

A cladistic analysis of Zoropsidae (Araneae), with the description of a new genus

Jan Bosselaers

“Dochterland”, R. novarumlaan 2, B-2340 Beerse, Belgium

ABSTRACT. A cladistic analysis of the spider family Zoropsidae has been performed. The ingroup of the analysis consisted of eight species traditionally classified in Zoropsidae, including *Zoropsis cyprogenia* Bosselaers, 1997, of which the hitherto unknown male has been recently discovered, and *Takeoa nishimurai* (Yaginuma, 1963). The outgroup contained four species, belonging to the genera *Ctenus* Walckenaer, 1805, *Acanthoctenus* Keyserling, 1876 and *Griswoldia* Dippenaar-Schoeman & Jocqué, 1997. Three different weighting schemes allowed selection of one preferred, most parsimonious tree. This tree implies that *Zoropsis cyprogenia* has to be placed in a new genus within Zoropsidae. A description of *Akamasia* n. gen. is given, as well as a redescription of *Acanthoctenus gaujoni* Simon, 1906.

KEY WORDS: Araneae, Zoropsidae, Ctenidae, *Zoropsis*, *Takeoa*, *Akamasia*, *Acanthoctenus*, cladistics, parsimony, weighting.

INTRODUCTION

According to SIMON (1892: 227-230), the spider family Zoropsidae Bertkau, 1882, consisted of two subfamilies: Acanthotheninae, with only one genus, *Acanthoctenus* Keyserling, 1876, and Zoropsinae, composed of three genera: *Raecius* Simon, 1892, *Zorocrates* Simon, 1888, and *Zoropsis* Simon, 1878. SIMON (1903: 974-975) later added *Uduba* Simon, 1880 to Zoropsinae. PETRUNKEVITCH (1923: 170; 1928: 146) raised Simon's Acanthotheninae and Zoropsinae to family rank and included *Zorodictyna* Strand, 1907, in the family Zoropsidae. ROEWER (1954: 1283-1288) also listed both groups as families.

LEHTINEN (1967: 374-378) dispensed with Zoropsidae and Acanthothenidae altogether: he transferred *Raecius*, *Uduba*, *Zorocrates* and *Zorodictyna* to Miturgidae and placed *Zoropsis* in the family Zoridae. He also described a new genus, *Takeoa* Lehtinen, 1967, which was attributed to Zoridae as well and to which he transferred *Zoropsis nishimurai* Yaginuma, 1963. Furthermore, LEHTINEN (1967) redelimited *Acanthoctenus* and placed it in Ctenidae, Acanthotheninae, a subfamily to which he added a large number of other genera: *Acantheis* Thorell, 1891, *Africactenus* Hyatt, 1954, *Anahita* Karsch, 1879, *Asthenoctenus* Simon, 1897, *Caloctenus* Keyserling,

1876, *Centroctenus* Mello-Leitão, 1929, *Enoploctenus* Simon, 1896, *Gephyroctenus* Mello-Leitão, 1936, *Leptoctenus* Koch, 1878, *Nothroctenus* Badcock, 1932, *Phymatoctenus* Simon, 1896, *Trujillina* Bryant, 1948, and *Viracucha* Lehtinen, 1967.

Several authors (WUNDERLICH, 1986; LEVY, 1990; CODDINGTON & LEVI, 1991; GRISWOLD, 1993; GRISWOLD et al., 1999) have since revalidated the family Zoropsidae, because the eye arrangement and the presence of scopulae in *Zoropsis* does not fit well in Lehtinen's Zoridae. The family Zoropsidae is limited nowadays to the genera *Zoropsis* and *Takeoa* (PLATNICK, 1993, 2002). However, cladograms presented by CODDINGTON & LEVI (1991), GRISWOLD (1993), and GRISWOLD et al. (1999) group *Acanthoctenus* together with Zoropsidae in one clade.

The family Zoropsidae, as presently delimited, has the following somatic characters (LEVY, 1990: 139): presence of a calamistrum and a narrow, bipartite cribellum; carapace with a longitudinal thoracic groove and eight eyes in two rows, arranged in a pattern similar to that of the family Lycosidae; toothed chelicerae; all legs with strong spines, tibiae and metatarsi I and II equipped with several pairs of ventral spines; metatarsi bearing scopulae and an apical, soft membranous rim on dorsum, tarsi bearing scopulae, trichobothria, claw tufts and two tarsal claws. The family is palearctic, but *Zoropsis spinimana* (Dufour, 1820) has recently been introduced into North America (GRISWOLD & UBICK, 2001).

