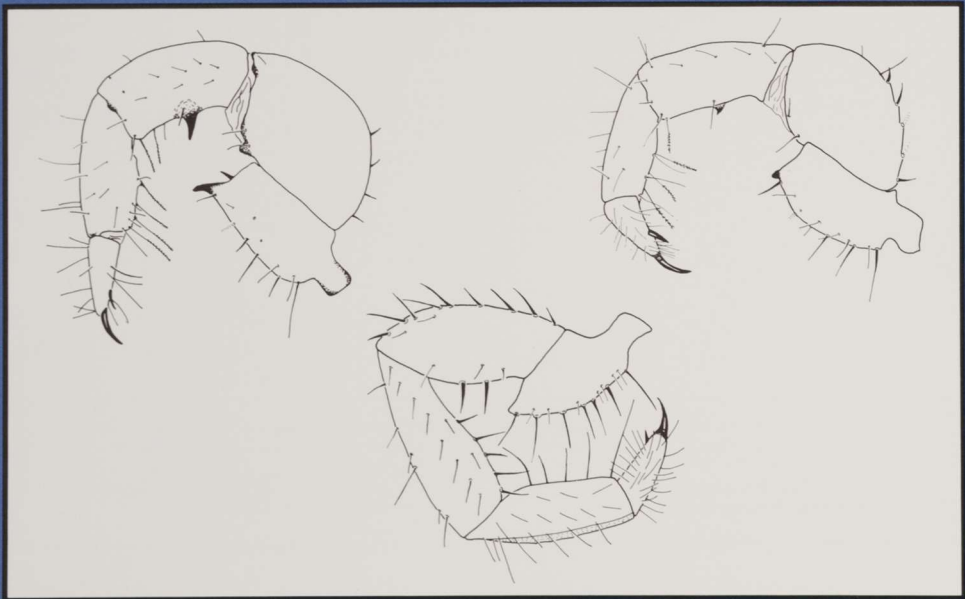


PEARCE-SELLARDS
SERIES
NUMBER 47

Redescription of
SCHIZOMUS CRASSICAUDATUS (PICKARD-CAMBRIDGE)
and diagnoses of
HUBBARDIA COOK, *STENOCHRUS CHAMBERLIN*, and
SOTANOSTENOCHRUS New genus,
with description of a new species of
HUBBARDIA from California
(ARACHNIDA: SCHIZOMIDA: HUBBARDIIDAE)

JAMES R. REDDELL
AND
JAMES C. COKENDOLPHER



FEBRUARY 13, 1991
TEXAS MEMORIAL MUSEUM, UNIVERSITY OF TEXAS AT AUSTIN

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with description of a new species of *Hubbardia* from California
(Arachnida: Schizomida: Hubbardiidae)

James R. Reddell
Texas Memorial Museum
University of Texas at Austin
2400 Trinity
Austin, Texas 78705, U.S.A.

James C. Cokendolpher
2007 29th St.
Lubbock, Texas 79411, U.S.A.

The Pearce-Sellards Series is an occasional, miscellaneous series of brief reports of Museum and Museum associated field investigations and other research. All manuscripts are subjected to extramural peer review before being accepted. The series title commemorates the first two directors of the Texas Memorial Museum: Dr. J. E. Pearce, Professor of Anthropology, The University of Texas at Austin, and Dr. E. H. Sellards, Professor of Geology, The University of Texas at Austin. Both professors are now deceased.

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ABSTRACT

Schizomus crassicaudatus (Pickard-Cambridge) from Sri Lanka is redescribed from the type series, and lectotypes of *Nyctalops crassicaudata* and *N. tenuicaudata* are designated. *Hubbardia* Cook, previously considered a synonym of *Schizomus* Cook, is considered valid and rediagnosed to include species from California and Arizona (U.S.A.). The family Hubbardiidae Cook has priority and therefore is used rather than Schizomidae Hansen and Sørensen. Likewise, Hubbardiinae Cook is substituted for Schizominae Hansen and Sørensen. Additional descriptive notes and records are provided and a lectotype is designated for *Hubbardia pentapeltis* Cook. *Hubbardia idria* new species is described from San Benito County, California. Additional records are included for *H. briggsi* (Rowland). A key for identification of males of *Hubbardia* is presented. The native (introduced elsewhere) North and Central American genus *Stenochrus* Chamberlin is rediagnosed for most species of the *Schizomus mexicanus*, *pecki*, and *goodnighorum* groups. *Sotanos-tenochrus*, new genus, is described for *Schizomus mitchelli* Rowland and *Schizomus cookei* Rowland and is known only from caves in San Luis Potosí and Tamaulipas, Mexico.

ACKNOWLEDGMENTS

We thank the following curators for loans of specimens: Dr. Jonathan Coddington, United States National Museum; Dr. Henrik Enghoff, Zoologisk Museum, Copenhagen; and Mr. I. Lansbury, Hope Entomological Collections, University of Oxford. We particularly thank Mr. Saul I. Frommer, University of California at Riverside, for making available specimens of *Hubbardia idria*, new species, and other material of interest.

ACRONYMS

CAS	California Academy of Sciences, San Francisco
TMM	Texas Memorial Museum, The University of Texas at Austin, Austin
UCR	University of California at Riverside, Riverside
UOHEC	University of Oxford, Hope Entomological Collection, Oxford
USNM	United States National Museum, Washington, D.C.
ZMC	Zoologisk Museum, Copenhagen
ZSI	Zoological Survey of India, Calcutta

INTRODUCTION

Study of the systematics of the order Schizomida has been hampered by the absence of adequate descriptions of the type-species of the two nominate genera *Trithyreus* and *Schizomus* and by a lack of knowledge of the internal genitalia of the female. Reddell and Cokendolpher (1985) redescribed *Trithyreus grassii* (Thorell) from the unique type specimen. *Trithyreus* as presently understood is monotypic, although it is possible that *S. claviger* Hansen and Sörensen belongs in *Trithyreus*. The rediscovery of the type-series of *Schizomus crassicaudatus* (Pickard-Cambridge) now allows us to provide a complete description of the type-species of *Schizomus*.

The convoluted nomenclatorial history of the Schizomida has been discussed in detail by Reddell and Cokendolpher (1985). *Schizomus* was originally separated from *Trithyreus* by the nature of the metapeltidium (entire in *Schizomus*, split in *Trithyreus*). As Hansen and Sörensen (1905) first pointed out, this character varies among closely related species, and it has since been discovered that both character states may occur in the same population of a single species. *Hubbardia* was erected by Cook (1899) because of the presence of the mesopeltidial plates in his material, not realizing that this is a character shared by all species in the order. Chamberlin (1922) erected the genus *Stenochrus* for a species characterized by the absence of these plates. This error in observation was corrected by Rowland (1973b) and *Stenochrus* was moved to the synonymy of *Schizomus*. The recognition of the unimportance of the metapeltidial plates for phylogenetic analysis led Hansen and Sörensen (1905) to place all schizomids in the genus *Schizomus*, although they provisionally retained *Trithyreus* as a subgenus. The genus *Trithyreus* was abandoned by Mello-Leitão (1931), a move followed by Lawrence (1969b). Rowland (1973b) first pointed out that *Trithyreus* was the earliest available name and removed all of the African Schizomidae to that genus, but deferred a final decision on the generic status of non-African species. Final synonymy of *Schizomus* with *Trithyreus* was made by Rowland and Reddell (1979a). All of these decisions were made in the absence of an adequate understanding of the type-species of either *Trithyreus* or *Schizomus* or knowledge of the nature of the internal female genitalia of either type-species.

It is apparent from study of *S. crassicaudatus* that *Schizomus* is a heterogeneous assemblage of species which must eventually be divided into more phylogenetically and zoogeographically natural units. The only revision of Old World species is that of Lawrence (1969b) for the African fauna. Unfortunately this study provides no illustrations of the internal female genitalia which provide characters we believe to be of fundamental importance in delineating generic relationships. The internal female genitalia have been described and illustrated for but relatively few Old World species referred to the genus *Schizomus*: one species each from Australia (Harvey, 1988); Java (Cokendolpher and Sites, 1988); Sumatra (Sissom, 1980; Cokendolpher et al., 1988); Thailand, Hong Kong, Japan, and Hawaii (Cokendolpher and Reddell, 1986); India (Cokendolpher et al., 1988); Liberia (Cokendolpher and Reddell, 1987); a species introduced to England (Cokendolpher et al., 1988); and four species from Japan and Taiwan (Cokendolpher, 1988). The female genitalia in these species present several drastically different morphological types and almost certainly some taxa will require new generic names.

