wanless, Russell-Smith; MRAC 154.439), juv.; Maun, Maphaning, Pan, Apr. 3, 1976 (Wanless, Russell-Smith; MRAC 154.437), juv.; Maxwee, Mopane woodland, 1976 (Russell-Smith, MRAC 154.594), 1 ♂. **EAST AFRICA** (unable to find localities on maps): Konde Unuha (Fülleborn, ZMB 9455), 1 ♀; Kongoram, Aug. 1894 (Stuhlmann, ZMB 9456), juvs.; Mbusine, Aug. 27–29, 1888 (F. Stuhlmann, ZMH), 1 ♀, juvs. (*T. karschi* Bös-

enberg and Lenz syntypes); Langenburg (Fülleborn, ZMB 9450), many ♀, juvs. **KENYA:** Jimba, 3 km SE Gedi, elev. 100 m, second growth forest, Mar. 28, 1989 (Coyle, Bennett, AMNH), 3 ♂, 3 ♀, juvs.; Kibwezi, July–Oct. 1907 (Scheffler; ZMB 9445, 9446), 26 ♂, many ♀, juvs.; Kilifi, Mkwajuni Motel grounds, elev. 50 m, Mar. 27–28, 1989 (Coyle, Bennett, AMNH), 1 ♂, 2 ♀, juv.; 9 km N Kilifi on Kilifi Beach Rd., elev. 10 m, Mar. 27–29, 1989 (Coyle, Bennett; AMNH and NMK), 9 ♂, 6 ♀, juvs.; 30 mi NE Magadi, Jan. 3, 1960 (E. Ross, CAS), 1 ♀; Mariakani, Dec. 28, 1980 (V. Eagle, NMK), 1 ♂; Sabaki R., June 1979 (N. Scharff, ZMD), juv.; Shelly Beach Rd., few miles S Mombasa, old field with scattered trees, elev. 30 m, Apr. 1, 1989 (Coyle, Bennett; AMNH), 1 ♂, 1 ♀, juvs.; Shimba Hills Nat. Res., S Kwale, Hunter's Camp Site, elev. 1050 ft, forest patch in grassland, Mar. 31, 1989 (Coyle, Bennett; AMNH), 1 ♂, 1 ♀, juvs.; Public Camp Site, elev. 1100 ft, open forest and scrub, Mar. 31, 1989 (Coyle, Bennett; AMNH), 1 ♂, 2 ♀; 9 mi E Taveta, elev. 900 m, Oct. 30, 1957 (Ross, Leech, CAS), 1 ♀; Kitani Lodge, Tsavo West Nat. Park, 41 km S Mtito Andei, elev. 2500 ft, rock garden, April 15, 1989 (Coyle, Bennett; AMNH and NMK), 8 ♂, 23 ♀, juvs.; Wangi, N Lamu (Tiede, ZMB 9453), 1 ♂. **MADAGASCAR:** Nossi Bé (MNMH), 1 ♂ (*E. striatipes* Simon type), 1892 (ZMH), 1 ♀. **MALAWI:** Blantyre, yard and garden, elev. 1000 m, Apr. 22, 1989 (Coyle, Bennett; AMNH), 2 ♀; Cape Maclear, elev. 480 m, Apr. 22, 1989 (Coyle, Bennett; AMNH), juvs.; Chintheche, June 1978 (R. Joqué, MRAC 151.889), 1 ♂; Aug. 31, 1977 (R. Joqué, MRAC 153.287), juvs.; Chirimo, elev. 100 m, Feb. 26, 1958 (Ross, Leech; CAS), 1 ♀; near Likhubula R. at base of Mulanje Mtn., elev. 750–850 m, Apr. 18, 1989 (Coyle, Bennett; AMNH), 1 ♂, 4 ♀; Mkuwazi Hill Forest, 11 mi S Nkata Bay, elev. 590 m, Feb. 22, 1958 (Ross, Leech; CAS); 1 ♀; Mt. Mulanje, Mulanje, Likubula, elev. 900 m, Nov. 27, 1981 (R. Jocqué, MRAC 155.240), 1 ♂; Nkhata Bay, evergreen forest, 1978 (R. Joqué, MRAC 153.046), juv.; NW edge Zomba, elev. 1000–1200 m, Apr. 21, 1989 (Coyle, Bennett; AMNH), 1 ♀, juv.; 24–26 km N Zomba on route M1, elev. 750 m, earth road bank, Apr. 21–22, 1989 (Coyle, Bennett; AMNH), 1 ♂, 2 ♀, juv. **MOZAMBIQUE:**

