New or little-known species of the genus *Echinotheridion* Levi (Araneae, Theridiidae)

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Summary

The male of *Echinotheridion cartum* Levi is described for the first time, and the species is newly recorded from Argentina. A male from Mato Grosso, Brazil, previously described as *Echinotheridion cartum*, is assigned to *Echinotheridion levii* n. sp. A new species, *Echinotheridion andresito*, is described from Misiones, Argentina and Rio de Janeiro, Brazil. Males of *Echinotheridion cartum* perforate the female's epigastrium, introducing a large pointed cymbial apophysis during mating.

Introduction

The genus *Echinotheridion* was established by Levi (1963) for four South American species, three of which were described as new, and the fourth as a new combination. At that time, only females were known, and the genus was characterised by having a very large epigynum and spurs on the fourth coxae.

Several years later, the same author (Levi, 1981) described for the first time a male of the genus, from a single specimen collected in Mato Grosso (Brazil), assigning it doubtfully to *E. cartum* Levi, 1963, known from Paraguay and Rio de Janeiro (Brazil). Buckup & Marques (1989) described *E. urarum* based on a male from Roraima (Brazil). In another paper Marques & Buckup (1989) described *E. lirum* from Manaus, Amazonas, based only on a female. Only one species, *E. gibberosum* (Kulczyński), is known outside South America, from the Canary Islands and Madeira (Schmidt, 1973). The males of *Echinotheridion* possess only one extraordinarily developed palpus, while the other may probably be amputated in a similar way as described by Branch (1942) for species of *Tidarren* Chamberlin & Ivie.

During recent trips several specimens of the genus *Echinotheridion* were collected in Misiones Province (Argentina) and in Rio de Janeiro State (Brazil). One of them is a male from Ilha Grande, Rio de Janeiro, different from the two species previously known from males. Several females of *E. cartum* were collected on the same island, one of them with a male palpal bulb inserted, piercing the epigastrium. This bulb coincides morphologically with that of the collected male. Given the similar body pattern of male and females, and the bulb found on a female, it seems reasonable to consider all these as members of a single species. It implies that the male from Mato Grosso assigned to *E. cartum* by Levi (1981) should be placed in a different taxon, and it is here considered as a new species, *E. levii*. We also describe an additional new species from Argentina and Brazil.

Material and methods

The descriptions follow Levi (1963). All measurements are in mm. The female reared in the laboratory was fed with *Drosophila* sp. The examined material is deposited in the following institutions (initials and curators in parentheses): Museu Nacional, Universidade Federal do Rio de Janeiro, Brazil (MRJ, Adriano Kury); Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires (MACN, Cristina Scioscia) and Museo de Ciencias Naturales de La Plata, Argentina (MLP, Luis Pereira).

Echinotheridion cartum **Levi, 1963** (Figs. 1–7)

Echinotheridion cartum Levi, 1963: 236, figs. 117–121 (female holotype from Apa River, Paraguay, in American Museum of Natural History).

Diagnosis: Males can be recognised by having two large, sharp and curved prolateral apophyses on the cymbium (Fig. 3).