Rowland and Reddell (1979a, 1979b, 1980, 1981) have revised the New World fauna, and it is apparent from the present study that *Schizomus* does not occur in the New World (the generic names *Stenochrus* Chamberlin, 1922, and *Heteroschizomus* Rowland, 1973a, are available). Final disposition of much of this large fauna must await a cladistic analysis of the numerous species involved. Three groups, however, are sufficiently distinct to warrant generic recognition.

One of these, *Hubbardia* Cook, 1899, consists of a complex of species, known only from Arizona and California in the southwestern United States, and appears to have its closest relationships with the Old World fauna, as Rowland (1975a) in an unpublished dissertation already has suggested. We are therefore providing a new diagnosis of *Hubbardia*, together with supplementary descriptive notes on the type-species *H. pentapeltis* Cook, new records for *H. pentapeltis* and *H. briggsi* (Rowland), and description of a new species, *H. idria* from San Benito County, California. The new species is the first to be reported from San Benito County and, with the exception of some populations of *H. briggsi*, is the most northern species of Schizomida in the New World. The description of *H. idria* brings to nine the number of species of *Hubbardia*, eight of which occur in California.

The discovery that *Schizomus* and *Trithyreus* do not occur in the New World also requires resurrection of the genus *Stenochrus* (type-species *Stenochrus portoricensis* Chamberlin) for most of those species placed by Rowland and Reddell (1979a) in the *mexicanus*, *pecki*, and *goodnightorum* groups. Finally, two species (*S. cookei* Rowland and *S. mitchelli* Rowland) are sufficiently distinct to warrant generic recognition (new genus described herein). It also appears that new generic names may be required for the extensive Antillean and South American fauna currently placed in the *dumitrescoae*, *simonis*, and *brasiliensis* groups. The recent descriptions of several enigmatic species in the Antilles and the discovery of large numbers of undescribed species throughout this region lead us to suggest that a final decision on the taxonomic status of this fauna must await further study.

The discovery of the validity of *Hubbardia* necessitates the resurrection of the family name Hubbardiidae Cook, 1899, for the species presently placed in Schizomidae Hansen and Sørensen, 1905.

The methods and terminology essentially follow those of Reddell and Cokendolpher (1985), except for some anatomical terms which follow Cokendolpher (1988). We have not followed Hammen's (1986) nomenclatorial scheme as closely as has Cokendolpher (1988) because doubt concerning the validity of some terms exists (see Shear et al., 1987:13-14). The female genital sternites were examined in lactophenol. The numbering of the cheliceral setae follows that of Lawrence (1969). The propeltidium was measured from the posteriormost seta on the anterior process to the posterior margin of the propeltidium. Leg and pedipalp segments were measured from dorsolateral joint to dorsolateral joint.

SYSTEMATICS

Hubbardiidae Cook

Tartarides Pickard-Cambridge, 1872:410.

Tartaridae: Simon, 1872:486.

Nyctalopoidae Thorell, 1883:35. NEW SYNONYMY.

Schizonotoidea Thorell, 1888:358.

Schizonotidae: Pocock, 1893:8, 9.

Hubbardiidae Cook, 1899:249-250.

Schizomoidae Hansen and Sørensen, 1905: 4.

Schizomidae: Jackson, 1908:74.

Schizopeltidae Millot, 1949:849.

Type-genera: Of Tartaridae and Nyctalopoidae: *Nyctalops* Pickard-Cambridge, 1872; of Schizonotidae: *Schizonotus* Thorell, 1888; of Hubbardiidae: *Schizomus* Cook, 1899; of Schizomidae: *Schizomus* Cook, 1899.

Discussion: Hubbardiidae is the earliest available family name for the order Schizomida. Tartarides (=Tartaridae) was based on no generic name; Nyctalopoidae, based on *Nyctalops*, and Schizonotidae, based on *Schizonotus*, are junior homonyms.

Hubbardiinae Cook

Hubbardiinae Cook, 1899:249-250 [nom. transl. herein (ex Hubbardiidae Cook, 1899)]

Schizominae Hansen and Sørensen, 1905:4 [nom. transl. Rowland, 1973b (ex Schizomidae Hansen and Sørensen, 1905)].

Type-genus: *Schizomus* Cook, 1899.

Included genera: *Trithyreus* Kraepelin, 1899; *Schizomus* Cook, 1899; *Hubbardia* Cook, 1899; *Stenochrus* Chamberlin, 1922; *Sotanostenochrus*, new genus.

Schizomus Cook

Nyctalops Pickard-Cambridge, 1872:410-411 [jun. hom.].

Schizonotus Thorell, 1888:358 [jun. hom.; nom. subst. pro *Nyctalops* (non *Nyctalops* Wagler, 1832)].

Schizomus Cook, 1899:249, 250, 253-256 [nom. subst. pro *Schizonotus* (non *Schizonotus* Ratzeburg, 1852)].

Type-species: Of *Nyctalops*: *Nyctalops crassicaudata* Pickard-Cambridge, 1872 [by subsequent designation (Cook, 1899)]; of *Schizonotus*: *Nyctalops crassicaudata* Pickard-Cambridge, 1872; of *Schizomus*: *Nyctalops crassicaudata* Pickard-Cambridge, 1872.

Diagnosis: Propeltidium with three apical setae (one pair on anterior process and one seta at base of process); eyespots absent; abdomen not attenuated, male without posterodorsal process on segment XII; pedipalps with spur on trochanter; anterior edge of trochanter produced to sharp spur in males; female flagellum with three articles; spermathecae of one pair of short lobes bearing distinct lateral branches; gonopod distinctly lengthened posteriorly; anterodorsal margin of femur IV produced at about a 90° angle.

Comments: Rowland (1973b) placed *Stenochrus* Chamberlin, 1922, in the synonymy of *Schizomus*. *Artacarus* Cook, in Kraepelin, 1897, was placed in the synonymy of *Schizomus* by Kraus (1960). *Heteroschizomus* Rowland, 1973a, was synonymized with *Schizomus* by Rowland and Reddell (1977). Based on studies in progress, *Stenochrus* is a valid taxon for many New World species, and *Heteroschizomus* is a junior synonym of *Stenochrus*. The spermathecal morphology of *Artacarus* differs sufficiently from that of *Schizomus* to indicate that it is probably also a valid taxon. It is felt to be unwise, however, to resurrect *Artacarus* at this time. Without cladistic studies of the world fauna and a better understanding of the Old World fauna any attempt at delineating the generic limits is premature. The above restricted diagnosis of *Schizomus* will certainly require modification when more Old World material is studied.

Schizomus crassicaudatus (Pickard-Cambridge)