(Tiesler, ZMB 9451), 1 ♀. **NAMIBIA:** Andara-Kavango, Okavango R., 1979 (M. Baddeley, MRAC 152.831), juv.; Katima Mulilo, woodland on bank of Zambezi R. near Nature Conservation Office, in small hollow tree, Oct. 20, 1987 (R. Jocqué, MRAC 168.678), 1 ♂; Ondangwa, elev. 1100 m, May 16, 1958 (Ross, Leech; CAS), 1 ♀; Tsumeb, June 13–19, 1911 (W. Michaelsen, ZMH), 1 ♀; 27 mi SE Tsumeb, elev. 1400 m, Dec. 19–20, 1966 (Ross, Lorenzen; CAS), 1 ♀. **TANZANIA:** Dar es Salaam (Stuhlmann; ZMB 9448, 9449), 3 ♂, many ♀, juvs.; Kipatimu, 1967 (Hofman, MRAC 133.307), juv.; Landsch. Irangi, Kondoa-Irangi, Jan. 1912 (E. Obst, ZMH), 1 ♂, 2 ♀; Mwanza, Kobamba, May 1927 (Bayet, MRAC 5034), juv.; 12 mi S Namanga, elev. 1425 m, Oct. 20, 1957 (Ross, Leech, CAS), 1 ♀; Neuhelgoland, near Liuli on shore of Lake Nyasa (Fülleborn, ZMB 9447), 6 ♂, many ♀; Sadani, July 1907 (Vosseler, ZMB 9452), 1 ♀; Zanzibar (Ruff, MNMH), 2 ♀. **ZAIRE:** Region Brgashi, Kilembe, July 1940 (Van Nuffelen, MRAC 27060), 1 ♀; Ht. Katanga, Gadotville, Kasampi, Oct. 1956 (M. Z. Baeq; MRAC 90550, 90293, 90241, 90243), 1 ♂, juvs.; Jadotstad, H. H., 1957 (A. DeDuker, MRAC 97106), 1 ♀; Kalemie (Albertville), 1960 (J. Verhaastrae, MRAC 116602), 4 ♀; Katanga, Kasapa, Nov. 21, 1973 (F. Malaisse, MRAC 145.534), 1 ♂, juvs., Nov. 1967 (G. Goffinet, MRAC 134.237), 1 ♂, juv.; Katanga, Katompe, June 1930 (Gerard, MRAC 5178), juvs.; Katanga, Kisenge, Dec. 1964 (A. Regnard, MRAC 127567), 2 ♂, 5 ♀, 1965 (A. Regnard, MRAC 129853), 2 ♂; Katanga, Lubumbashi (Elizabethville), June 1968 (G. Goffinet, MRAC 134.225), 2 ♀, Apr.–May 1966 (G. Godeaux, RMAC 131.513), 1 ♀, (Kirkvoorde; MRAC 27058, 27059), 2 ♀, Sept. 1961 (MRAC, 120489), 1 ♀, juv.; Katanga, Luiswishi, Oct. 9, 1974 (F. Malaisse, MRAC 146.219), 1 ♀, juv.; Kinda (L. Charliers, MRAC 12913), 1 ♂; Kisenge, Dilolo, Oct. 1963 (A. Regnard; MRAC 126094, 126032, 126027, 126026), 1 ♂, 5 ♀; Kivu, Mt. Kahuri, Feb. 1952 (H. Bomans, MRAC 85536), juv.; Kivu, Uvira, July 1961 (R. Kiss, MRAC 119907), 1 ♀, Oct. 19, 1961 (R. Kiss, MRAC 120352), 1 ♀, juv.; near Lubumbashi, Jan. 1962 (MRAC 121187, 121170, 121152, 120482), 1 ♂, 3 ♀; 8 mi W Luanza, elev. 1330 m, Jan. 15, 1958 (Ross, Leech; CAS), 1 ♂;