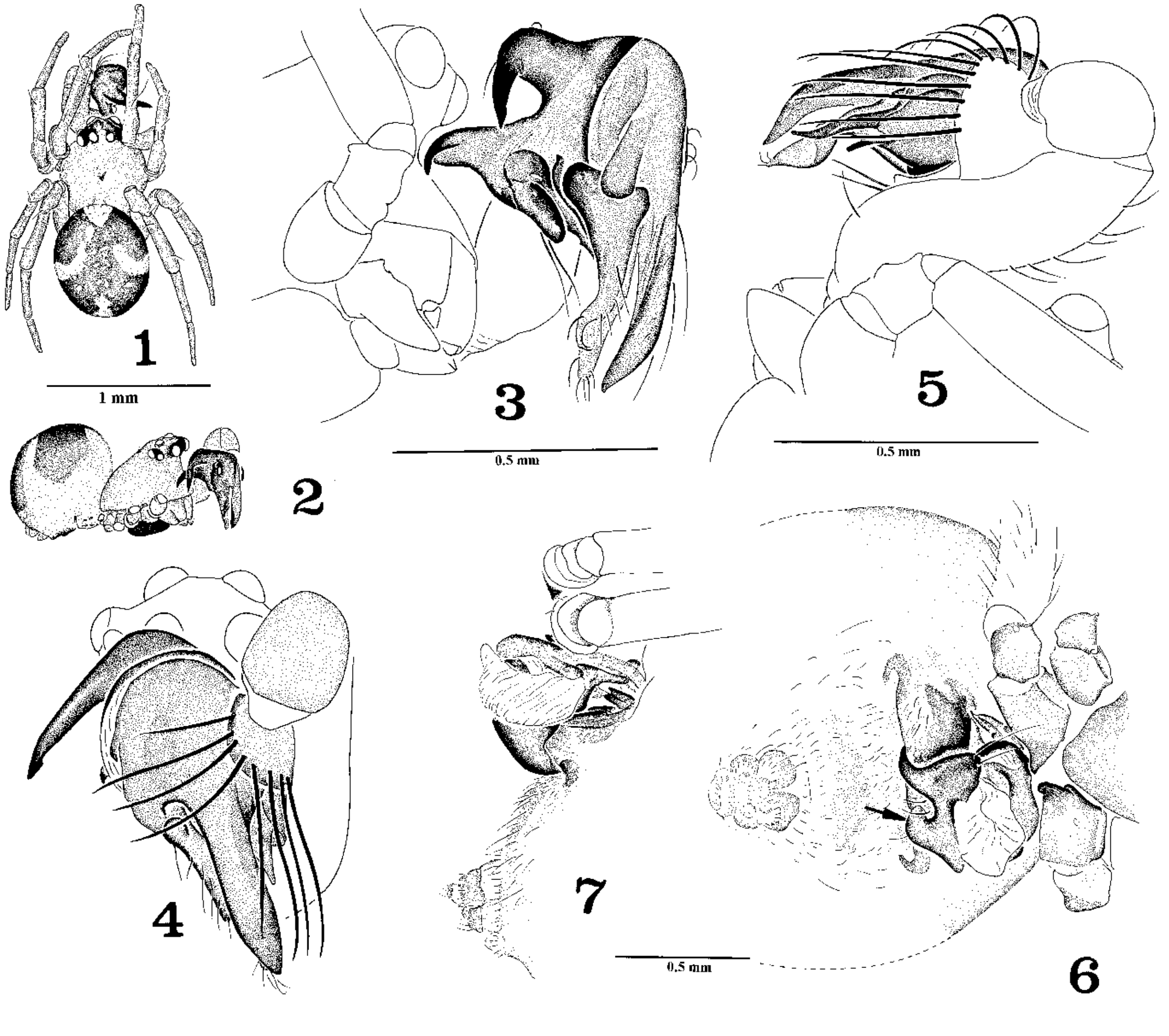
Description: *Male:* Carapace pale brown, with grey central spot, ocular area dark grey. Legs light brown with distal half of femora and ventral side from patellae to metatarsi grey. Chelicerae, labium and maxillae pale yellow; sternum very convex, dark grey. Abdomen pale yellow with dorsal dark grey spots, as in Figs. 1–2, and one ventral patch between epigastric groove and spinnerets. Ocular area high and protruding, clypeus long (Fig. 2). Chelicerae very short and weak, not reaching apex of maxillae. Right palpus missing. Coxae without modifications. Total length 1.26. Carapace length 0.56, width 0.56. Legs: I, femur 0.77, patella 0.22, tibia 0.32, metatarsus 0.38, tarsus 0.33; II, patella + tibia 0.54; III, patella + tibia 0.40; IV, patella + tibia 0.59. Only left palpus present (Figs. 3–5). Palpal femur thick, tibia with large, regularly disposed retrolateral setae. Cymbium with two large, sharp, curved prolateral apophyses and a slightly sclerotised apical process.