- Nyctalops crassicaudata* Pickard-Cambridge, 1872:411-413, pl. 22 (fig. 1); Pickard-Cambridge, 1875:298; Hansen and Sørensen, 1905:2; Rowland, 1973b:195, 200; Rowland, 1975a:22-23, 29-30; Rowland and Reddell, 1977:83.
- Nyctalops tenuicaudata* Pickard-Cambridge, 1872:412-413, pl. 22 (fig. 2); Simon, 1872:487-488; Pickard-Cambridge, 1875:298; Hansen and Sørensen, 1905:2-3; Rowland, 1973b:195; Rowland, 1975a:22-23.
- Nyctalops crassicaudatus*: Simon, 1872:487-488; Savory, 1935:63, 65, figs. 23, 27-28; Savory, 1964:154-155, figs. 70, 72, 291; Savory, 1977:139, 339, figs. 42-43; Rowland, 1975a:29; Reddell and Cokendolpher, 1985:43.
- Nyctalops crassicaudatus*: Savory, 1977:140, fig. 44 (lapsus calami).
- Schizonotus crassicaudatus*: Thorell, 1888:358 (by implication); Hansen and Sørensen, 1897:231; Kraepelin, 1897:52, 57, 59-60, pl. 1 (figs. 1b, 2b), pl. 2 (figs. 56a, 57); Kraepelin, 1899:233-234, fig. 83; Börner, 1904:4, 20; Arldt, 1908:437; Kästner, 1932:65.
- Schizonoto* (*Nyctalopi*) *tenuicaudato*: Thorell, 1889:559.
- Schizonotus* (*Nyctalops*) *tenuicauda*: Simon, 1895:92.
- Schizonotus tenuicaudatus*: Kraepelin, 1897:52, 58, 60, pl. II (fig. 56b, 58a) (part—*Artacarus liberiensis* Cook); Kraepelin, 1899:233-234, fig. 84 (part—*Artacarus liberiensis*); Arldt, 1908:437, 441, 443.
- Schizomus crassicaudatus*: Cook, 1899:249; Pocock, 1900:118-122, figs. 37 (A-C), 38 (A-E); Lankester, 1904:243-244, figs. 57-59; Hansen and Sørensen, 1905:5, 15, 25-26, 33, 38-42, 73, pl. 3 (fig. 1a-i); Gravely, 1910:45-47, fig. C (part—*S. peradeniyensis*); Lankester, 1910:305-306, figs. 57-59; Gravely, 1915a:383-385; Buxton, 1917:7; Mello-Leitão, 1931:16-17, 66; Berland, 1932:74-75, fig. 105; Kästner, 1932:65, fig. 89; Giltay, 1935:6; Savory, 1935:67; Werner, 1935:398-399, 452, 457-458, 469, figs. 88, 156; Takashima, 1941:93; Silvestri, 1947:29; Takashima, 1947:45; Takashima,

1948:100; Cloudsley-Thompson, 1949:261; Millot, 1949:557-558, fig. 316; Petrunkevitch, 1949:pl. 1 (fig. 304); Petrunkevitch, 1955:P122-P123, fig. 86(1); Cloudsley-Thompson, 1958:122-124, 214, fig. 28; Yoshikura, 1958:3; Modder, 1960:173-189, pls. I-V; Rémy, 1961a:408, 414; Rémy, 1961b:506-507; Vachon, 1963:199, fig. 54; Cloudsley-Thompson, 1968:152-154, fig. 28; Rowland, 1973b:200; Sturm, 1973:114-115, 137; Brignoli, 1974a:149, 151; Brignoli, 1974b:734; Rowland, 1975a:31; Brach, 1976:99; Reddell and Cokendolpher, 1984:5.

Schizomus tenuicaudatus: Hansen and Sørensen, 1905:5, 7; Werner, 1935:321, fig. 3; Takashima, 1941:93; Kraus, 1960:103.

Schizomus (s.str.) *crassicaudatus*: Gravely, 1911:136-137, 139, fig. 2(A) (part—*S. peradeniyensis*); Gravely, 1915b:523-526, pl. 24 (fig. 27).

Schizomus (*Nyctalops*) *crassicaudatus*: Lawrence, 1969b:230.

Type-data: *Nyctalops crassicaudatus*: Royal Botanic Gardens, Peradeniya, Kandy District, SRI LANKA (1871, M. Ferdinandus), male lectotype, herein designated (UOHEC); 2 male paralectotypes (UOHEC); 1 male paralectotype (ZMC); of *Nyctalops tenuicaudata*: Royal Botanic Gardens, Peradeniya, Central Province, SRI LANKA (1871, M. Ferdinandus), female lectotype, herein designated (UOHEC), 12 female paralectotypes (UOHEC), 1 female paralectotype (ZMC).

Description: Male lectotype: Length from distal margin of propeltidium to base of flagellum, 3.18 mm. Propeltidium, chelicerae, and pedipalps orangish brown; abdomen and legs somewhat lighter.

Cephalothorax: Propeltidium (Fig. 1) 1.10 mm long, 0.76 mm wide; with one pair of setae on anterior process and one setae centered behind pair; with one pair setae about 1/3 from distal margin and one pair about 1/5 from posterior margin. Eyespots absent. Gap between mesopeltidial plates about 1.2 times anterior length of one plate. Metapeltidium undivided. Anterior sternum with 10 setae, plus two sternapophysial setae. Posterior sternum unsclerotized, with four setae; two setae at posterior edge or immediately behind sternum.

Abdomen: Tergites I-VII with one pair dorsal setae each; tergite VIII with one pair dorsal and one pair small lateral seta; tergite IX less than 1/2 length of tergite VIII, with one pair dorsolateral and one pair lateral setae. Genital sternite as in Fig. 2. Sternites V-VIII with one slightly irregular row of setae near posterior margin and one irregular row near middle of sternite; sternite IX with one row of setae. Sternite VI about 3.9 times as wide as long; width/length ratio versus body length, 0.8. Segments X-XI telescoped; posterodorsal process on segment XII absent. Flagellum (Figs. 3-5) 0.4 mm long, 0.2 mm wide; with distinct stalk, spade-shaped; with six dorsal, two lateral, and 12 ventral setae.

Chelicerae (Figs. 6-8): Fixed jaw with four rounded teeth between two large outer teeth; movable finger with three rounded teeth laterally and serrula with 16 teeth, the distalmost the largest. Seta: 1 = 3; 2 = ?; 3 = 4; 4 = 3; 5 = 10; 6 = 1, plus four dorsad setae above group 4.

Pedipalps (Figs. 9-10): Lateral setation as in Fig. 9. Trochanter produced to sharp curved anteroventral spur and smaller mesal spur dorsad to large spur; with two setae on mesal surface. Femur with rounded anteroventral knob; with four scattered setae on mesal surface and two spinose setae near ventromesal margin. Patella with prominent sharp

ventrolateral spur near middle of segment; with long spinose seta on ventromesal margin and two long plumose setae on ventromesal margin at distal end. Tibia with scattered setae on dorsal and mesal surface and four long plumose setae on ventromesal margin. Basitarsus-tarsus with several long plumose setae on ventromesal margin and ventral surface; spur about 0.18, claw about 0.5 times dorsal length of basitarsus-tarsus.

Legs: Segment lengths in Table I. Leg I, including coxa, 5.08 mm long; basitarsus-tarsus proportions (Fig. 11): 13:2:3:3:4:4:10. Femur IV (Fig. 12) about 2.2 times longer than deep.

Female lectotype: Length from distal edge of propeltidium to base of flagellum, 3.30 mm. Propeltidium 1.14 mm long, 9.72 mm wide. As in male except as follows: Anterior sternum with eight setae plus two sternapophysial setae; posterior sternum with four setae. Sternite VI 4.4 times as wide as long; width/length ratio versus body length, 0.75. Flagellum (Fig. 13) 0.38 mm long, with two faint annuli. Genital sternite as in Fig. 14. Spermathecae (Figs. 15-16) with two pairs of lobes; with small lateral extension from near base of lobe. Pedipalps (Figs. 17-18): Trochanter with distal spur straight and very short. Patella with ventrolateral spur greatly reduced. Basitarsal-tarsal spur about 0.29, claw about 1.8 dorsal length of basitarsus-tarsus. Leg measurements in Table II. Leg I, including coxa, 4.80 mm long. Femur IV about 2.2 times as wide as deep.

Variation: Some specimens have the posterior pair of propeltidial setae missing. Slight variation also occurs in the degree of reduction of the spurs on the pedipalpal trochanter and patella in the female.