Mamima, Kasongo, Sept. 1959 (P. Benoit, MRAC 116604), 1 ♂; Parc National de L'Upemba, Gorges de la Pelenge, elev. 1250–1600 m, May 22, 1947 (M. DeWitte; MRAC 139.819, 139.820), 2 ♀; Kabenga, elev. 1240–1300 m, Apr. 6–9, 1949 (M. DeWitte, MRAC 139.825), 1 ♀, Kabwe, elev. 132 m, May 26–28, 1948 (M. DeWitte, MRAC 139.822), 1 ♀, juvs.; Kaswabilenga River, Lufira, elev. 680 m, Sept. 27–30, 1947 (M. DeWitte, MRAC 139.823), 2 ♂, 6 ♀, juvs.; Kilwezi, elev. 700–1000 m, Sept. 1–7, 1948 (M. DeWitte, MRAC 139.821), juv.; Lusinga, elev. 1810 m (M. DeWitte, MRAC 139.812), juv.; Mabwe R., E Lac Upemba, elev. 585 m, Aug. 14–24, 1947 (M. DeWitte; MRAC 139.815, 139.816, 139.817), juvs.; Munoi R., elev. 890 m, June 3–5, 1948 (M. DeWitte, MRAC 139.826), juvs.; 10 mi W Tshikapa, Aug. 9, 1957 (Ross, Leech, CAS), 1 ♀; 30 mi N Uvira, elev. 960 m, Aug. 22, 1957 (Ross, Leech, CAS), juv. **ZAMBIA:** Abercorn, elev. 1600 m, Feb. 16, 1958 (Ross, Leech; CAS), 1 ♀; Kalambo Falls, 33 km NW Mbala, elev. 1200 m, Jan. 18, 1958 (Ross, Leech; CAS), 1 ♀; Pemba, Aug. 1919 (Cassett, SAM B4666), 1 ♀ (*I. cassetti* Tucker type); Senga Hill, 40 mi S Abercorn, elev. 1580 m, Feb. 12, 1958 (Ross, Leech; CAS), 1 ♀. **ZIMBABWE:** Mazoe, 1899 (J. Darling, BMNH), 1 ♂, 6 ♀ (*I. mashonica* Pocock types).

**NATURAL HISTORY:** Benoit (1971) regarded *T. striatipes* as the most widely distributed diplurid in Africa. This wide geographic range is presumably the result, in part, of this species' ability to inhabit a wide variety of natural and disturbed habitats. It has been collected from sea level to 1800 m elevation and recorded in the following habitats: *Brachystegia* woodlands, disturbed semi-open forest, "islands" of low forest in savanna (fig. 440), low scrubby second-growth forest, old fields with scattered trees and shrubs (fig. 439), woody vegetation and earth banks along edges of cultivated fields, and residential areas with trees, shrubs, hedges, or rock gardens. The highest population densities observed were 50 adult and near-adult webs in an 18-m-long hedge at Kilifi, Kenya (fig. 441), and about 200 adult and near-adult webs in a 35-m<sup>2</sup> "rock garden" (fig. 9) at Kitani, Kenya. Searches for *T. striatipes* webs in dense mesic forests were unsuccessful. Benoit (1971) re-