Female: Described by Levi (1963).

Note: One female from Ilha Grande was collected with a left male palpal bulb inserted in the epigastrium. The largest, more sharply curved, prolateral apophysis of the cymbium is deeply introduced into the female's abdomen, piercing the thin cuticle of the epigastric furrow, posteriorly to the epigynum (Figs. 6–7). The smaller prolateral apophysis fits in the epigastric fold, preventing the rotation of the bulb. In this position, the tip of the embolus is close to the copulatory openings. About half of the examined females had a small copulatory plug closing the copulatory openings, and one, two, or three small scars in the epigastrium, posterior to the epigynum. The scars were distributed through the specimens as follows: 3♀ with a scar on the left side (perforation as in Figs. 6–7), 1♀ with two on the left side, one posterior to the other, 2♀ with one on the right side, 2♀ with one on the right side and one in the centre, and 1♀ with three scars, on the right, left, and centre. The central scar might be produced by the smaller prolateral apophysis (see position in Fig. 6). The scars on left and right sides might have been produced by left- and right-palped males respectively. Females with scars on opposite sides, or two scars on the same side, could have experienced successive matings. The females without copulatory plugs had no scars, and are presumed to be virgin.

Natural history: Females build a cap-shaped shelter hanging from silk threads, with the opening facing down, 5 cm to 1 m above the ground, attached to vertical or overhanging sides of trunks or rocks. On the outside surface of the shelter the spider sticks soil particles, vegetal detritus or fragments of insects. The cocoons are placed inside the shelter. A subadult female from Ilha Grande kept in the laboratory until maturity attached and properly oriented the original shelter collected in the field, near the top of the flask. When the flask was turned upside-down, the spider moved the shelter and placed it again in the correct position. After moulting, she enlarged the side of the shelter with silk only, keeping the detritus in its original position. When soil was introduced into the flask, she stuck particles on the shelter. Another female from Urca, Rio de Janeiro, was collected in a shelter containing two cocoons, one with 10 eggs and the other with approximately 17 newly emerged juveniles, as well as several spiderlings with hairs and teeth completely developed.

Material examined: BRAZIL: *Rio de Janeiro*: Ilha Grande, surroundings of Villa Abraão, February 1994 (M. Ramírez), 1♂ (MACN 9567); Ilha Grande, Enseada



Figs. 1–5: *Echinotheridion cartum* Levi. **1** Male habitus, dorsal; **2** Ditto, lateral; **3** Left male palpus, prolateral; **4** Ditto, dorsal; **5** Ditto, retrolateral; **6** Female with male palpal bulb inserted in epigastrium, ventro-posterior view (arrow pointing to cymbial apophysis piercing epigastrium); **7** Ditto, lateral view.

das Palmas, 16–22 January 1996 (M. Ramírez), 1♀ (MACN 9566), 2–12 February 1997 (M. Ramírez), 7♀ (MACN 9568), 1♀ with ♂ palpal bulb inserted in epigastrium (MACN 9569), 3♀ (MLP); Pinheral, Barra do Piraí, 16–18 November 1988 (R. L. C. & A. Baptista), 1♀ (MRJ); Urca, Rio de Janeiro city, 16 April 1994 (M. Ramírez & R. L. C. Baptista), 2♀ (MACN 9572). *Minas Gerais*: Carrancas, 15 September 1992 (R. L. C. & A. Baptista), 1♀ (MRJ). ARGENTINA: *Misiones*: Parque Nacional Iguazú, 8–15 February 1995 (M. Ramírez), 2♀ (MACN 9570, 9571).

Echinotheridion levii, new species

Echinotheridion cartum: Levi, 1981: 178, figs. 1–2, ♂ (misidentification).

Type: Male holotype here designated, from Brazil, Mato Grosso, Sinop (12°31′S, 55°37′W), October 1975, M. Alvarenga, deposited in American Museum of Natural History, figured by Levi (1981).

Etymology: The specific name is dedicated to the arachnologist Herbert W. Levi, who first described this male.