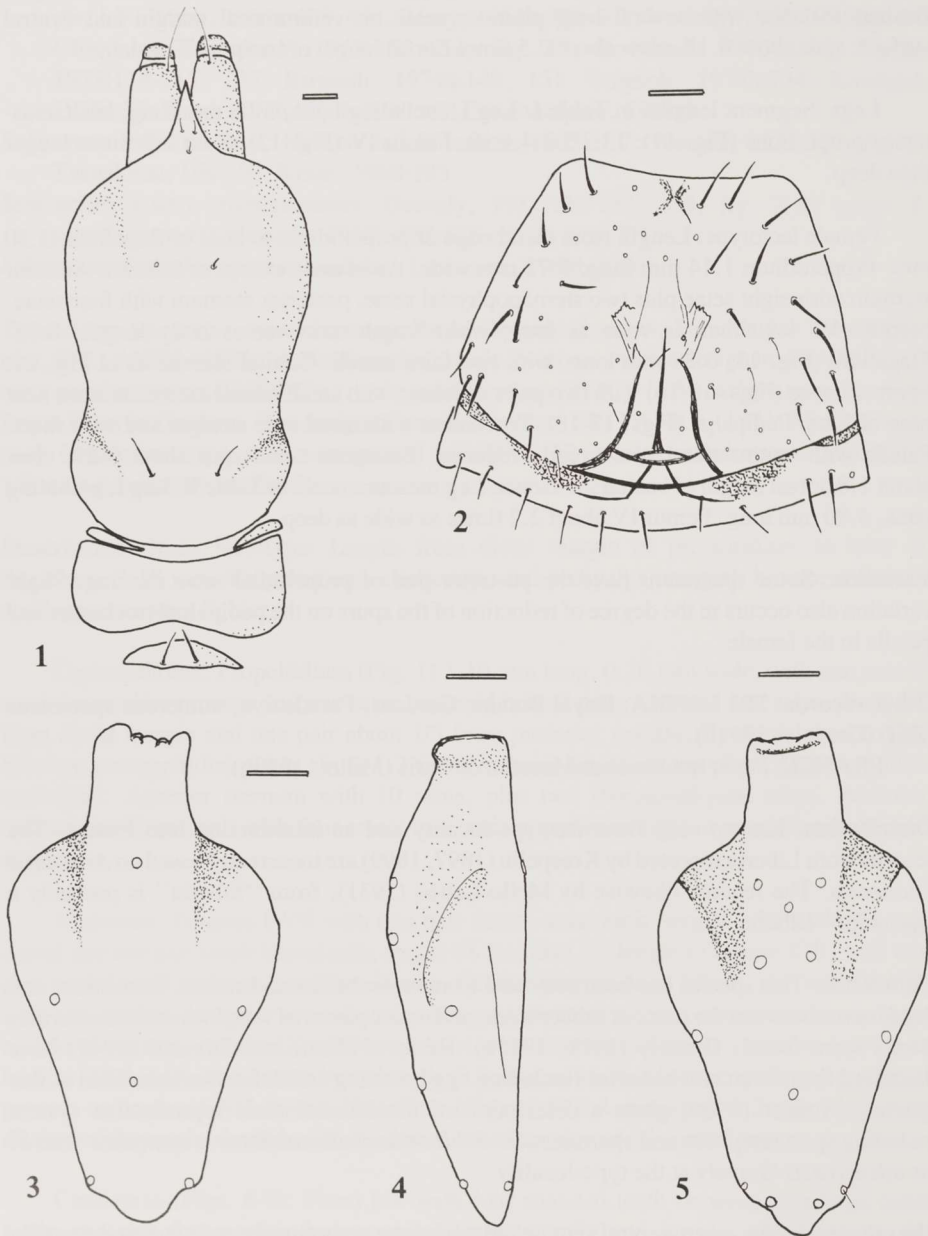
Other records: SRI LANKA: Royal Botanic Gardens, Peradeniya, numerous specimens (ZSI) (Gravely, 1911b).

FRANCE: Paris: hot house at Muséum de Paris (Millot, 1949b).

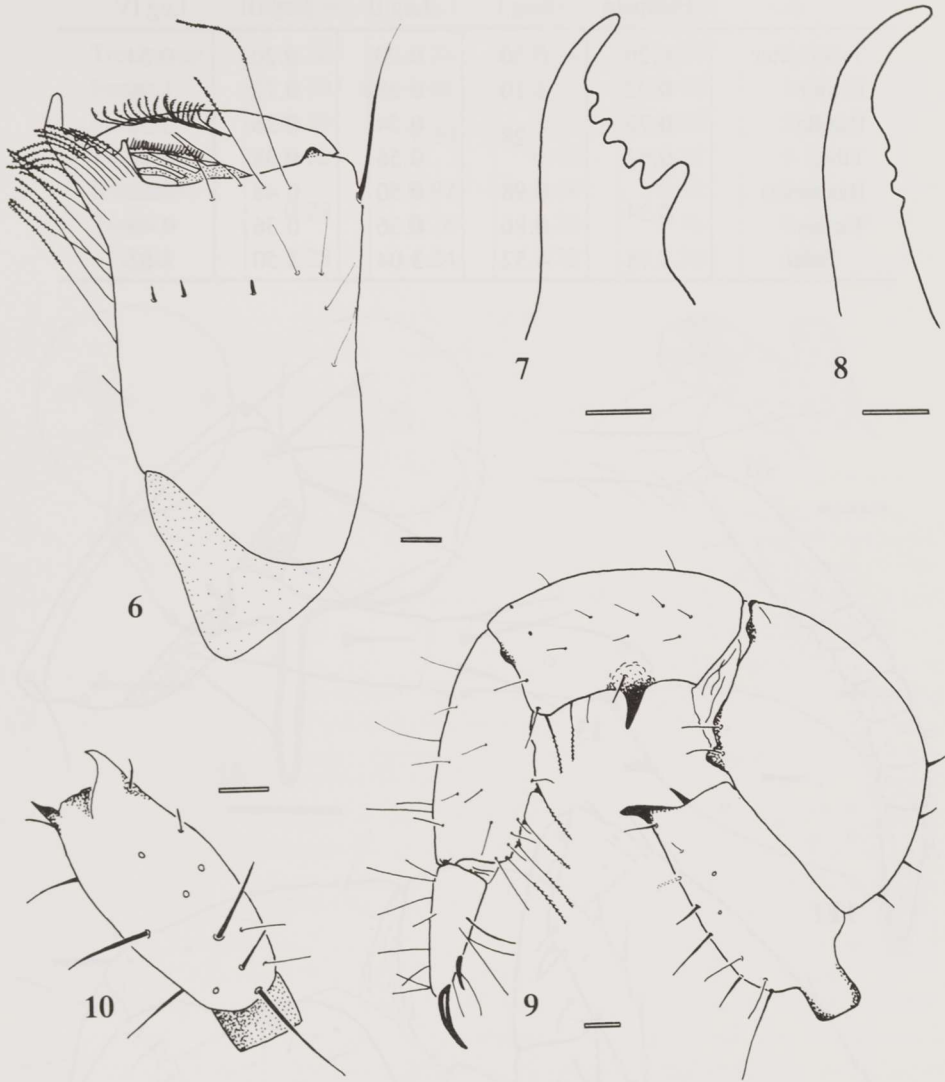
Distribution: Known only from the type-locality and an introduction into France. The records from Liberia reported by Kraepelin (1897, 1899) are incorrectly based on *Artacarus liberiensis*. The record, likewise by Mello-Leitão (1931), from "Siberia" is probably a lapsus for "Liberia."

Comments: This species has been collected from under bricks and stones, from sticks and dead leaves between the roots of rubber trees, and under pieces of wood where *Nasutitermes* Banks were found. Gravely (1911, 1915b), Rémy (1961a), and Silvestri (1947) have discussed the habitat and behavior (including egg brooding and defensive secretion) of this species. Modder (1960) gives a description of the internal male reproductive system including spermatophore and spermatozoa. *Schizomus crassicaudatus* is sympatric with *S. peradeniyensis* Gravely at the type-locality.

The presence of the anteroventral spur on the trochanter and ventrolateral spur on the patella separates *S. crassicaudatus* from other known species of Sri Lankan Schizomida.