439

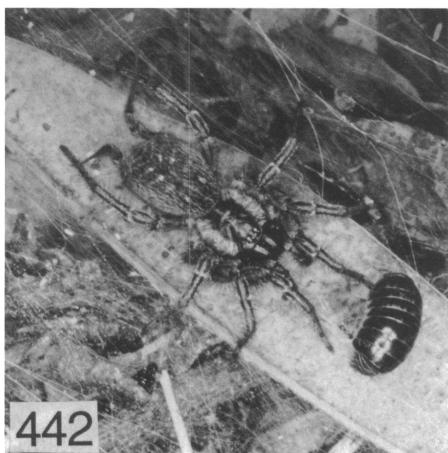


440

Figs. 439, 440. *Thelechoris striatipes* habitats.  
439. End of Kilifi Beach Rd., 9 km N Kilifi, Kenya.  
440. Forest "island" in savanna at Shimba Hills, Kenya.

marks that this species "avoids faithfully the forest regions of the Congo Basin." Webs were common in the following microhabitats: in crevices and limb junction crotches of trees and shrubs (from ground level to 4 m above ground), rock piles, and crevices and depressions in rock outcrops and earthen banks.

The web (figs. 5, 8, 9, 441, 442) typically consists of a tubular silk retreat (protected in a crevice, within a limb junction, or under or between rocks) opening out via one to three access tunnels to an exposed capture web, which is an irregular complex of interconnected horizontal and inclined sheets and funnels fanning out and supported by surrounding substrates. Adult capture webs generally cover 500–1500 cm<sup>2</sup> when viewed from above. Occasionally, peripheral portions of the capture webs of two or three individuals are interconnected. Silk lines often extend from capture sheets vertically upwards as



Figs. 441, 442. *Thelechoris striatipes*. 441. Web in shrubbery at Kilifi, Kenya, showing vertical lines above capture web. 442. Female approaching prey at Kitani Lodge, Tsavo West National Park, Kenya.

much as 60 cm to branches, leaves, or other substrates (figs. 8, 441). Perhaps these vertical strands also help support the capture web and/or knock down flying insects. Capture webs are capable of at least temporarily entangling ants and other arthropods in the manner of similarly constructed *Ischnothel*

webs (Coyle and Ketner, 1989). Often much organic debris, especially leaves and pieces of leaves, is found in these webs, particularly in and near the retreat. These large, apparently long-lived webs often support numerous spider, insect, and other arthropod co-habitants, which function as kleptoparasites, commensals, and/or spiderling predators (Forster and Murphy, 1986; Baert and Murphy, 1987; Coyle and Meigs, 1992).

Prey capture by *T. striatipes* (fig. 442) is similar to that of *Ischnothel* species and involves the same advance-pause-advance approach (Coyle and Ketner, 1990). During most daylight hours, the spider remains within its retreat and is very reluctant to emerge onto the capture web in response to struggling prey or vibrations simulating such prey. At night the spider is often outside the retreat mouth in an access passageway and can readily be lured onto the capture web by vibrations. At least some spiders are not reluctant to approach prey during the early daylight hours. Some individuals captured isopods and grasshoppers that were dropped into their webs. Remains of the following prey were found in retreats of the Kenyan spiders: ants, beetles, millipedes, hemipterans, spiders, isopods, cicadas (30-mm wing length), winged termites, wasps, flies, grasshoppers, and snails. The first three taxa were especially abundant; ants and beetles ranged widely in diversity and size, from tiny to large (beetle elytra of 10–15 mm were rather common).

See Coyle and O'Shields (1990) for a description and discussion of courtship and mating behavior in *T. striatipes*. Male maturation and behavior may be regulated so that mating occurs during rainy seasons. This is suggested by the presence of adult males in their own webs at Kilifi and other coastal areas just before the onset of the late March–May rainy season, the presence of adult males primarily in female webs at Kitani during this rainy season, and the absence of adult males in the Malawi populations after the November–April rainy season of that region. The collection of many males from Kibwezi, Kenya, by Scheffler sometime between July and October 1907 does not appear to support this hypothesis, although a short rainy season does occur in that area in October and/or November.