Diagnosis: Males can be recognised by the three sharp prolateral apophyses on the cymbium, the median one much shorter than the others.

Description: Male described by Levi (1981).

Note: Because the pattern of the abdomen is not contrasting (Levi, 1981: fig. 1), it is quite improbable that this male could be assigned to any of the species known from females from Brazil and Argentina.

Echinotheridion andresito, new species (Figs. 8–13)

Type: Female holotype from Parque Nacional Iguazú, Misiones, Argentina, 8–15 February 1996 (M. Ramírez, MACN 9574).

Etymology: The specific name is a noun in apposition after the Chief of the Guaraní indians, Andresito (Andrés Guacurarí y Artigas, 1778–1822), who lived in Misiones Province, Argentina.

Diagnosis: Abdominal pattern as in *E. cartum*, from which it can be distinguished by the wider triangular scape and the shorter copulatory ducts (Figs. 11–13).

Description: Carapace light brown, with grey central spot, ocular area dark grey. Legs light brown, with distal half of femora and ventral side of patellae and tibiae grey. Chelicerae, labium and maxillae pale yellow; sternum very convex, dark grey. Abdomen light grey, with grey and white marks as in Figs. 8–9. Ocular area high (Fig. 10). Chelicerae longer than clypeus, but not reaching apex of maxillae. Posterior coxae with mesal spurs (Fig. 9). Total length 1.65. Carapace length 0.74, width 0.67. Legs: I, femur 0.89, patella 0.32, tibia 0.60, metatarsus, 0.71, tarsus 0.49; II, patella+tibia 0.62; III, patella+tibia 0.53; IV, patella+tibia 0.78. Epigastric area prominent, epigynum large, with triangular scape (Figs. 11–12). Spermathecae large, copulatory ducts short (Fig. 13).

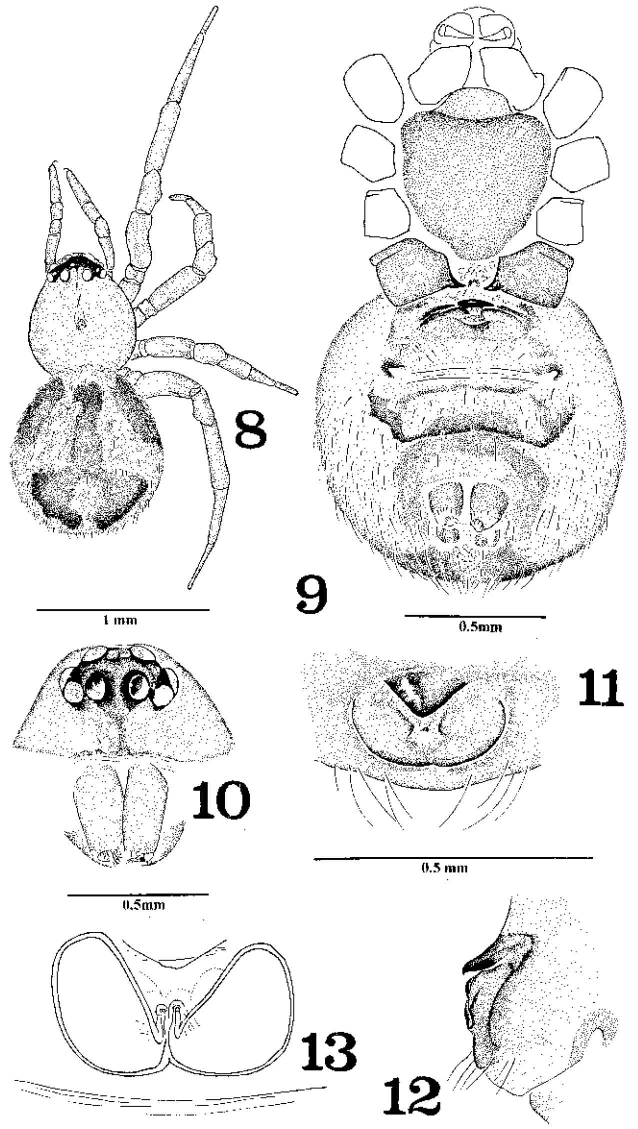


Fig. 8–13: *Echinotheridion andresito*, new species, female. **8** Habitus, dorsal; **9** Ditto, ventral; **10** Carapace and chelícerae, anterior; **11** Epigynum, ventral; **12** Ditto, lateral; **13** Cleared vulva, ventral.