ROEWER (1954) listed 12 species and two subspecies in the genus *Zoropsis*. BRIGNOLI (1983) catalogued five more species and PLATNICK (1993) yet another species. BOSSELAERS (1997) described an additional species based on a female specimen from Cyprus. Many of the species described, e.g. in DAHL (1901a, 1901b), have later been synonymised (LEHTINEN, 1967; WUNDERLICH, 1994). On the other hand, WUNDERLICH (1994: 724) and THALER & KNOFLACH (1998: 179) removed *Zoropsis quedenfeldti* Dahl, 1901 and *Zoropsis oertzeni* Dahl, 1901 from synonymy with *Zoropsis spinimana*. In the absence of a complete revision of the family Zoropsidae, this leaves us with 14 Zoropsid species: *Zoropsis beccarii* Caporiacco, 1935, a doubtful species described from a juvenile from Turkey; *Zoropsis bilineata* Dahl, 1901 from Morocco, Algeria and Mallorca; *Zoropsis coreana* Paik, 1978 from Korea; *Zoropsis cyprogenia* Bosselaers, 1997 from Cyprus; *Zoropsis libanica* Simon, 1884, a doubtful species from the Middle East; *Zoropsis lutea* (Thorell, 1875) from the eastern Mediterranean; *Zoropsis markamensis* Hu & Li, 1987 from China; *Zoropsis media* Simon, 1878 from the western Mediterranean; *Zoropsis oertzeni* from Italy and the Balkan; *Zoropsis pekingensis* Schenkel, 1953 from China; *Z. quedenfeldti* from Morocco; *Zoropsis rufipes* (Lucas, 1838) from the Canary isles and Madeira; *Zoropsis spinimana* (Dufour, 1820) from southern Europe and northern Africa and *Takeoa nishimurai* (Yaginuma, 1963) from Japan and China (CHEN & ZHANG, 1991).

The most recent treatments of seven Mediterranean and Atlantic *Zoropsis* species can be found in WUNDERLICH (1994) and THALER & KNOFLACH (1998).

Recently, the male of *Zoropsis cyprogenia* has been collected. Upon study of the specimen, it became obvious that this species does not belong in *Zoropsis* and has to be placed in a genus of its own. A cladistic analysis has been performed to study the matter in more detail.

MATERIAL AND METHODS

Specimens were studied by means of incident light under a stereomicroscope equipped with an eyepiece grid. Internal female genitalia were observed after clearing the vulva in methyl salicylate. Cleared vulvae were observed with a compound microscope using transmitted light. The vulva illustrated was photographed in several focal planes under a compound microscope and the photographs of these optical sections were subsequently used for the execution of the drawing. All measurements are in mm.

Cladistic analyses were performed using the computer programmes Pee-Wee 2.6 (GOLOBOFF 1997a), NONA 2.0 (GOLOBOFF 1997b), PAUP 4.0 beta 4a (SWOFFORD 1999) and SEPAL 1.1 (SALISBURY 2000a). Optimisation of character states and printing of the preferred tree was performed using Winclada 1.0 (NIXON 2002). All analyses were run on a 1 Ghz pentium III machine with 256 Mb RAM.

ABBREVIATIONS USED

APS:	apparent phylogenetic signal
ci:	consistency index
do:	dorsal
fe:	femur
MA:	median apophysis of the male palp
MOQ:	median ocular quadrangle
mt:	metatarsus
MTP:	membranous tegular process
pa:	patella
pl:	prolateral
rc:	rescaled consistency index
ri:	retention index
rl:	retrolateral
RAM:	random access memory
RTA:	retrolateral tibial apophysis
ta:	tarsus
TBR:	tree bisection and reconnection
ti:	tibia
ve:	ventral
vsp:	ventral spine pairs

Abbreviations of personal and institutional collections (curators in parentheses):

ACJ:	Arachnological Society of Japan, Otemon Gakuin University, Osaka (Y. Nishikawa)
AMNH:	American Museum of Natural History, New York (N. Platnick)
CCD:	Collection Christa Deeleman
CJB:	Collection Jan Bosselaers
CJK:	Collection Johan Van Keer
CKT:	Collection Konrad Thaler
CMA:	Collection Martin Askins
CPC:	Collection Pedro Cardoso
CRB:	Collection Rop Bosmans
MNHN:	Muséum National d'Histoire Naturelle, Paris (C. Rollard)
NCA:	National Collection of Arachnida, Pretoria (A. Dippenaar-Schoeman)
RBINS:	Royal Belgian Institute of Natural Sciences, Brussels (L. Baert)
USMN:	United States National Museum of Natural History (D. Furth)

