Zootaxa 1094: 25–40 (2005)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)
1094

Ectonocryptoides quadrimeropus, a new centipede genus and species from Jalisco, Mexico; proposal of Ectonocryptopinae, analysis of subfamilial relationships, and a key to subfamilies and genera of the Scolopocryptopidae (Scolopendromorpha)

ROWLAND M. SHELLEY[1] & RANDY MERCURIO[2]

[1] *Research Lab., North Carolina State Museum of Natural Sciences, 4301 Reedy Creek Rd., Raleigh, NC 27607 USA. email rowland.shelley@ncmail.net*

[2] *Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th St., New York, NY 10024 USA. email mercurio@amnh.org*

Abstract

Ectonocryptoides quadrimeropus, n. gen., n. sp., is proposed for a minute scolopocryptopid centipede occurring near sea level in coastal Jalisco that is anatomically similar to the unillustrated, written description of *Ectonocryptops kraepelini* Crabill, 1977, from ca. 1,615 m (5,300 ft) elevation in the interior of Colima. Both possess enlarged, subclavate caudal legs that lack claws and in which the distal podomeres are inflated and bulbous, but this appendage has only 4 articles in the former (tibiae and 1st tarsi enlarged) and 5 in the latter (tibiae and 1st & 2nd tarsi enlarged). The genera cannot be accommodated by an existing subfamily, necessitating proposal of Ectonocryptopinae, the fourth scolopocryptopid subfamily, the others being Newportiinae, Kethopinae, and Scolopocryptopinae. A key is provided to the subfamilies and eight component genera; each of the former contains two anatomically similar genera, as *Tidops* Chamberlin, 1915, is returned to the Newportiinae from the nominate taxon, where it was transferred without justification. Relationships among the four subfamilies are postulated as Kethopinae + (Scolopocryptopinae + (Ectonocryptopinae + Newportiinae)).

Key words: *Ectonocryptoides quadrimeropus*, *Ectonocryptops kraepelini*, Ectonocryptopinae, Newportiinae, Scolopocryptopidae/nae, Kethopinae

Introduction

In his final publication on the Scolopendromorpha, Crabill (1977) proposed *Ectonocryptops kraepelini*, n. gen., n. sp., for a small-bodied centipede from Colima, Mexico, that is

Accepted by A. Minelli: 28 Nov. 2005; published: 13 Dec. 2005

blind and possesses 23 pedal segments. It is thus referrable to the Scolopocryptopidae (see Shelley 2002), although Crabill did not recognize this taxon and placed it in the Cryptopidae. The descriptions are adequately detailed but lack illustrations, and it is difficult for even a specialist to visualize a new form solely from a written characterization. There was only one specimen, the holotype, that supposedly was deposited in the American Museum of Natural History, New York, USA (AMNH), but it has not been seen since RMS began studying scolopendromorphs in the 1980s. Extensive searches among typical and non-typical material in other repositories, particularly the National Museum of Natural History, Smithsonian Institution, Washington, DC, where Dr. Crabill was a curator in 1977, also have not revealed the specimen, so the only representative of the genus and species is lost. Without a specimen and illustrations, the identity of *E. kraepelini* is unknown and the genus cannot be accurately placed taxonomically, although Schileyko & Pavlinov (1997) allied it with both *Dinocryptops* + (*Newportia* + *Tidops*) and *Cryptops* + *Paracryptops* in separate cladograms. To the best of our knowledge, this is the only subsequent publication that mentions *Ectonocryptops*.

While perusing unsorted millipedes at the AMNH in September 2005, RMS discovered a misplaced centipede sample with two minute scolopocryptopids from Jalisco, adjacent to Colima, with expanded, somewhat clavate caudal legs that neither of us had seen before (Figs. 1–2, 12–16). Suspecting *Ectonocryptops*, if not *E. kraepelini* itself, we checked Crabill's paper and found the characterization "ultimate second tarsus subclavate…" in both the generic and specific accounts. The centipedes correspond with many aspects of Crabill's descriptions, but there are also differences; in particular, *E. kraepelini* possesses five podomeres on the caudal legs whereas these specimens have only four. Close examination of these appendages shows no evidence of breakage or tearing, and the apices are actually slightly depressed with fine protruding hairs, suggesting a sensory function. The ultimate 2nd tarsi are clearly lost in these centipedes, a fundamental difference from *E. kraepelini* that, for consistency within the Scolopocryptopidae and Scolopendromorpha as a whole, warrants generic-level recognition. Examples of generic distinctions in the Scolopocryptopidae that are based primarily on a single feature are *Dinocryptops* and *Scolopocryptops* (also *Rhysida* and *Otostigmus* in the Scolopendridae), which differ in the presence (*Dinocryptops*, *Rhysida*) versus the absence (*Scolopocryptops*, *Otostigmus*) of spiracles on the 7th segment, and *Newportia* and *Tidops*, which differ primarily in the lengths of the forcipular tarsungula. Unfortunately, neither individual is in good condition—the cuticles are detached from the underlying tissues, which could either represent a premolt condition or result from years in preservative; one specimen is broken in two and held together only by the cuticle (Fig. 1) while the other is mashed flat; most walking legs are missing; and only one ultimate leg remains attached, two others being loose in the vial. We therefore designate syntypes rather than a holotype and paratype and do not describe the mouthparts, clypeus, or labrum, opting to forgo a destructive dissection on such small organisms to preserve what remains of their structural integrities. We provide here descriptive accounts of the new taxa along with illustrations of pertinent external features; as the overall configurations of the caudal legs are apparently similar despite the different numbers of podomeres, future workers can use these figures to recognize both the new genus and *Ectonocryptops* when the latter is rediscovered. We also erect a new subfamily to accommodate these taxa, provide a key to scolopocryptopid subfamilies and genera, and offer a preliminary hypothesis of affinities within the family. Terminology follows the recommendations of Lewis *et al*. (2005).

Taxonomy

Family Scolopocryptopidae Pocock, 1896

Scolopocryptopidae Pocock, 1896:28. Ribaut, 1915:339. Shelley, 2002:49–51.
Scolopocryptidae (sic.): Verhoeff, 1906:433; 1907:253. Ribaut, 1912:76. Attems, 1930:287.