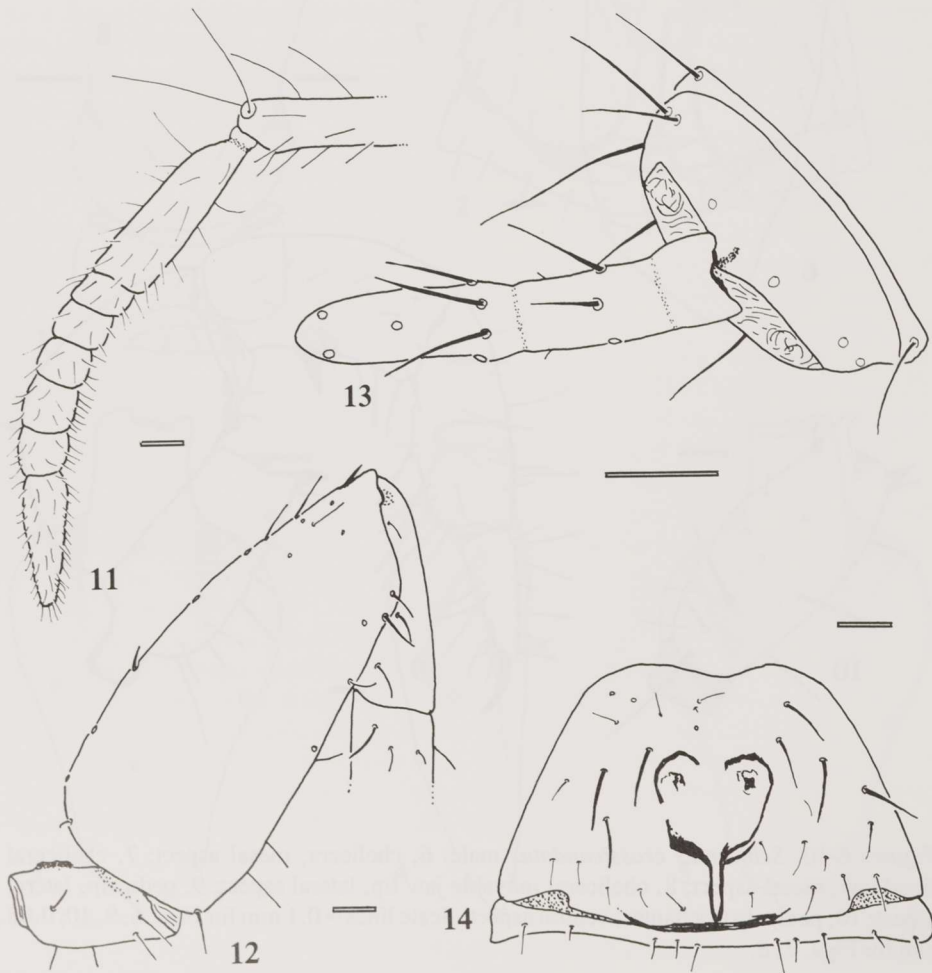
Figures 1-5. *Schizomus crassicaudatus* male: 1, prosoma, dorsal aspect; 2, genital sternite, ventral aspect; 3, flagellum, dorsal aspect; 4, flagellum, lateral aspect; 5, flagellum, ventral aspect. Scale lines = 0.1 mm for Figs. 1, 2; 0.05 mm for Figs. 3-5.



Figures 6-10. *Schizomus crassicaudatus* male: 6, chelicera, mesal aspect; 7, cheliceral fixed jaw, mesal aspect; 8, cheliceral movable jaw tip, lateral aspect; 9, pedipalp, lateral aspect; 10, pedipalp trochanter, ventral aspect. Scale lines = 0.1 mm for Figs. 6, 9, 10; 0.05 mm for Figs. 7, 8.

Table I—Measurements of male lectotype of *Nyctalops crassicaudata*.

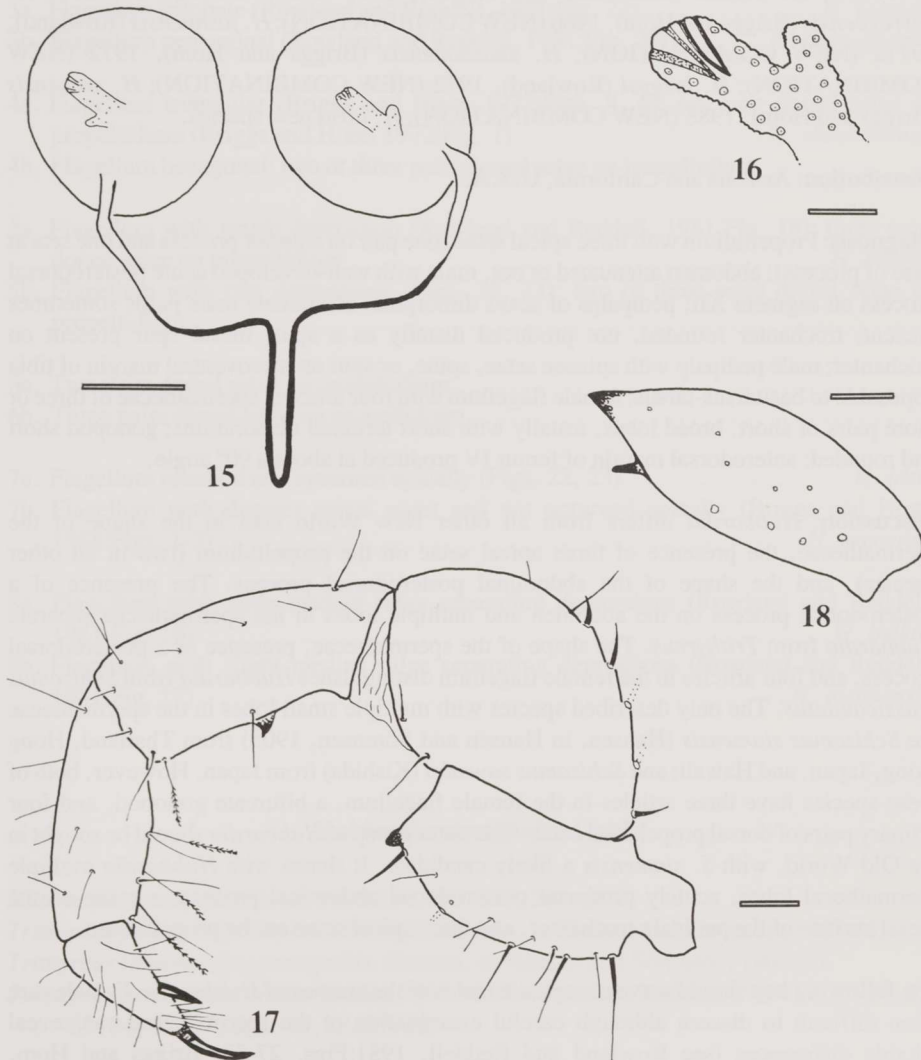
	Pedipalp	Leg I	Leg II	Leg III	Leg IV
Trochanter	0.20	0.30	0.20	0.20	0.34
Femur	0.92	1.10	0.88	0.72	1.06
Patella	0.70	1.28	0.54	0.36	0.56
Tibia	0.62		0.56	0.38	0.72
Basitarsus		0.98	0.50	0.48	0.68
Tarsus	0.34	0.86	0.36	0.36	0.46
Total	2.78	4.52	3.04	2.50	3.82



Figures 11-14. *Schizomus crassicaudatus*: 11, male leg I tarsus, lateral aspect; 12, male trochanter, femur, patella of leg IV, lateral aspect; 13, female flagellum, dorsal aspect; 14, female genital sternite, ventral aspect. Scale lines = 0.1 mm.

Table II.—Measurements of female lectotype of *Nyctalops tenuicaudata*.

	Pedipalp	Leg I	Leg II	Leg III	Leg IV
Trochanter	0.20	0.28	0.16	0.20	0.30
Femur	0.70	1.08	0.78	0.70	1.04
Patella	0.58	1.20	0.50	0.30	0.54
Tibia	0.52		0.48	0.32	0.70
Basitarsus		0.92	0.44	0.42	0.64
Tarsus	0.28	0.76	0.36	0.36	0.44
Total	2.28	4.24	2.72	2.30	3.66



Figures 15-18. *Schizomus crassicaudatus* female: 15, spermathecae and gonopod, ventral aspect; 16, detail of spermatheca; 17, pedipalp, lateral view; 18, pedipalp trochanter, ventral aspect. Scale lines = 0.1 mm for Figs. 17, 18; 0.05 mm for Fig. 15; 0.01 mm for Fig. 16.

Hubbardia Cook

Hubbardia Cook, 1899:250, 253. Hansen and Sörensen, 1905:3-4, 29-30; Hansen, in Hansen and Sörensen, 1905:33, 70.

Schizomus (Trithyreus): Hansen and Sörensen, 1905:4.

Schizomus (Hubbardia): Hansen, in Hansen and Sörensen, 1905:70.

Schizomus briggsi group: Rowland and Reddell, 1981:26-27.

Type-species: *Hubbardia pentapeltis* Cook, 1899 (by monotypy).