RESULTS AND DISCUSSION

PHYLOGENETIC ANALYSIS

Taxon choice

The ingroup of the analysis consists of eight species belonging to the two genera presently recognised within Zoropsidae: on the one hand the enigmatic eastern Asian *Takeoa nishimurai* and on the other hand *Zoropsis bilineata*, *Zoropsis lutea*, *Zoropsis media*, *Zoropsis oertzeni*, *Zoropsis rufipes*, *Zoropsis spinimana*, and the species recently described as *Zoropsis cyprogenia*. Four species constitute the outgroup. Two of these belong to the genus *Acanthothenus*, the sister group of Zoropsidae in the cladograms published by CODDINGTON & LEVI (1991),

GRISWOLD (1993), and GRISWOLD et al. (1999): *Acanthoctenus gaujoni* Simon, 1906 and an undescribed *Acanthoctenus* species from Peru. The other two outgroup species belong to the “ctenoid complex” which GRISWOLD (1993) considers to be a sister group to the Zoropsidae-

Acanthoctenus clade: *Griswoldia urbensis* (Lawrence, 1942) and an undescribed *Ctenus* species from South Africa that is closely related to *Ctenus gulosus* Arts, 1912. Collection details of the specimens studied can be found in Table 1.

TABLE 1

Specimens examined to provide character data, with collection data and deposition.

<p><i>Acanthoctenus gaujoni</i> Simon, 1906; 1m (holotypus): Ecuador, Loja, Zamora, Gaujon leg. (MNHN AR5168); 1f (paratypus): Ecuador, Loja, Zamora, Gaujon leg. (MNHN AR5168).</p> <p><i>Acanthoctenus</i> sp.; 1m, 1f: Peru, Madre de Dios, Zona Reservada Tambopata, S 12° 50' W 69° 17', elev. 290 m, 8 and 6 Jun. 1988, J. Coddington leg. (USNM 2009677).</p> <p><i>Akamasia cyprogenia</i> (Bosselaers, 1997); 1m: Cyprus, Akamas peninsula, Neo Chorion, March 1998, M. Askins leg. (CMA); 1f (holotypus): Cyprus, Akamas peninsula, Avakas Gorge, in leaf litter on the bank of Avgas river, elev. 20 m, 5 April 1997, J. Bosselaers leg. (RBINS 28515).</p> <p><i>Ctenus</i> sp.; 2m, 2f: South Africa, Kwazulu-Natal, Ngome State Forest, E 31° 26' S 27° 49', in pitfall trap in pine forest, Jan. 1993, M. v.d. Merwe leg. (NCA 94/719).</p> <p><i>Griswoldia urbensis</i> (Lawrence, 1942); 5m, 5f: South Africa, Kwazulu-Natal, Ngome State Forest, E 31° 26' S 27° 49', in pitfall trap in grass, Jan. 1993, M. v.d. Merwe leg. (NCA 94/712).</p> <p><i>Takeoa nishimurai</i> (Yaginuma, 1963); 1m (paratypus): Japan, Kyoto prefecture, Kyoto City, Fushimi-ku, Momoyama, 22 Mar. 1962, T. Nishimura leg. (ACJ); 1f (holotypus): Japan, Yamaguchi pref., Hikari City, Murozumi-cho, 7 Jul. 1962, K. Nakagawa leg. (ACJ).</p> <p><i>Zoropsis bilineata</i> Dahl, 1901; 1m, 1f: Algeria, W. Laghouat, Laghouat, Oued M' Zi, elev. 750 m, litter under reed, 22 Dec. 1987, R. Bosmans leg. (CRB); 2f: Morocco, Vallée du Drâa, 8 km South of Tansikht, under stones in palm tree plantation, 5 Feb. 1996, J. Van Keer leg. (CJK 1564).</p> <p><i>Zoropsis lutea</i> (Thorell, 1875); 2m: Greece, South Peloponnesos, Girion Sirio camping, 1 Oct. 1991, B. Knoflach leg. (CKT); 1f: Greece, Rhodos, N.E. of Laerma, in field under stones, 15 Apr. 1984 (CCD); 1f: Greece, Attika, Athens, Mt. Parnes, elev. 500 m., under stones, 5 Jan. 1985 (CCD); 1f: Crete, Ano Zaros, elev. 450 m, in olive grove under stones, 10 Apr. 1995 J. Bosselaers leg. (CJB 1190); 1f: Crete, Akrotiri, Moni Gouverneto, elev. 200 m, near entrance of Bear Cave under stones, 9 Apr. 1996 J. Bosselaers leg. (CJB 1093); 1f: Cyprus, Limassol, Akrotiri Salt Lake, salt march, under stones, 2 Apr. 1997 J. Bosselaers leg. (CJB 1274); 1f: Crete, Aghia Galini, at beach under stones, 3 May 1997, J. Van Keer leg. (CJK 1743).</p> <p><i>Zoropsis media</i> Simon, 1878; 1m: France, Banyuls, 2 Feb. 1912 (MNHN AR211); 3m, 8f: Algeria and Southern France (MNHN AR208); 1f: Spain, Palamós, Cap Gros, elev. 70 m, in litter in pine wood near sea, 21 Jul. 1995, J. Bosselaers leg. (CJB 1197).</p> <p><i>Zoropsis oertzeni</i> Dahl, 1901; 1m: Slovenia, Sezana Blazeva, Kustor leg. (CCD); 1m: Croatia, N. Dalmatia, Isle of Cres, Dragozetici, elev. 400 m, in oak litter (CCD); 1f: Croatia, N. Dalmatia, Isle of Pag, Diniste, 7 Apr. 1971 (CCD); 1f: Greece, Attiki, Piraeus, Alephari, shaded camping, 22 May 1998, R. Bosmans leg. (CRB); 1f: Greece, Peloponnesos, Achaia, Kalogria, in salt marsh, 30 May 1998, J. Van Keer leg. (CJK 1844).</p> <p><i>Zoropsis rufipes</i> (Lucas, 1838); 1m, 1f: Spain, Canary Islands, Tenerife, Nov. 1975, P. Oromi leg. (AMNH, Griswold's Lycosoid study exemplars).</p> <p><i>Zoropsis spinimana</i> (Dufour, 1820); 2m: Portugal, Baixa da Banheira, 16 Dec. 1997, P. Cardoso leg. (CPC); 1f: Spain, Gerona, Empuria Brava, under stones near house, 7 Jul. 1995, J. Van Keer leg. (CJK 1584).</p>
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Character coding and description