Diagnosis. Scolopendromorpha with 23 pairs of legs and pedal segments; cephalic plate without ocelli.

Components. Four subfamilies and eight genera, distinguished in the following key.

Distribution. North, South, and Central America; Mexico; West Indies; western Africa (Guinea and Sierra Leone to Gabon); Pacific Rim of Asia (Japan, Korea, China, the Philippines, Vietnam, Indonesia, and New Guinea); Oceania (Fiji) (Kraepelin 1903; Attems 1914, 1930, 1938, 1953; Chamberlin 1920; Demange 1963, 1966, 1968; Bücherl 1974; Shinohara 1990; Shelley 1997, 2002; Chagas 2003). The Scolopocryptopidae is primarily a New World taxon and is most diverse and abundant in the Americas, especially the Neotropics. In North America it occupies seven disjunct areas as detailed by Shelley (2002:49–51); precise distributions on other continents are unknown. Three of the four subfamilies—Kethopinae, Newportiinae, and Ectonocryptopinae—are restricted to the Western Hemisphere; the nominate alone occurs in Africa and Asia, and except for the purported occurrence of *Dinocryptops* Crabill, 1953, in the latter (China, Vietnam, Fiji) (Chamberlin 1920; Attems 1930, 1938, 1953; Chagas 2003), the only Old World genus is *Scolopocryptops* Newport, 1844, itself. Regarding *Dinocryptops*, we emphasize that the type species, *D. miersii* (Newport, 1845), occurs in the Neotropics and is the only New World component; Chagas (2003) designated a neotype from São Paulo State, Brazil, and synonymized all other names proposed for forms from this region. Thus, if those in Asia differ significantly and are not congeneric (i. e. if concordance in possessing spiracles on segment 7 represents convergence), they will require a new genus, and *Dinocryptops* will become monotypic and another endemic New World taxon.

Remarks. As both the Scolopocryptopidae and Newportiidae were proposed by Pocock (1896:28, 29) in this sequence, and confusion remains as to the correct familial name, we reiterate that the former holds priority. As discussed by Shelley (2002:3), this situation is governed by Article 24.2.2 of the 2000 Edition of the International Code of Zoological Nomenclature, which states that the first reviser determines precedence for simultaneously published names; as Attems (1930) was the first author to change their relative ranks, he is properly considered the first reviser. Attems reduced Scolopocryptopidae to subfamilial status under Cryptopidae and placed Newportiidae in synonymy, which therefore accords higher ranking and priority to Scolopocryptopidae. Consequently, Scolopocryptopidae and Newportiidae are either equivalent in rank and separate families, or the latter is a subfamily under the former; because of Article 24.2.2, Scolopocryptopinae cannot be a subfamily under Newportiidae.

Chamberlin (1915) erected *Tidops* for a *Newportia*-like scolopocryptopid from Grenada with short tarsungula in which only the apices overlap when the forcipules are closed. Attems (1930) placed *Tidops* in the Scolopocryptopinae (family Cryptopidae) along with *Newportia* Gervais, 1847, in which the tarsungula are long and substantially overlap in the closed position. Schileyko and Minelli (1998) also considered *Tidops* to be closely related to *Newportia* because the 2nd tarsi on the ultimate legs are divided into "pseudopodomeres" in both genera, and we concur with this assessment. However, Schileyko (2002:483) transferred *Tidops* from the Newportiinae to the Scolopocryptopinae "according to the diagnostic characters (Schileyko, unpubl.)," i. e. on the basis of information that is (these data are still unpublished) known only to him. We therefore return *Tidops* to the Newportiinae, because concordance with *Newportia* in the pseudosegmented 2nd tarsi constitutes a clear synapomorphy that unites them in a monophyletic taxon. Taxonomic actions that are based on nebulous unpublished data, known to only one person and not the scientific community as a whole, cannot be accorded credence and should be deferred until the evidence is published, so that colleagues can evaluate it.

While differences exist throughout the bodies and their general appearances differ, the most obvious distinctions among the scolopocryptopid subfamilies involve aspects of the caudal legs. Each presently includes two component genera that are anatomically similar and differ primarily in one principal feature.

Key to Subfamilies and Genera of the Scolopocryptopidae

1. Ultimate legs extending sublinearly; prefemora with at least one ventral spinous process apiece; tibiae and tarsi variably setose but unarmed 3

\- Ultimate 2nd tarsi typically flexed against 1st tarsi and lower tibiae to form a "clasping apparatus"; prefemora unarmed, tibiae and 1st tarsi with "saw teeth"; California, Utah, and New Mexico, USA (Crabill 1958, 1960; Shelley 2002) .... Kethopinae Shelley, 2002...2

2. Sterna distinctly margined laterad; epigean environments in California, Utah, and New

Mexico ....*Kethops* Chamberlin, 1912
- Sterna not margined; caves in New Mexico.......................... *Thalkethops* Crabill, 1960

3. Ultimate legs not modified, leg-like in overall appearance, with 5 distinct podomeres and terminal claws; entire familial distribution....Scolopocryptopinae Pocock, 1896...5
- Ultimate legs substantially modified and without claws, either elongated and with considerably more than 5 apparent podomeres or enlarged and swollen 4

4. Ultimate legs subclavate in general appearance, distal podomeres inflated and bulbous; coxopleura short; Colima and Jalisco, Mexico.. .... Ectonocryptopinae, new subfamily...6
- Ultimate legs elongated by division of 1st tarsi into "pseudoarticles"; coxopleura prolonged; Mexico, Central and South America, West Indies ....Newportiinae Pocock, 1896...7

5. 7th pedal segment with a pair of spiracles; Martinique to Argentina, southeast Asia, Fiji (Shelley 2000, Chagas 2003)....................................... *Dinocryptops* Crabill, 1953
- 7th pedal segment without spiracles; entire familial distribution .... *Scolopocryptops* Newport, 1844

6. Ultimate legs with 5 articles; Colima..............................*Ectonocryptops* Crabill, 1977

Ultimate legs with 4 articles; Jalisco............................... *Ectonocryptoides*, new genus