Other material examined: BRAZIL: *Rio de Janeiro*: Teresópolis, Sede Parque Nacional Serra dos Orgãos (R. L. C. Baptista), 1♀ paratype (MRJ).

Natural history: The female holotype was collected in a shelter similar to that of *E. cartum*.

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The effect of leg loss on prey capture in *Nephila clavipes*

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Summary

Efficiency of prey capture in *Nephila clavipes* suffered as a result of leg loss in two ways. Spiders that had lost legs built webs which retained prey less well than normal webs. Moreover, spiders with missing legs oriented less accurately and caught prey more slowly, even when placed in the more regular webs built by intact spiders.

Introduction

The golden-web spider *Nephila clavipes* (L.), like many other orb spiders, builds its webs across insect flight paths (Castillo & Eberhard, 1983). Because of a very tight mesh, the huge webs are capable of intercepting rather small prey; thus tiny Hymenoptera and Diptera, minute relative to the spider, may constitute a major part of *Nephila*'s diet (Robinson & Mirick, 1971; Hill & Christenson, 1981; Rypstra, 1985; Nentwig, 1985). Mesh size (spacing of the capture spiral) typically influences the predatory success of spiders: narrower meshes retain smaller insects (Chacón & Eberhard, 1980) and thus prey interception is correlated with thread density (Eberhard, 1986; ap Rhisiart & Vollrath, 1994). However, there are costs as well as benefits of a fine mesh: the size of a web, the area covered by the capture spiral, the number of load-bearing radii, the spacing and regularity of the capture spiral, and the total amount of silk in a web can all be interrelated and traded off against one another (Craig, 1987). Further costs and trade-offs are found in the metabolism, speed and accuracy of the building process that leads to the final structure, i.e. the building behaviour with its complex manipulation, locomotion and orientation behaviour patterns (Vollrath, 1992).

The behaviour of most animals would be affected by the loss of a leg. Especially so, one would have thought, a highly tuned and interactive behaviour such as the orb spider's web-building (Vollrath, 1987). Leg loss does indeed cause altered geometry of webs in *Araneus diadematus* Clerck (Jacobi-Kleemann, 1953; Reed *et al.*, 1965) and *Zygiella x-notata* (Clerck) (Le Guelte, 1965) as well as in *Nephila clavipes* (Weissmann & Vollrath, in prep.). In all three species the webs of spiders with missing legs were smaller and less regular, and had fewer radii and spiral turns (Weissmann & Vollrath, in prep.). Regularity, in particular, could be strongly affected if more than one leg was missing. Thus leg loss can indirectly affect a spider's prey-capture success through its effect on web geometry (Weissmann & Vollrath, 1998). In addition, leg loss might also directly affect prey capture by partially incapacitating the spider and thus slowing it down. Prey attack is an important part of the integrated system spider+web dealing with the incoming prey, and it is the part of the capture sequence where speed and accuracy of orientation can matter tremendously (Klärner & Barth, 1982; Landolfa & Barth, 1996). Our study was designed to examine specifically this aspect in *Nephila clavipes*. In nature, leg loss is typically found in 5–10% of a given species, thus compensating for leg loss is a realistic selection pressure for web spiders (Vollrath, 1990, 1995; Weissmann & Vollrath, 1998), with *Nephila* being no exception.

Material and methods

Nephila clavipes is common in tropical and subtropical regions of South and North America. It builds a large and tightly meshed web (*c.* 60 cm diameter) at the edges of forest clearings and across paths and streams. The web is U-shaped with the hub close to the upper rim. Often the web is surrounded by a three-dimensional structure of threads that connect to the surrounding vegetation.

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