Included species: *Hubbardia pentapeltis*; *H. wessoni* (Chamberlin), 1939 (NEW COMBINATION); *H. belkini* (McDonald and Hogue), 1957 (NEW COMBINATION); *H. borregoensis* (Briggs and Hom), 1966 (NEW COMBINATION); *H. joshuensis* (Rowland), 1971a (NEW COMBINATION); *H. shoshonensis* (Briggs and Hom), 1972 (NEW COMBINATION); *H. briggsi* (Rowland), 1972 (NEW COMBINATION); *H. secoensis* (Briggs and Hom), 1988 (NEW COMBINATION); *H. idria* new species.

Distribution: Arizona and California, U.S.A.

Diagnosis: Propeltidium with three apical setae (one pair on anterior process and one seta at base of process); abdomen attenuated or not, male with well-developed acute posterodorsal process on segment XII; pedipalps of sexes dimorphic, effeminate male palps sometimes present; trochanter rounded, not produced distally as a spur; mesal spur present on trochanter; male pedipalp with spinose setae, spine, or spur on mesoventral margin of tibia appposable to basitarsus-tarsus; female flagellum with four articles; spermathecae of three or more pairs of short, broad lobes, usually with short terminal elaborations; gonopod short and rounded; anterodorsal margin of femur IV produced at about a 90° angle.

Discussion: *Hubbardia* differs from all other New World taxa in the shape of the spermathecae, the presence of three apical setae on the propeltidium (two in all other species), and the shape of the abdominal posterodorsal process. The presence of a posterodorsal process on the abdomen and multiple lobes in the spermathecae separate *Hubbardia* from *Trithyreus*. The shape of the spermathecae, presence of a posterodorsal process, and four articles in the female flagellum distinguishes *Hubbardia* from *Schizomus crassicaudatus*. The only described species with multiple small lobes in the spermathecae are *Schizomus siamensis* (Hansen, in Hansen and Sörensen, 1905) from Thailand, Hong Kong, Japan, and Hawaii; and *Schizomus sawadai* (Kishida) from Japan. However, both of these species have three articles in the female flagellum, a bifurcate gonopod, and four primary pairs of dorsal propeltidial setae. The sister group of *Hubbardia* should be sought in the Old World, with *S. siamensis* a likely candidate. It shares with *Hubbardia* multiple spermathecal lobes, acutely produced posterodorsal abdominal process, a spine on the mesal surface of the pedipalp trochanter, and three apical setae on the propeltidium.

The following key should serve to separate males of the species of *Hubbardia*. Females are often difficult to discern although careful examination of the spermathecae can reveal reliable differences (see Rowland and Reddell, 1981:Figs. 27-33; Briggs and Hom, 1988:Fig. 9). The female of *H. idria* is unknown and the spermathecae of *H. shoshonensis* have never been illustrated.

Key to Males of Species of *Hubbardia*

- 1a. Pedipalp tibia with two or more spines or strong setae apposable to basitarsus-tarsus (Rowland and Reddell, 1981:Fig. 35) 2
- 1b. Pedipalp tibia with spur apposable to basitarsus-tarsus (Fig. 25; Rowland and Reddell, 1981:Figs. 36, 37). 3
- 2a. Flagellum long and triangular (Figs. 20, 21); pedipalp tibia with three strong setae apposable to basitarsus-tarsus *H. pentapeltis*
- 2b. Flagellum short and club-shaped 4
- 3a. Flagellum trilobate (Rowland and Reddell, 1981:Fig. 22). *H. wessoni*
- 3b. Flagellum pentagonal (Rowland and Reddell, 1981:Fig. 20) *H. borregoensis*
- 4a. Flagellum triangular (Briggs and Hom, 1972:Figs. 4, 6); one pair dorsal setae on propeltidium (Briggs and Hom, 1972:Fig. 1) *H. shoshonensis*
- 4b. Flagellum hexagonal; two or three pairs dorsal setae on propeltidium 5
- 5a. Flagellum with single depression (Rowland and Reddell, 1981:Fig. 18); three pairs dorsal setae on propeltidium *H. briggsi*
- 5b. Flagellum with two depressions (Figs. 22, 23); two or three pairs dorsal setae on propeltidium 6
- 6a. Two pairs dorsal setae on propeltidium 7
- 6b. Three pairs dorsal setae on propeltidium 8
- 7a. Flagellum rounded and upturned apically (Figs. 22, 23) *H. idria*
- 7b. Flagellum with distinct apical point and not upturned apically (Briggs and Hom, 1988:Figs. 1-3) *H. secoensis*
- 8a. Flagellum with wide median ridge separating depressions (Rowland and Reddell, 1981:Fig. 16) *H. belkini*
- 8b. Flagellum with slight median ridge separating depressions (Rowland and Reddell, 1981:Fig. 17) *H. joshuensis*

Hubbardia pentapeltis Cook

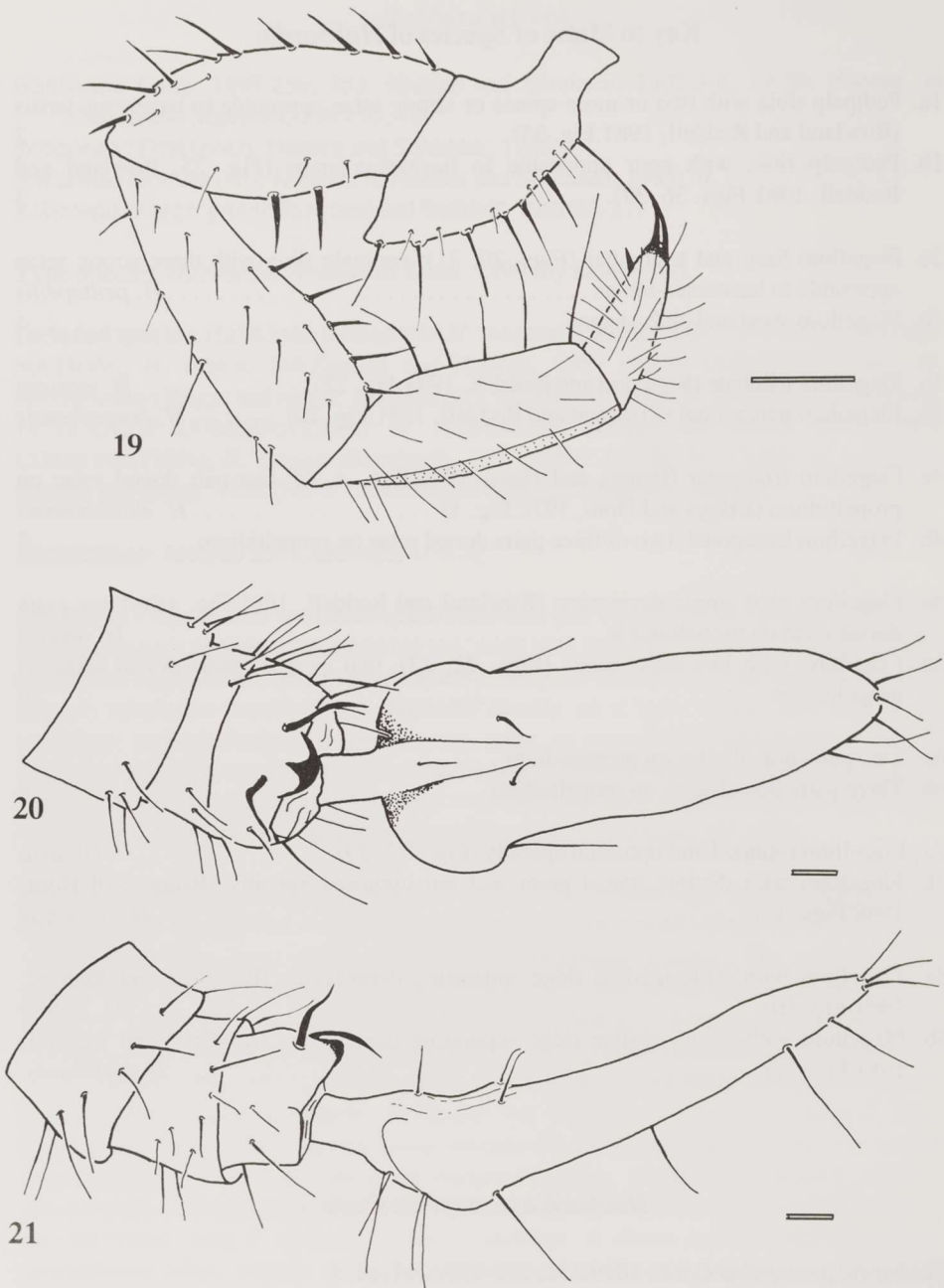
Hubbardia pentapeltis Cook, 1899:251, 253-255, 261, pl. 3.