7. Tarsungula long, nearly completely overlapping in closed position; Mexico, Central and South America, West Indies (Schileyko & Minelli 1998, Chagas & Shelley 2003) ....*Newportia* Gervais, 1847
- Tarsungula short, apices alone overlapping in closed position; Grenada to Brazil......... ....*Tidops* Chamberlin, 1915

Ectonocryptopinae, new subfamily

Diagnosis. Minute, small-bodied Scolopocryptopidae (ca. 10–12 mm long) with generally yellowish coloration. Cephalic plate without paramedial sulci, with or without vague frontal sulcus; anterior margin slightly prolonged and sublinear, posterior margin overlapping anterior margin of tergite 1 (T1). Antennae normally with 17 articles. Coxosternum without sulci, tooth plates, lobes, or other armature. Forcipules not exceeding anterior margin of cephalic plate, without trochanteroprefemoral spurs, teeth, or processes, tarsungula substantially overlapping in closed position. T1 with prominent, anterior transverse suture giving rise to 2 converging paramedian sulci, either meeting and merging or not; T2–T22 with subparallel paramedian sulci. Ultimate tergite (T23) wider than long, caudal margin gently rounded. Legs 1–22 with stiff setae or bristles but without spines, one basal seta apiece on inner surfaces of claws in position of accessory spines. Coxopleura short, with acuminate apical spines, with or without pores. Ultimate legs subclavate in overall appearance, with 4 or 5 podomeres, without claws; prefemora and femora with 3 and 2 ventral spinous processes, respectively, and additional small spines; tibiae and 1st tarsi inflated and bulbous, latter with excavations on ventromedial or dorsal surfaces; 2nd tarsi present or absent, inflated and bulbous when present.

Distribution. Known only from Colima and Jalisco, Mexico (Fig. 3). The type locality of *Ectonocryptops kraepelini* in Colima, 3.2 km (2.0 mi) south of Tonila and around 75 km (46.8 mi) inland from the Pacific Ocean, is on the base of Colima Volcano in the Sierra Madre del Sur. Crabill (1977) gave no further details and did not report the habitat, but from internet map sites, the elevation is roughly 1,615 m (5,300 ft), and the locality is approximately 160 km (100 mi) due east of the type locality of *Ectonocryptoides quadrimeropus*, which is nearly at sea level (roughly 30m [98 ft]). The elevational disparity mandates substantially different habitat requirements because of markedly different environments at these heights. As the sites are in different physiographic regions, we suspect that the Ectonocryptopinae occurs widely, and in varying environments, in the western periphery of "mainland" Mexico (excluding the Baja California peninsula); it should be expected at intervening elevations and possibly even higher than Tonila. We also note that the taxon has only been encountered twice, in two Mexican states and physiographic provinces, and both samples constituted new genera and species. This suggests that field investigations from Sinaloa southward in the poorly sampled coastal border may yield more new species and possibly even genera.

Components. *Ectonocryptops* Crabill, 1977; *Ectonocryptoides*, new genus.

Relationships. We present in fig. 4 a hypothesis of subfamilial relationships in the Scolopocryptopidae; outgroups are the two other scolopendromorph families, Scolopendridae and Cryptopidae. Apomorphies are as follows:

1. Presence of 23 pairs of legs and pedal segments. This is the apomorphy for the Scolopocryptopidae; the only other scolopendromorph with this feature is the Brazilian scolopendrid, *Scolopendropsis bahiensis* (Brandt, 1841) (Kraepelin 1903, Attems 1930, Bücherl 1974, Schileyko 2002). All other scolopendromorphs possess 21 leg pairs and segments.

2. Presence of at least one ventral "spinous process" on each ultimate prefemur. Lewis *et al*. (2005) suggested the term "spinous processes" for the projections from the ultimate legs in the Scolopocryptopidae, which are immovable outgrowths of the exoskeleton, are not connected to it by articulations, and do not arise from sockets or alveoli. These structures are absent from the Kethopinae but present in, and apomorphic for, the clade, Scolopocryptopinae + (Ectonocryptopinae + Newportiinae). They differ from true "spines" found in the Scolopendridae, which can be dislodged leaving a faint, rounded hump.

3. Presence of at least one ventral "spinous process" on each ultimate femur. In addition to those on the prefemora, the Ectonocryptopinae and Newportiinae exhibit "spinous processes" on the ventral surfaces of the ultimate femora, which constitutes a synapomorphy for these subfamilies.

4. Loss of claws. To our knowledge, claws are present on the ultimate legs of all scolopendromorphs except representatives of the Ectonocryptopinae and Newportiinae. This loss is another synapomorphy for these subfamilies and is possibly associated with the assumption of a sensory function that manifests itself differently in the taxa. The elongated, "pseudoarticulated" caudal legs of newportiines superficially resemble antennae and would seem to have a similar function, while the inflated, subclavate appendages of ectonocryptopines possess apical depressions with fine protruding hairs that are consistent with sensory structures, although their presence in *Ectonocryptops* awaits confirmation.

5. Presence of a dorsomedial "spinous process" on each ultimate prefemur. Both components of the Scolopocryptopinae possess an additional, smaller "spinous process" on the dorsomedial surface of each ultimate prefemur; Chagas (2003) reported that this structure is on the dorsolateral surface of *D. miersii*, but it is actually dorsomedial (Chagas, pers. comm. to RMS). The Ectonocryptopinae and Newportiinae possess true "spinous processes" only ventrad, so the presence of a small dorsomedial one is a synapomorphy for *Dinocryptops* + *Scolopocryptops* and an autapomorphy for the Scolopocryptopinae.

6. Presence of a trochanteroprefemoral spur. All scolopocryptopines possess this autapomorphic structure; while varying in size, it is at most only a large spur and never a longer process as in the Scolopendridae. It is absent from the other subfamilies except for minute spurs in a few species of *Newportia*.

7. Inflated, bulbous podomeres. To our knowledge, such podomeres, which impart a subclavate overall appearance to the ultimate legs of ectonocryptopines and are soft and weakly sclerotized, are not found on any other scolopendromorph. The enlarged caudal podomeres in representatives of the Plutoniuminae (Cryptopidae) and some scolopendrids are quite different, being stiff, rigid, and strongly sclerotized (Shelley 1997).