A series of 56 characters (43 binary and 13 multistate) was coded for the 12 taxa chosen. Character state numbering does not imply plesiomorphy or apomorphy, because character polarity is derived during cladogram search by outgroup comparison (WATROUS & WHEELER 1981; MADDISON et al. 1984; KITCHING et al. 1998). Where necessary (Characters 21, 22, 23, 24, 29, 30, 47, 48, 50, 51, 54, 55), characters were scored with character states hierarchically related, as advocated by HAWKINS et al. (1997), even though this necessitated coding missing entries due to character inapplicability in some instances

(MADDISON 1993). A few of the characters used (Characters 9, 13, 14, 23, 24, 32, 40, 47) are autapomorphies and as a result phylogenetically uninformative, but they were included in the matrix nevertheless since these characters are potential synapomorphies that might be of interest to future workers preparing analyses on larger numbers of taxa. Because most of the species studied in the analysis have heavily spined legs, 12 characters refer to leg spination. Establishing homology between individual spider leg spines is not always straightforward. Fortunately, in a number of cases such as the do, pl and rl tibial spines (Characters 2, 3, 4, 9, 10, 11, 12), there can be little doubt about homology and the presence of indi-

vidual spines could be scored. However, in the case of tibial and metatarsal vsp, establishing homology of individual spines was problematic (Characters 5, 6, 7, 8). Rather than dismissing this probably important information altogether, it was decided to score these characters as multi-state characters describing numbers of spine pairs.

The characters used in the analysis

Legs

1. *Male tibial crack*: (0) absent; (1) present. This character was first described by GRISWOLD (1993: 1, 23, Figs. 3, 4) as “a conspicuous suture line visible through the cuticle at the base of the leg tibiae of males just distal to the basal pair of ventral spines; it is visible on the surface as a shallow, depressed ring”. When present, the male tibial crack is clearly visible.
2. *Male ti I basal do spine*: (0) absent; (1) present.
3. *Male ti I median do spine*: (0) absent; (1) present.
4. *Male ti I terminal do spine*: (0) absent; (1) present.
5. *Number of male ti I vsp*: (0) 5; (1) 6; (2) 8; (3) 9.
6. *Number of male mt I vsp*: (0) 2; (1) 3; (2) 4; (3) 5.
7. *Number of female ti I vsp*: (0) 5 or less; (1) 6; (2) 8; (3) 9.
8. *Number of female mt I vsp*: (0) 3; (1) 4; (2) 5.
9. *Female ti I basal pl spine*: (0) absent; (1) present. Apart from several vsp, tibiae I and II of most of the species studied also carry spines on the pl and rl faces.
10. *Female ti I basal rl spine*: (0) absent; (1) present.
11. *Female ti I median pl and rl spine*: (0) absent; (1) present. When present, both spines always occurred together in the specimens studied.
12. *Female ti I terminal pl and rl spine*: (0) absent; (1) present.
13. *Female ti I additional pl and rl spines*: (0) absent; (1) present.
14. *Dense claw tufts*: (0) absent; (1) present.
15. *Ve scopulae on ta*: (0) absent; (1) present.
16. *Patellar indentation*: (0) wide; (1) narrow. The patellar indentation is a slit-like membranous indentation on the rl side of the pa. May be very narrow (“closed”) or rather wide (SIMON, 1892: 22; LEDOUX & CANARD, 1991: Fig. 15A-15B).
17. *Trochanter notch depth*: (0) shallow; (1) deep.