Trithyreus pentapeltis: Banks, 1900:422; Hansen, in Hansen and Sørensen, 1905:44.

Trithyreus (Hubbardia) pentapeltis: Hansen, in Hansen and Sørensen, 1905:70.

Schizomus pentapeltis: Mello-Leitão, 1931:18; Rowland and Reddell, 1981:19, 27-30, 32, 33, 34, 36, 37, figs. 15, 23, 27, 38.

Type-data: Palm Springs, Riverside County, California, U.S.A. (8, 13 Feb., 6 March 1897, Mr. Hubbard), male lectotype (herein designated), male and female paralectotypes (USNM).



Figures 19-21. *Hubbardia pentapeltis* male: 19, pedipalp, lateral aspect (Palm Springs); 20-21, flagellum and abdominal segments X-XII (Deep Canyon): 20, dorsal aspect; 21, lateral aspect. Scale lines = 0.1 mm.

Supplementary description: The male pedipalp (Fig. 19) has a small peg-like spine on the mesal surface of the trochanter and three stout spinose setae on the mesoventral margin of the tibia appposable to the basitarsus-tarsus in the same position as spines and spurs in other species of *Hubbardia*.

New records: CALIFORNIA: Riverside County: Andreas Canyon, collector and date unknown, 1 male, 1 female, 1 immature (UCR); Santa Rosa Mountains, Deep Canyon, 457 m, 10 Jan. 1981, D. Giuliani, 1 male (UCR); Santa Rosa Mountains, Cactus Spring Trail, between Highway 74 and Horsethief Creek, Deep Canyon area, in scrub oak (*Quercus turbinella* Greene) duff, 1036 m, 22 May 1976, J. Burnett and J. Pinto, 2 females, 1 immature (UCR); Winchester, 19 Jan. 1971, J.M. Rowland, 2 males, 1 female, 1 immature (TMM).

Variation: Rowland and Reddell (1981) mention that the flagellum and abdomen of males are highly variable, but illustrate only a topotype. A male from Deep Canyon has the abdomen and flagellum slightly shorter and thicker than from the type-locality (Figs. 20-21).

Comments: The collection at 1036 m elevation in Deep Canyon probably represents a new altitude record for California schizomids.

Hubbardia briggsi (Rowland)

Trithyreus briggsi Rowland, 1972:1-9, figs. 1, 3-6.

Schizomus briggsi: Rowland and Reddell, 1979a:163; Rowland and Reddell, 1981:19, 27-29, 31, 34, 36-40, figs. 15, 18, 21, 30, 36-37.

New records: CALIFORNIA: Fresno County: 0.8 km. before Pine Flat Dam above King's River, 6 Feb. 1977, J.D. Clark, 1 male (USNM); 16.5 km SW Trimmer, 27 Jan. 1968, T. Briggs, 1 female (TMM). Tulare County: Lemoncove, 19 Feb. 1963, W.H. Ewart, 1 female, 1 immature (UCR).

Hubbardia idria new species

Type-data: 2.9 km SW of Idria, San Benito County, California, U.S.A., 25 March to 8 June 1981 (A.J. Gilbert, N. Smith), antifreeze pit trap in oak woodland, male holotype (CAS), male paratype (UCR).

Etymology: The species name is from the type-locality, Idria, used as a noun in apposition.

Description: Holotype male: Length from distal edge of propeltidium to base of flagellum, 4.34 mm; orangish.

Cephalothorax: Propeltidium 1.16 mm long, 0.76 mm wide; with one pair setae on anterior process and one seta at base of process, and two pairs dorsal setae. Eyespots oval, indistinct. Mesopeltidia separated by about width of one plate. Metapeltidium divided by

distinct suture. Anterior sternum with 10 setae plus two sternapophysial setae, posterior sternum with 7 setae.

Abdomen: Tergite I with 2 pairs small anterior and one pair larger posterior setae, tergite II with three pairs small anterior and one pair large posterior setae, tergites III-VII with one pair dorsal setae each, tergites VIII-IX with one pair dorsal and one pair lateral setae each. Sternite V about 3 times as wide as long; width/length ratio versus body length, 0.7. Segments X-XI telescoped, segment XII with well-developed acute posterodorsal process. Segment X with six long ventral setae; segment XI with 2 dorsolateral and 6 long ventral setae; segment XII with 2 stout (widened and flattened at bases) curved spinose dorsal setae, 2 dorsolateral setae, and 7 long ventral setae. Flagellum (Figs. 22-23) roughly hexagonal, with two shallow dorsal depressions flanking median longitudinal ridge; apex rounded, upturned; two prominent lateral lobes ventrally; with 5 dorsal setae, 2 setae on distal margin, and 10 ventral setae.

Pedipalps (Figs. 24-25): Elongate, surface imbricate. Trochanter not produced distally; femur elongate, expanded distally; patella elongate, expanded distally; tibia short with large mesal apical spur apposable to basitarsus-tarsus; basitarsus-tarsus flattened dorsoventrally; spur about 1/8 length of segment, claw about 1/4 length of segment.

Chelicerae: Fixed jaw (Fig. 26) with four rounded teeth between two larger outer teeth, serrula with 20 teeth, the distalmost the largest. Seta: 1 = 3; 2 = 4; 3 = 5; 4 = 4; 5 = 12; 6 = 1; plus three dorsal setae above group 4.

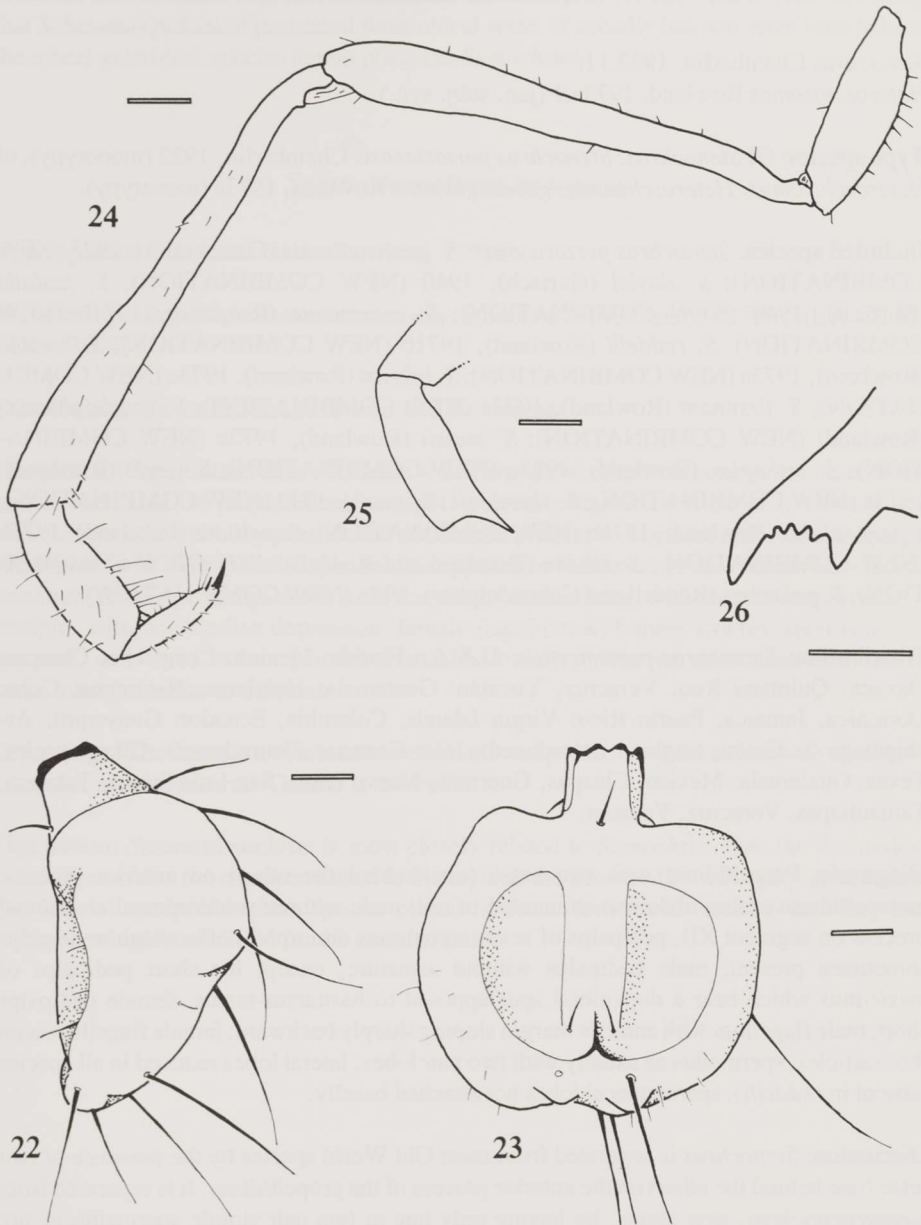
Legs: Segment lengths in Table III. Femur IV about 2.6 times as long as deep. Leg I, including coxa, 6.10 mm long; basitarsal-tarsal segment proportions: 20:3:4:4:5:12.