8. Small size. The minuteness of presumably adult ectonocryptopines, ca. 11 mm (0.4 in.) long and less than 1.0 mm wide, contrasts them with all other scolopocryptopids, which are considerably larger, well over 25 mm (1.0 in.) long as adults.

9. Pseudoarticulations. In the Scolopendromorpha, division of the ultimate 2nd tarsi into "pseudosegments" is unique to the Newportiinae.

No apomorphy is known for the Kethopinae, which we regard as the plesiomorphic sister-group to the rest of the Scolopocryptopidae. As noted by Crabill (1960), it is distinguished by flexure of the ultimate 2nd tarsi and the presence of "saw teeth" on the tibiae and 1st tarsi, these being plesiomorphies that are shared with the Cryptopinae (Cryptopidae) (see Crabill 1958, fig. 3; 1960, fig. 15) and seemingly indicative of shared ancestry. The Kethopinae is endemic to, and occurs sporadically in, the aforementioned western and southwestern United States (US), its present stronghold being the western slope of the Sierra Nevada in California, where *Kethops utahensis* (Chamberlin, 1909) has been encountered most often (Shelley 2002). Additionally, *Thalkethops grallatrix* Crabill, 1960, seems rather common in the caves of Carlsbad Caverns National Park, this being a form that apparently sought refuge from the arid desert environments of southeastern New Mexico in cool, moist subterranean habitats (Crabill 1960, Barr & Reddell 1967, Shelley 2002). Despite several field trips to epigean areas where the Kethopinae occurs, RMS has never seen a live individual, and preserved ones also are rare, as none exist in California repositories. We believe the Kethopinae is an "old" group that is declining naturally toward extinction, and it may have been displaced from much of its former range by the younger and more successful Scolopocryptopinae, which is at or near its zenith, at maximal expansion with minimal geographic discontinuities. A Pangean origin for both subfamilies is likely and would account for the latter's occurrences in Africa and Asia.

The Scolopocryptopinae surely antedates the Newportiinae and Ectonocryptopinae, with more regional distributions. Crabill (1977) correctly perceived that *Ectonocryptops* is related to *Newportia*, but the affinity is actually at the subfamilial level. These taxa appear to have arisen comparatively recently and have "experimented" with modifications of the distal podomeres of the caudal legs for a possible sensory function, an aspect of which is loss of the claw. In *Ectonocryptoides quadrimeropus*, the proximal podomeres are heavily armored with small spines in addition to the "spinous processes"; Crabill (1977) does not mention such spines in *Ectonocryptops kraepelini* and perhaps did not examine the appendages at high enough magnification, a matter to be checked on fresh material. The Newportiinae is quite successful, having dispersed across the Panamanian portal and spread over most of the Neotropics including the West Indies; the subfamily therefore contrasts with the entire order Geophilomorpha, which shows little evidence of trans-Panamanian passage (Pereira *et al*. 1997). The present restricted distribution of the Ectonocryptopinae is surely an artifact, though the taxon probably is not as widespread as the Newportiinae.

The Scolopocryptopinae, Ectonocryptopinae, and Newportiinae occur in Mexico, while the Kethopinae lies just to the north in the adjacent US, a geography that suggests a broad part of the now southwestern US and northern/northwestern Mexico as the likely source area for the family. Consequently, if undiscovered scolopocryptopid "subfamilies" exist, this region, particularly the Sierra Madre, is where they likely occur.

Remarks. As no specimen or illustration exists, we necessarily have to accept Crabill's accounts (1977) for features of *Ectonocryptops kraepelini* in formulating the foregoing diagnosis. It may thus need modification when this species or the genus is rediscovered, and the accuracy of Crabill's written descriptions can be assessed. He did not, for example, characterize the apices of the caudal legs, so we do not know whether they also exhibit depressions with protruding hairs; if so, this will be another apomorphy of the subfamily.

According to Crabill (1977), the holotype of *Ectonocryptops kraepelini* had 17 articles in both antennae. One individual of *Ectonocryptoides quadrimaculatus* also has 17, but the other has 2 & 3 fewer on the left and right antennae, respectively. This disparity is slight, and we believe 17, the basic number of antennomeres in the Scolopendromorpha, to be the number in the Ectonocryptopinae.

The apparent rarity of the Ectonocryptopinae probably reflects a general lack of investigations along the Pacific Coast of Mexico coupled with their minuteness and a possible preference for litter habitats. A person collecting manually would have difficulty distinguishing an organism this small in litter or a mass of decaying leaves, whereas the centipede would stand out somewhat by contrast under bark of decaying logs, as do species of *Cryptops* Leach, 1815 (Cryptopidae) in the eastern United States. Consequently, Berlese extraction is probably the best, and perhaps the only, method of collecting ectonocryptopines. An analogous situation in Mexico involves the rarely encountered milliped order Siphoniulida, which was known only from Sumatra and Guatemala until seven individuals were discovered in berlesate samples from Chiapas and Veracruz (Sierwald *et al.* 2003). The authors surmised that siphoniulids may be deep humus dwellers that are missed by investigators focusing on larger, subsurface forms and concluded that "berlese extraction may be the best method of obtaining siphoniulids, and one should probably include substantial humus as well as loose litter."

***Ectonocryptoides*, new genus**

Type species. *Ectonocryptoides quadrimeropus*, new species.

Diagnosis. Ectonocryptopinae with 4 podomeres on ultimate legs, 2nd tarsi absent, tibiae and 1st tarsi inflated and bulbous, imparting subclavate appearance to overall appendage, latter with dorsal excavations forming terminal lobes and with short, fine hairs arising in shallow apical depressions; prefemora and femora heavily armored with small spines in addition to ventral spinous processes.

Species. One.

Distribution. Known only from coastal Jalisco.

Etymology. The generic name reflects the close anatomical similarity to *Ectonocryptops,* based on Crabill's written description (1977) of the latter.