Cephalothorax

18. *Ctenid eye pattern*: (0) absent; (1) present. The classic ctenid eye pattern consists of three rows (2:4:2). Because the anterior eye row is strongly recurved, the anterior lateral eyes are situated just in front of the posterior lateral eyes (DIPPENAAR-SCHOEMAN & JOCQUÉ, 1997: 135-136).
19. *Number of male retromarginal cheliceral teeth*: (0) 2; (1) 3; (2) 4.
20. *Number of female retromarginal cheliceral teeth*: (0) 2; (1) 3; (2) 4.

Abdomen

21. *Cribellum*: (0) present; (1) absent.
22. *Cribellum shape*: (0) linear; (1) oval.

Male palp

The homology of the various tegular apophyses of the male palp (Fig. 1c) is still not fully elucidated for most spiders. A hyaline or sclerotised appendage, immovably attached to the tegulum and facing the embolus tip is considered to be a conductor in this analysis, while a sclerotised appendage that is flexibly attached to the tegulum via a thin membrane is considered to be a MA (SIERWALD 1990: 21; GRISWOLD 1993: 10). In addition to conductor and MA, many of the species studied also have a hyaline membranous flap attached to the tegulum near the embolus base: the MTP (Fig. 1c). Unfortunately, the terminology used to designate the three appendages mentioned differs significantly between authors. The MA of GRISWOLD (1993: 10), LEHTINEN (1967: 377) and SIERWALD (1990: 21) is called “hooked tegular apophysis” by LEVY (1990: 140) and “Tegularapophyse” by THALER & KNOFLACH (1998: 175). The MTP of GRISWOLD (1993: 15) and LEVY (1990: 140) is called “distal apophysis” by SIERWALD (1990: 22) and “Begleitfortsatz des Embolus” by THALER & KNOFLACH (1998: 175). For unspecified reasons, and in contrast to the other authors mentioned here, LEHTINEN (1967: 377) calls the conductor “secondary conductor” and considers the embolus to be a complex of embolus and “primary conductor”.

23. *Conductor*: (0) present; (1) absent.
24. *Conductor texture*: (0) hyaline; (1) sclerotised.
25. *Embolus insertion*: (0) basal; (1) median; (2) apical. The embolus base can be inserted in the basal (Fig. 4a), median (Figs 5a) or apical third (Fig. 1c) of the tegulum.
26. *Embolus cross section*: (0) flattened; (1) cylindrical; (2) obtusely triangular.
27. *Embolar lamella*: (0) absent; (1) present. In many of the species studied, the embolus has a uni- or bilaterally flattened “wing”, referred to as the embolar lamella in this publication (Figs 1c, 5c).
28. *MA insertion*: (0) basal; (1) median; (2) apical. The MA base can be inserted in the basal (Fig. 5c), median (Fig. 5a) or apical third (Fig. 4a) of the tegulum.
29. *MA shape*: (0) cup-shaped; (1) convex, with tip.
30. *MA tip*: (0) simple; (1) bifid; (2) mushroom-shaped.
31. *MTP*: (0) absent; (1) present.
32. *Proximal rim of tegulum*: (0) unmodified; (1) with lamella; (2) with bump. The proximal tegular rim bears a lamellar outgrowth in *Zoropsis bilineata* (THALER & KNOFLACH, 1998: Fig. 10) and a conspicuous bump in *Griswoldia urbensis* (GRISWOLD, 1991: Fig. 65).
33. *Proximal pl part of tegulum*: (0) not protruding; (1) protruding. The proximal pl part of the tegulum is protruding in most of the species studied (Fig. 1c).
34. *Proximal rl part of tegulum*: (0) not protruding; (1) protruding. The proximal rl part of the tegulum is protruding in *Takeoa nishimurai* and *Akamasia cyprogenia* (Figs 1a, 4a).