Female: Unknown.

Comments: This species is most closely related to *Hubbardia secoensis* from Monterey County. *H. idria* has the male pedipalps elongate, while they are stout in *H. secoensis*. The presence of both stout and elongate pedipalps in other species of *Hubbardia* casts doubt on the value of this character for species recognition, since both character states may be present in these species. The two species are most easily separated by details of the male flagellum. The flagellum of *H. idria* is rounded and upturned apically, while it has a distinct point and is not upturned in *H. secoensis*. The male paratype of *H. idria* agrees in all important characters with the holotype.

Table III.—Measurements of male holotype of *Hubbardia idria*.

	Pedipalp	Leg I	Leg II	Leg III	Leg IV
Trochanter	0.62	0.30	0.22	0.22	0.30
Femur	1.74	1.36	0.92	0.84	1.30
Patella	1.82	1.58	0.54	0.40	0.60
Tibia	0.70		0.58	0.48	0.90
Basitarsus		1.18	0.54	0.58	0.84
Tarsus	0.48	1.08	0.44	0.48	0.54
Total	5.36	5.50	3.24	3.00	4.48



Figures 22-26. *Hubbardia idria* male holotype: 22, flagellum, lateral aspect; 23, flagellum, dorsal aspect; 24, pedipalp, lateral aspect; 25, pedipalp tibia, mesal aspect (setae excluded); 26, cheliceral fixed jaw. Scale lines = 0.1 mm.

Stenochrus Chamberlin

Stenochrus Chamberlin, 1922:11.

Heteroschizomus Rowland, 1973a:1 (jun. subj. syn.).

Type species: Of *Stenochrus*: *Stenochrus portoricensis* Chamberlin, 1922 (monotypy); of *Heteroschizomus*: *Heteroschizomus goodnightorum* Rowland, 1973a (monotypy).

Included species. *Stenochrus portoricensis*; *S. guatemalensis* (Chamberlin), 1922 (NEW COMBINATION); *S. davisii* (Gertsch), 1940 (NEW COMBINATION); *S. mulaiki* (Gertsch), 1940 (NEW COMBINATION); *S. mexicanus* (Rowland), 1971b (NEW COMBINATION); *S. reddelli* (Rowland), 1971b (NEW COMBINATION); *S. bartolo* (Rowland), 1973a (NEW COMBINATION); *S. lukensi* (Rowland), 1973c (NEW COMBINATION); *S. firstmani* (Rowland), 1973a (NEW COMBINATION); *S. goodnightorum* (Rowland) (NEW COMBINATION); *S. moisii* (Rowland), 1973c (NEW COMBINATION); *S. orthoplax* (Rowland), 1973a (NEW COMBINATION); *S. pecki* (Rowland), 1973a (NEW COMBINATION); *S. sbordonii* (Brignoli), 1973 (NEW COMBINATION); *S. lanceolatus* (Rowland), 1975b (NEW COMBINATION); *S. pallidus* (Rowland), 1975b (NEW COMBINATION); *S. silvino* (Rowland and Reddell), 1977 (NEW COMBINATION); *S. palaciosi* (Reddell and Cokendolpher), 1986 (NEW COMBINATION).

Distribution: *Stenochrus portoricensis*: U.S.A.: Florida; Mexico: Campeche, Chiapas, Oaxaca, Quintana Roo, Veracruz, Yucatán; Guatemala; Honduras; Nicaragua; Cuba; Dominica; Jamaica; Puerto Rico; Virgin Islands; Colombia; Ecuador: Guayaquil, Archipiélago de Colón; England (introduced); Islas Canarias (?introduced). Other species: Texas; Guatemala; Mexico: Chiapas, Guerrero, Nuevo León, San Luis Potosí, Tabasco, Tamaulipas, Veracruz, Yucatán.

Diagnosis: Propeltidium with two setae (one behind the other) on anterior process; metapeltidium entire; abdomen attenuated or not; male without posterodorsal abdominal process on segment XII; pedipalps of sexes sometimes dimorphic, effeminate male palps sometimes present; male pedipalps without armature, except for short pedipalps of *mexicanus* which bear a dorsotibial spur apposed to basitarsus-tarsus; female pedipalps short; male flagellum with anterior margin sloping sharply backward; female flagellum with three articles; spermathecae usually with two pair lobes, lateral lobes reduced in all species (absent in *reddelli*); spermathecal lobes not attached basally.

Discussion: *Stenochrus* is separated from most Old World species by the presence of two setae (one behind the other) on the anterior process of the propeltidium. It is separated from *Sotanostenochrus*, new genus, by having only one or two pair simple spermathecae not attached basally; male flagellum with anterior margin sloping backward. The male pedipalps of *Sotanostenochrus* have a ventromedial tibial spur apposed to the basitarsus-tarsus. Two species from southern Mexico, *Schizomus infernalis* Rowland and *Schizomus hoffmannae* Reddell and Cokendolpher, were provisionally placed in the *mexicanus* group by Reddell and Cokendolpher (1986). The remarkable nature of the male pedipalps and the subequal nature of the spermathecal lobes indicate that these may not belong in *Stenochrus*. They will be dealt with when the remainder of the New World fauna is studied cladistically. It should also be noted here that Reddell and Cokendolpher (1986) were in error in stating that *Schizomus palaciosi* possessed three apical setae. It actually has two setae (one behind the other) as in other species herein placed in *Stenochrus*.

It should also be noted here that Reddell and Cokendolpher (1986) were in error in stating that *Schizomus palaciosi* possessed three apical setae. It actually has two setae (one behind the other) as in other species herein placed in *Stenochrus*.

Sotanostenochrus, new genus

Type-species: *Schizomus cookei* Rowland, 1971a.

Included species: *Sotanostenochrus cookei*, *S. mitchelli* (Rowland), 1971b (NEW COMBINATIONS).

Distribution: Caves in San Luis Potosí and Tamaulipas.

Diagnosis: Propeltidium with two setae (one behind the other) on anterior process; three pair dorsal setae on propeltidium; eyespots absent; metapeltidium entire; abdomen not attenuated; male without posterodorsal abdominal process on segment XII; male pedipalps dimorphic, with ventromedial spur on tibia apposed to basitarsus-tarsus, otherwise without armature; female pedipalps short; male flagellum subtriangular, with anterior margin nearly straight, with one median depression; female flagellum with three articles; spermathecae palmate, with three to four pair lobes attached basally; lobes not sclerotized terminally; some lobes bifurcate or trifurcate.

Etymology: The name is a combination of *sotano*, a Spanish word for a cave with a vertical entrance, and *Stenochrus*. Gender is masculine.

Discussion: *Sotanostenochrus* is most closely related to *Stenochrus*. See the discussion under *Stenochrus* for characters used to distinguish the genera. The reduced pigmentation and lack of eyespots in both species placed in *Sotanostenochrus* indicate that they are troglobites highly modified for the cave habitat.

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TEXAS MEMORIAL MUSEUM
The University of Texas at Austin
2400 Trinity, Austin, TX 78705
(512) 471-1604