Remarks. The discovery of a new scolopendromorph genus is a rare event. Only five years into the new millenium, two and three new genus-group names have already been erected in the Lithobiomorpha and Geophilomorpha, respectively; *Ectonocryptoides* is not only the first in the 21st century for the Scolopendromorpha, it is also the first since Schileyko (1992) established *Tonkinodentus* for a Vietnamese species. Only nine generic names have been proposed for scolopendromorphs since 1950[1], whereas around 36 and 78 have been proposed in the Lithobiomorpha and Geophilomorpha, respectively, during this same 55 year period, though some are junior subjective synonyms of older names (Jeekel

---

[1] They are *Dinocryptops* Crabill, 1953; *Thalkethops* Crabill, 1960; *Paratrigonocryptops* Demange, 1963, a subgenus of *Cryptops*; *Congobius* Dobroruka, 1968; *Asanadopsis* Würmli, 1972; *Ectonocryptops* Crabill, 1977; *Notiasemus* Koch, 1985; *Tonkinodentus* Schileyko, 1992; and *Ectonocryptoides* new genus.

2005 plus searches in Zoological Record, the Nomenclator Zoologicus website, and references in RMS' personal library); conversely, only three new genera have been proposed for the Scutigeromorpha, the least diverse global order. As the Scolopendromorpha contains the largest and most visible chilopods, with lengths ranging to over 300 mm (12 in) (Shelley and Kiser 2000), perhaps man has now discovered, named, and diagnosed most of the obvious genera, even with substantial unexplored areas in the tropics. However, minute, litter-dwelling scolopendromorphs are a different and virtually untouched realm, and where, it would seem, additional genera are most likely to be found.

Ectonocryptoides quadrimeropus, new species

Figs. 1–2, 5–16

Type specimens. Two syntypes (AMNH) collected by R. T. Schuh and B. M. Massie, 4–7 April 1985, at the Universidad National Autonoma de Mexico Field Station on Highway 200 (the coastal highway) at Chamela, 59 km (36.9 mi) N Barra de Navidad, Jalisco, Mexico.

Diagnosis. With the characters of the genus.

FIGURE 1. *Ectonocryptoides quadrimeropus*, lateral view of syntype with one attached ultimate leg.
FIGURE 2. The same, close up photo of terminal segment and ultimate leg.

FIGURE 3. Known occurrences of the Ectonocryptopinae. triangle, *Ectonocryptops kraepelini*; Dot, *Ectonocryptoides quadrimeropus*.

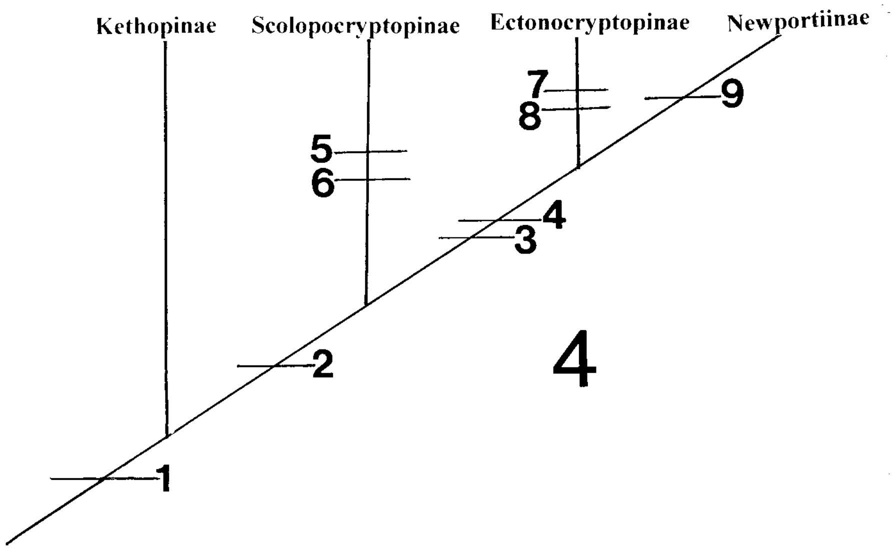
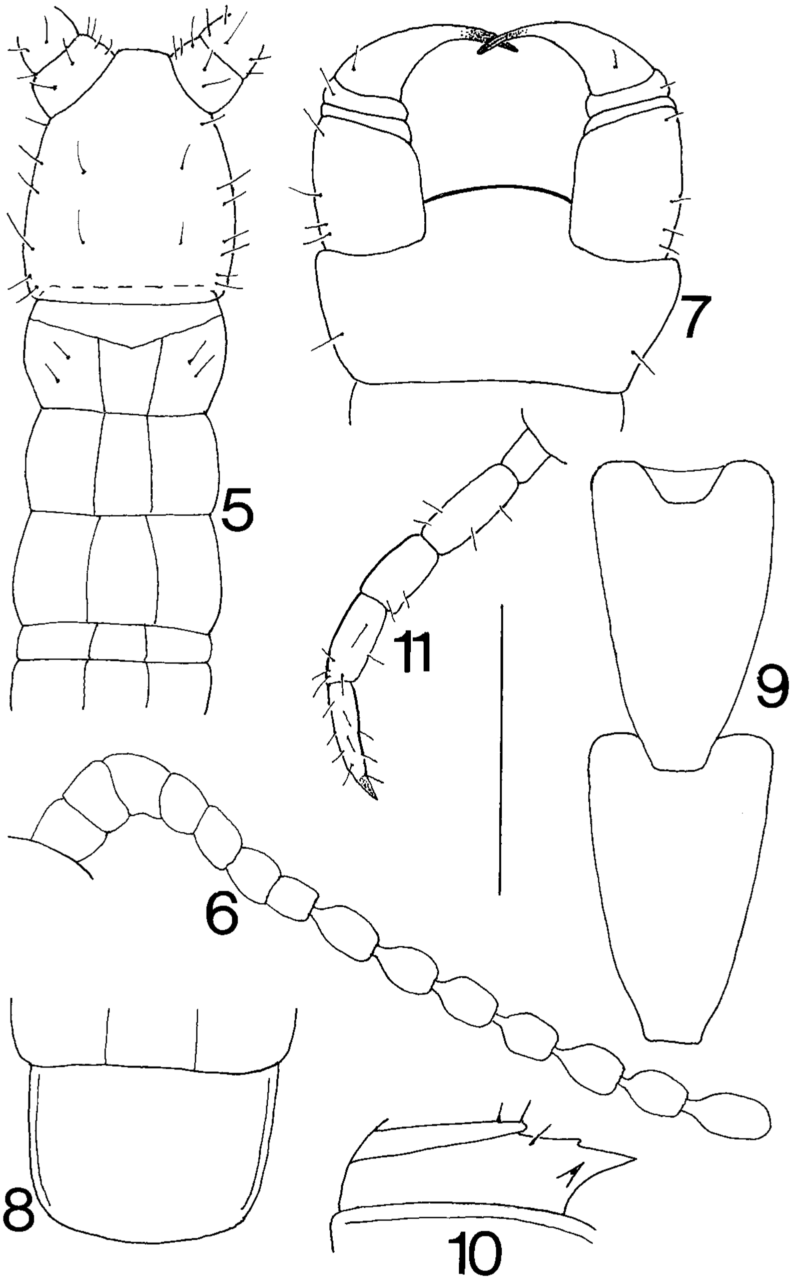