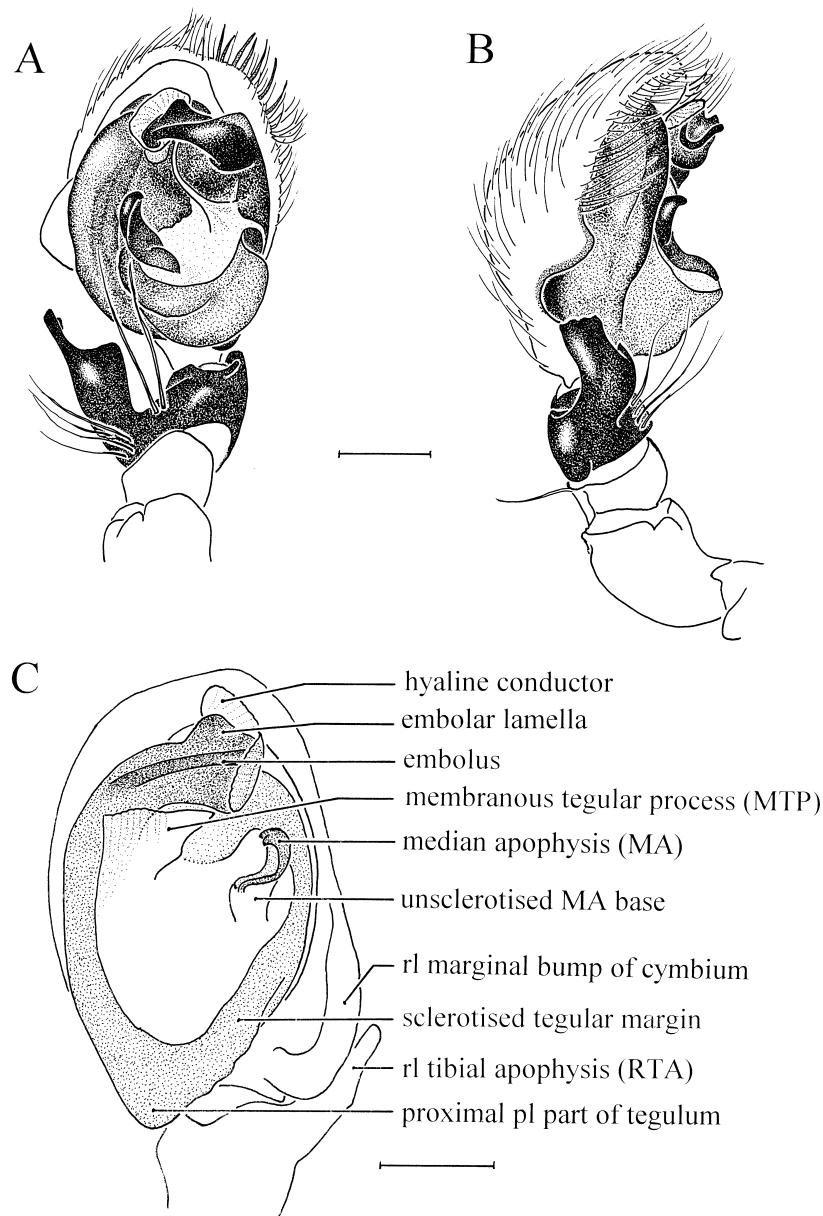


Fig. 1. – *Takeoa nishimurai*, right male palp. – A. Ventral view. – B. Retrolateral view. – *Zoropsis spinimana*. – C. Schematic ventral view of left male palp. Scale bars = 0.5 mm.

35. *Protruding basal part of tegulum*: (0) absent; (1) present. In some species, e.g. *Takeoa nishimurai*, the basal half of the tegulum, when viewed laterally, is protruding and making an angle with the distal half (Fig. 1b).
36. *Unsclerotised basal part of MA*: (0) absent; (1) present. In *Zoropsis*, the basal part of the MA is a white, unsclerotised stalk (Figs 1c, 5c).
37. *Additional sclerite next to embolus*: (0) present; (1) absent. The tegulum of *Ctenus* and *Griswoldia* has an additional, isolated sclerite, surrounded by white, membranous tissue, near the embolus base.
38. *Bristle mat on cymbium*: (0) absent; (1) present. Most of the species studied have a dense mat of short bristles on the do side of the cymbium (LEVY, 1990: Fig. 7).
39. *Retrolateral marginal bump on cymbium* (Fig. 1c): (0) absent; (1) present.
40. *Basal do apophysis on cymbium*: (0) absent; (1) present.
41. *Cymbium tip shape*: (0) blunt; (1) narrowed.
42. *RTA*: (0) mesal; (1) distal. The RTA can be inserted mesally (Fig. 1a) or distally (Figs 4b, 5b, 5d) on the palpal ti.
43. *Palpal patella*: (0) unmodified; (1) swollen.