Egg sacs are constructed in the wall of the female's retreat (fig. 420) and are somewhat elongate and hammock-shaped (14–25 mm long, 9–16 mm wide, 7–15 mm thick: N = 6). The one observation of construction behavior revealed that the bottom (hammock-like) sheet of the sac is spun first, the eggs are deposited in a mass in its center, and then the cover layer of silk (which becomes part of the retreat lining) is spun over the eggs and attached peripherally to the bottom sheet. The female appears to spend most of her time in the retreat positioned over the surface of the egg sac as if monitoring/protecting the sac. Of nine egg sacs collected from the coastal region of Kenya (March 28–April 1), two contained eggs only, one contained hatching eggs, four contained second postembryonic stage spiderlings, and two contained only the exuviae of emerged spiderlings. Of six egg sacs collected from Kitani, Kenya (April 15), one contained only eggs, two contained second postembryonic stage spiderlings, two contained only the exuviae of emerged spiderlings, and one contained a mantispid pupa within its yellow cocoon, remnants of consumed eggs and spiderlings, and a few uninjured third postembryonic stage spiderlings. I am aware of only one other report of a mantispid associated with a mygalomorph spider, the Japanese ctenizid, *Latouchia typica* (Kishida) (Kishida, 1929; Bristowe, 1932; K. Hoffman, personal commun.). One egg sac was collected in Malawi (April 18); it contained hatching eggs. Thirteen spiders oviposited in captivity between April 9 and August 20, 1989; three of these consumed their eggs within 4 days of oviposition (Willey and Coyle, 1992).

Careful examination of these broods confirms the postembryonic developmental pattern described for *T. striatipes* by Holm (1954), one that is essentially the same as that described by Galiano (1972) for *Ischnothele*, by Yoshikura (1955, 1958) for *Heptathela* and *Atypus*, and by Coyle (1971) for antro-

diaetids. The cuticle of the first postembryonic stage (Holm, 1954: figs. 4a, 4b) splits soon after the spiderling emerges from the chorion and is shed attached to the chorion. The second postembryonic stage spiderlings (also called the "first free postembryonic stage" by Holm) are initially unpigmented, have only rudimentary fangs, eyes, tarsal claws, and spigots (Galiano, 1972: figs. 3–10), and move their appendages only slowly when disturbed. The third postembryonic stage spiderlings are well pigmented (seven or eight chevrons on abdominal dorsum), have all the aforementioned structures well developed, are active, and emerge from the egg sac. Development in the egg sac appears to be remarkably rapid; in captivity at 72–75°F, oviposition to hatching took less than 11 days (N = 2) and oviposition to emergence of the third postembryonic stage spiderlings from the sac took 14 days for one brood and 17 for another. It is not known how long spiderlings remain in the maternal web after emerging from the egg sac, but several webs at Kitani contained many postemergent spiderlings, and in a few adult webs (not at Kitani) one to a few small postspiderling juveniles were present (one of these webs also contained an egg sac with spiderlings).

In nature, brood size ranged from 56 to 277 (mean =  $168 \pm 58$ , N = 10); the coastal Kenya broods tended to be smaller (56–235,  $152 \pm 52$ , N = 7) than those from Kitani (143–277,  $205 \pm 55$ , N = 3). Broods oviposited in captivity tended to be smaller (44–134,  $87 \pm 27$ , N = 12). Two spiders from Kitani oviposited twice in captivity; in one case only 17 days elapsed between oviposition, in the other 75 days elapsed. Egg size was recorded for 10 eggs in each of five broods: the eggs of two broods of 134 and 235 eggs produced in nature by coastal Kenya populations ranged from 0.98 to 1.26 mm in diameter; those of three smaller broods (52, 80, 117) produced in captivity by Kitani spiders ranged from 1.22 to 1.46 mm in diameter.

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