FIGURE 4. Hypothesized relationships among scolopocryptopid subfamilies; apomorphies are discussed in the text.



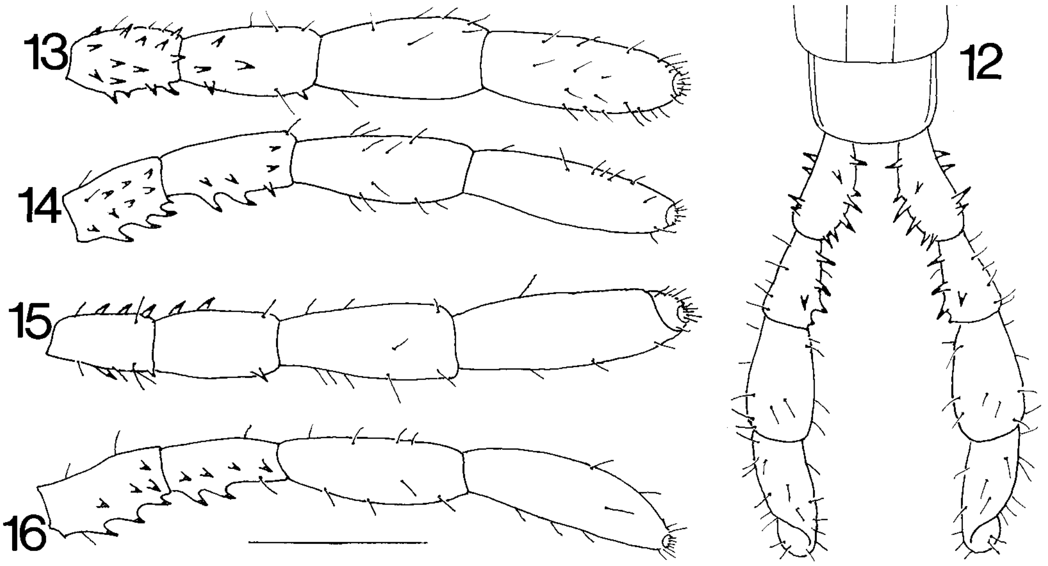
FIGURES 5–11. 5, Cephalic plate and T1–T4, dorsal view; 6, right antenna, setation omitted; 7, coxosternum and forcipules; 8, ultimate and penultimate tergites; 9, midbody sterna; 10, right coxopleura, lateral view; 11, midbody leg, caudal view. Scale line = 1.00 mm for figs. 5–6 & 9, 0.50 mm for figs. 7–8 & 10–11.

Syntypes. Bodies slender, fragile, and in poor condition, legs mostly detached and broken, only one ultimate leg still in place; cuticles detached from underlying tissues. Lengths ca. 10–12 mm, maximum widths ca. 0.7 mm. Preserved coloration light yellow, head and T1 darker. *Cephalic plate* (Fig. 5): longer than wide, slightly prolonged and truncate between antennal bases; sides slightly curved, caudal margin linear; surface essentially glabrous, with only a few short, fine hairs, sulci not detected. *Antennae*: reaching back to around midlength of T3; 17 antennomeres in both antennae in one syntype, but only 15 in the left antenna and 14 in the right in the other. Antennomeres 1–4 with a few scattered, relatively long setae, 6th to ultimate articles with dense, fine pubescence; distal 8–9 articles extended and loosely connected to each other on all antennae, revealing narrow, central, basal portions (Fig. 6). *Coxosternum*: anterior margin gently bowed outward and slightly thickened, without tooth plates or lobes; surface with only a few short hairs, sulci not detected (Fig. 7). *Forcipules*: set well apart basally with tarsungula substantially overlapping in closed position, with scattered setae, without processes, teeth, or tubercles (Fig. 7). *Tergites*: smooth, glabrous, and glossy, with only a few short hairs on T1–T2. T1 with angular anterior transverse suture, paramedian sulci converging slightly but well separated on caudal margin (Fig. 5). Sulci on other terga difficult to discern on detached cuticle, but apparently with complete paramedian ones on T2–T22; lateral and oblique sulci not detected. Pretergites evident from T4–T22 (Fig. 5). Ultimate tergite (T23) shorter than preceding, without paramedian sulci, with lateral sulci setting off slightly elevated margins (Fig. 8). *Sterna*: relatively long and wide, glabrous, without depressions or sulci, configuration generally that of an inverted triangle; endosterna narrower, fitting into complementary depressions on anterior surfaces of succeeding sterna (Fig. 9). Ultimate sternum short and narrow. *Coxopleura*: short and narrow, with one darkened, lateral spine apiece; apical spines sharply acuminate, not pigmented; pores not detected (Fig. 10). *Leg pairs 1-22*: longer than body widths, with 5 podomeres; prefemora with two short, stiff, ventral bristles, femora and tibiae with one ventral bristle apiece (Fig. 11). *Ultimate legs* (Figs. 12–16): femora slightly longer than prefemora; tibiae and 1st tarsi inflated and bulbous, latter excavated dorsally forming rounded terminal lobes, also with shallow apical depressions and fine, minute hairs arising from within. Prefemora with 3 ventral spinous processes, not aligned linearly, most apparent in medial and lateral profiles, also with numerous smaller spines of varying sizes on medial, lateral, and ventral surfaces but only one spine and a few scattered setae dorsally; femora with small spines of varying sizes on medial, lateral, and ventral surfaces in addition to 2 large, ventral spinous processes, dorsal surfaces with small distolateral spines; tibiae and 1st tarsi with only faint, scattered setae on all surfaces.