Female genitalia

44. *Epigyne lateral lobe extension*: (0) leaving central depression (Fig. 3c-d); (1) tightly enclosing scape (Fig. 3a).
45. *Epigyne lateral tooth*: (0) absent; (1) present.
46. *Epigyne lateral lobe pocket*: (0) absent; (1) present.
47. *Epigynal scape*: (0) present; (1) absent. The epigynes of most zoropsids and their allies have a conspicuous, sclerotised median scape, which often reaches beyond the poste-

- rior rim of the lateral lobes of the epigyne (Fig. 3a). The scape is lacking in *Takeoa nishimurai*.
48. *Epigynal scape attachment*: (0) broad; (1) narrow. The scape can be broadly attached to the epigyne (Fig. 3b) or connected to it by a narrow stalk (Figs 3a, 3c).
49. *Sclerotised base plate in epigynal central depression*: (0) absent; (1) present. Some zoropsids have a flat, sclerotised base plate, to which the scape is attached, in the central depression of the epigyne (Fig. 3c). *Takeoa nishimurai* has the base plate, but lacks a scape (Fig. 3d).
50. *Shape of epigynal scape*: (0) obtusely rectangular; (1) bilobed; (2) lozenge-shaped; (3) ribbon-shaped; (4) mushroom-shaped; (5) arrow-shaped.
51. *Length of epigynal scape*: (0) long (reaching posterior margin of the epigyne); (1) short.
52. *Posterior ends of lateral lobes of epigyne*: (0) separated; (1) touching.
53. *Cavity of spermatheca*: (0) simple; (1) complex: chambered or coiled.
54. *Ovoid bodies*: (0) absent; (1) present. The ovoid bodies (LEVY, 1990: 141) are small oval or sausage-shaped cavities situated in the vicinity of the spermathecae. They may be secondary spermathecae. In Fig. 3e, the mushroom-shaped bodies situated left and right of the symmetry axis in the upper (anterior) half of the vulva are the spermathecae, the sausage-shaped cavities immediately adjacent to these and running parallel to their stalks are the ovoid bodies.
55. *Ovoid body position*: (0) median; (1) anterior; (2) lateral.
56. *Insemination duct*: (0) short and simple (1) long and contorted. In the lower (posterior) third of Fig. 3e, the long and

contorted insemination duct of *Takeoa nishimurai* can be seen.

Analysis and results

The matrix of character states can be found in Table 2. All characters were run unordered in the analyses performed.

An equally weighted analysis of the data matrix was performed in PAUP with **hsearch addseq=random nreps=1000** (heuristic search with tree bisection and reconnection swapping and 1000 random addition sequences). In order to avoid spurious resolution due to unsupported (CODDINGTON & SCHARFF, 1994; WILKINSON, 1995) or ambiguously supported (NIXON & CARPENTER, 1996) branches, those with a minimum length of zero were collapsed with **condense collapse=minbrlen**. Two shortest trees were found in 883 out of 1000 random addition sequences. An exhaustive tree search using the command **alltrees** found the same shortest trees after evaluating 654729075 trees. One of these trees ("tree 1") is illustrated in Fig. 2. In the second tree ("tree 2"), the two *Acanthoctenus* species branch off in sequence below node 3 (Fig. 2), *Acanthoctenus gaujoni* being in the more basal position. Apart from this, tree 2 is identical to tree 1. Both trees have the following statistics in PAUP: length 109, ri 0.6822, rc 0.4694, ci 0.6881, ci excluding phylogenetically uninformative characters 0.6600 and goloboff fit -40.250 (tree 1) or -40.150 (tree 2). NONA 2.0 (commands **amb** to avoid spurious resolution and **mult*500**, using **max*** was not necessary) found the same shortest trees.