Variation. While the number of ventral spinous processes on the ultimate prefemora and femora is constant, the number and arrangement of the small spines varies. The spinous processes are best viewed in medial and lateral profiles; the podomeres are so minute, $\leq$ ca. 0.25 mm long, that they appear subsimilar to the other spines in direct ventral views.

Ecology. The syntypes were recovered from subtropical thorn forest litter at roughly 30 m (98 ft) elevation by Berlese extraction.

Distribution. Known only from the type locality.



FIGURES 12–16. 12, Reconstruction of ultimate tergite (T23) and legs, the right leg, still attached, is inverted and drawn on the left to simulate the natural condition. 13–16, spine and setal patterns on detached right ultimate leg; 13, ventral view; 14, medial view; 15, dorsal view; 16, lateral view. Scale line = 0.67 mm for fig. 12, 0.50 mm for figs. 13–16.

Etymology. Literally translated, the specific name means "four parts foot," and references the four podomeres on the ultimate legs.

Remarks. Because of the detached cuticles and the poor conditions of the syntypes, we were unable to detect the spiracles; *E. kraepelini* has 11 pairs, on segments 3, 5, 7, 8, 10, 12, 14, 16, 18, 20, and 22 (Crabill 1977). The positions of the spiracles and the structures of the mouthparts need to be characterized from fresh material in good condition.

Crabill (1977) did not record the width of *Ectonocryptops kraepelini*, but presumably it is approximately the same as that of *Ectonocryptoides quadrimeropus*, because the two ectonocryptopines are essentially the same length. At only 0.7 mm wide, the latter is the smallest known scolopocryptopid and at first glance appears to be a cryptopid; however, the specimens are even smaller than adults of North American species of *Cryptops*. We cannot be certain that either syntype is an adult, but they are essentially the same size and all external features seem fully developed. Crabill (1977) reported "about 20 small pores" on the ventral 2/3 of the coxopleura of *Ectonocryptops kraepelini*; however, RMS examined both specimens of *Ectonocryptoides quadrimeropus* from varying angles under varying intensities of both direct and incident light without detecting any, and the pores are readily visible in slightly larger individuals of *C. leucopodus* (Rafinesque, 1820). According to Lewis (1981), scolopendromorphs "frequently bear numerous pores" on the coxopleura, but the only other genera that we know of without pores are *Asanada* Meinert, 1886, and *Asanadopsis* Würmli, 1972 (Scolopendridae: Scolopendrinae) (Kraepelin 1903, Attems 1930, Lawrence 1955, Dobroruka 1969, Würmli 1972). Apparently, *Ectonocryptoides* also belongs in this rare category.

Acknowledgements

RMS thanks L. Prendini, AMNH curator, for permission to search through the museum's myriapod holdings, and A. Chagas, for answering questions and advising on *Dinocryptops miersii*. We especially thank R. G. Kuhler, for assistance with the line drawings, and A. E. Bogan and J. Raine, for helping prepare figs. 1–2. The manuscript benefited substantially from critical reviews by R. L. Hoffman, J. G. E. Lewis, and A. Minelli.

References

Attems, C. (1914) Die indo-australischen Myriopoden. *Archiv für Naturgeschichte*, 4(4), 1–398.

Attems, C. (1930) Myriapoda 2. Scolopendromorpha. *Das Tierreich*, 54, 1–308.

Attems, C. (1938) Die von Dr. C. Dawydoff in Französisch Indochina gesammelten Myriopoden. *Mémoires du Muséum National d'Histoire Naturelle, Paris, Nouvelle Série*, 6(2), 187–353.

Attems, C. (1953) Myriopoden von Indochina. Expedition von Dr. C. Dawydoff (1938–1939). *Mémoires du Muséum National d'Histoire Naturelle, Paris, Série A*, 5(3), 133–199.

Barr, T.C., & Reddell, J.R. (1967) The arthropod cave fauna of the Carlsbad Caverns Region, New Mexico. *Southwestern Naturalist*, 12, 253–274.

Bücherl, W. (1974) Die Scolopendromorpha der Neotropischen Region. *Symposia of the Zoological Society of London*, 32, 99–133.

Chagas, A., Jr. (2003) The Neotropical taxa of the genus *Dinocryptops* Crabill, 1953 (Chilopoda: Scolopendromorpha). *Zootaxa*, 237, 1–11.

Chagas, A., Jr., & Shelley, R.M. (2003) The centipede genus *Newportia* Gervais, 1847, in Mexico; description of a new troglomorphic species; redescription of *N. sabina* Chamberlin, 1942; revival of *N. azteca* Humbert & Saussure, 1869; and a summary of the fauna (Scolopendromorpha: Scolopocryptopidae: Newportiinae). *Zootaxa*, 379, 1–20.

Chamberlin, R.V. (1915) New chilopods from Mexico and the West Indies. *Bulletin of the Museum of Comparative Zoology*, 59(8), 495–541.

Chamberlin, R.V. (1920) The Myriopoda of the Australian region. *Bulletin of the Museum of Comparative Zoology*, 64(1), 1–269.

Crabill, R.E., Jr. (1958) A new *Kethops* from New Mexico, with a key to its congeners (Chilopoda, Scolopendromorpha, Cryptopidae). *Proceedings of the Entomological Society of Washington*, 60(5), 235–238.

Crabill, R.E., Jr. (1960). A new American genus of cryptopid centipede, with an annotated key to the scolopendromorph genera from American north of Mexico. *Proceedings of the United States National Museum*, 111, 1–15.

Crabill, R.E., Jr. (1977) A new cryptopid genus, with a key to the genera known to occur in North America including Mexico (Chilopoda: Scolopendromorpha: Cryptopidae). *Proceedings of the Entomological Society of Washington*, 79(3), 346–349.

Demange, J.-M. (1963) La Réserve Naturelle Intégrale de Mont Nimba. III. Chilopoda. *Memoires de l'Institut Français d'Afrique Noire*, 66, 41–118.

Demange, J.-M. (1966) Myriapodes récoltés aux Monts Loma (Sierra Leone) par la Mission E. N. S.-I. F. A. N. Note préliminaire. *Bulletin de l'Institut Français d'Afrique Noire*, 28, serie A (2), 583–595.

Demange, J.-M. (1968) Myriapodes Chilopodes du Gabon. *Revue "Biologia Gabonica,"* 4(3), 281–294.

Dobroruka, L.J. (1969) Some Chilopoda from Zambia. *Revue Zoologique et Botanique Africaines*, 79(3–4), 352–358.

Jeekel, C.A.W. (2005) Nomenclator generum et familiarum Chilopodorum: A list of the genus and family-group names in the Class CHILOPODA from the 10th edition of Linnaeus, 1758, to the end of 1957. *Myriapod Memoranda Supplement*, 1, 1–130.

Kraepelin, K. (1903) Revision der Scolopendriden. *Mitteilungen aus dem naturhistorischen Museum in Hamburg*, 20, 1–276.

Lawrence, R.F. (1955) Chilopoda. *South African Animal Life*, 2, 4–56.

Lewis, J.G.E. (1981) *The Biology of Centipedes*. Cambridge University Press, Cambridge, United Kingdom, 476 pp.

Lewis, J.G.E., Edgecombe, G.D., & Shelley, R.M. (2005) A proposed standardised terminology for the external taxonomic characters of the Scolopendromorpha (Chilopoda). *Fragmenta Faunistica*, 48(1), 1–8.

Pereira, L.A., Foddai, D., & Minelli, A. (1997) Zoogeographical aspects of neotropical Geophilomorpha (Chilopoda). *Entomologica Scandinavica Supplement*, 51, 77–86.

Pocock, R.I. (1895–1910) Chilopoda and Diplopoda. *Biologia Centrali Americana*, 217 pp. [Fascicle treating the Scolopocryptopidae distributed in January 1896].

Ribaut, H. (1912) Contribution à l'étude des Chilopodes de Colombie. *Mémoires de la Société neuchâteloise des Sciences naturelles*, 5, 67–95.

Ribaut, H. (1915) Notostigmophora, Scolopendromorpha Geophilomorpha (Myriapodes) (Première Série). *Archives de Zoologie Expérimentale et Générale*, 55, 323–346.

Schileyko, A.A. (1992) Scolopenders of Viet-Nam and some aspects of the system of Scolopendromorpha (Chilopoda Epimorpha). Part 1. *Arthropoda Selecta*, 1(1), 5–19.

Schileyko, A.A. (2002) Scolopendromorpha. pp. 479–500, *In*: Adis, J., ed., *Amazonian Arachnida and Myriapoda. Identification keys to all classes, orders, families, some genera, and lists of known terrestrial species*. Pensoft Publishers, Sofia, Bulgaria, 590 pp. + i–vi.

Schileyko, A.A., & Pavlinov, I.J. (1997) A cladistic analysis of the order Scolopendromorpha (Chilopoda). *Entomologica Scandinavica Supplement*, 51, 33–40.

Schileyko, A.A., & Minelli, A. (1998) On the genus *Newportia* Gervais, 1847 (Chilopoda: Scolopendromorpha: Newportiidae). *Arthropoda Selecta*, 7(4), 265–299.

Shelley, R.M. (1997) The Holarctic centipede subfamily Plutoniuminae (Chilopoda: Scolopendromorpha: Cryptopidae) (nomen correctum ex subfamily Plutoniinae Bollman, 1983). *Brimleyana*, 24, 51–113.

Shelley, R.M. (2000) Occurrence of the centipede, *Dinocryptops miersii* (Newport) (Scolopendromorpha: Scolopocryptopidae), in Tobago, Trinidad and Tobago. *Caribbean Journal of Science*, 36(1–2), 155–156.

Shelley, R.M. (2002) A synopsis of the North American centipedes of the order Scolopendromorpha (Chilopoda). *Virginia Museum of Natural History Memoir 5*, 1–108.

Shelley, R.M., & Kiser, S.B. (2000) Neotype designation and a diagnostic account for the centipede, *Scolopendra gigantea* L. 1758, with an account of *S. galapagoensis* Bollman, 1889 (Chilopoda Scolopendromorpha Scolopendridae). *Tropical Zoology*, 13, 159–170.

Shinohara, K. (1990) A new species of the genus *Scolopocryptops* (Chilopoda: Cryptopidae) from Japan. *Proceedings of the Japanese Society of Systematic Zoology*, 41, 62–65.

Sierwald, P., Shear, W.A., Shelley, R.M., & Bond, J.E. (2003) Millipede phylogeny revisited in the light of the enigmatic order Siphoniulida. *Zeitschrift für zoologische Systematik und Evolutionsforschung*, 41, 87–99.

Verhoeff, K.W. (1906) Vergleichend-morphologische Studien über die coxopleuralen Körperteile der Chilopoden, mit besonderer Berücksichtigung der Scolopendromorpha, ein Beitrag zur Anatomie und Systematik derselben, nebst physiologischen und phylogenetischen Mitteilungen und Ausblicken auf die Insekten. *Nova Acta Leopoldina*, 86, 349–502.

Verhoeff, K.W. (1907) [1902–1925] Chilopoda, pp. 1–725, *In*: Bronn, H.G., ed., *Klassen und Ordnungen des Tier-Reichs, wissenschaftlich dargestellt in Wort und Bild*, 5(2), 63–101.

Würmli, M. (1972) Chilopoda von Sumba und Flores I. Scolopendromorpha. *Verhandlungen der Naturforschenden Gesellschaft in Basel*, 82(1), 88–104.