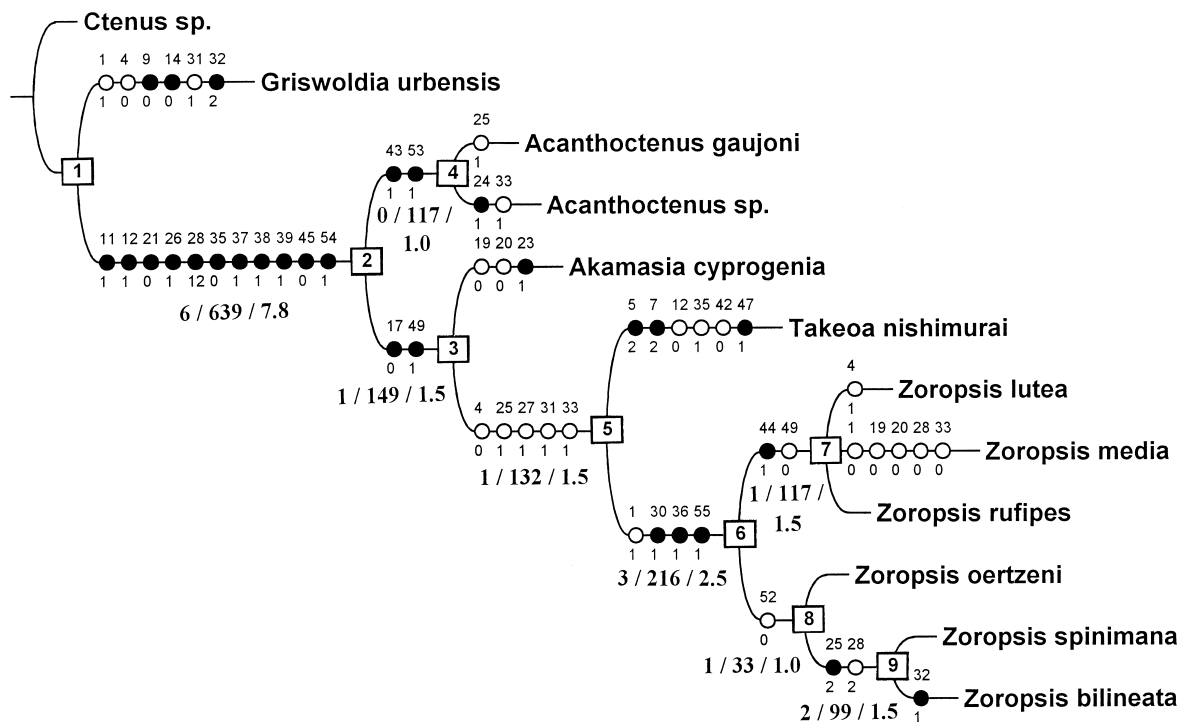


Fig. 2. – Preferred cladogram, with node numbers and unambiguous character state changes indicated. White dots are homoplasious character state changes, black dots non-homoplasious character state changes. Figures below branches are equal weighting, successive weighting, and implied weighting decay values, respectively.

TABLE 2
Character-taxon matrix

Characters	Ctenus sp.	Griswoldia urbense	Acanthoctenus gaujoni	Acanthoctenus sp.	Takeoa nishimurai	Zoropsis spinimana	Zoropsis bilineata	Zoropsis oertzeni	Akamasia cyprogenia	Zoropsis lutea	Zoropsis media	Zoropsis rufipes	Steps	ci	fi	Goloboff fit
1	0	1	0	0	0	1	1	1	0	1	0	1	3	.33	.60	.60
2	1	0	1	1	0	0	0	0	0	0	0	0	2	.50	.50	.75
3	1	0	1	1	0	0	0	0	0	0	0	0	2	.50	.50	.75
4	1	0	1	1	0	[01]	0	01	1	1	0	[01]	3	.33	.50	.60
5	0	0	3	3	2	1	1	1	1	1	1	1	3	1.0	1.0	1.0
6	0	0	3	1	2	2	2	2	2	2	2	2	3	1.0	1.0	1.0
7	0	0	3	?	2	1	1	1	1	1	1	1	3	1.0	1.0	1.0
8	0	0	2	?	1	1	1	1	1	1	1	1	2	1.0	1.0	1.0
9	1	0	[01]	?	1	1	1	1	1	1	1	1	1	1.0	0/0	1.0
10	0	0	[01]	?	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0
11	0	0	1	?	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0
12	0	0	1	?	0	1	1	1	1	1	1	1	2	.50	.50	.75
13	0	0	1	?	0	0	0	0	0	0	0	0	1	1.0	0/0	1.0
14	1	0	1	1	1	1	1	1	1	1	1	1	1	1.0	0/0	1.0
15	1	0	0	0	1	1	1	1	1	1	1	1	2	.50	.50	.75
16	1	0	1	1	0	0	0	0	0	0	0	0	2	.50	.50	.75
17	1	1	1	1	0	0	0	0	0	0	0	0	1	1.0	1.0	1.0
18	1	0	1	1	0	0	0	0	0	0	0	0	2	.50	.50	.75
19	2	1	1	1	1	1	1	1	0	1	0	1	3	.67	0.0	.75
20	2	1	1	1	1	1	1	1	0	1	0	1	3	.67	0.0	.75
21	1	1	0	0	0	0	0	0	0	0	0	0	1	1.0	1.0	1.0
22	-	-	1	1	0	0	0	0	0	0	0	0	1	1.0	1.0	1.0
23	0	0	0	0	0	0	0	0	1	0	0	0	1	1.0	0/0	1.0
24	0	0	0	1	0	0	0	0	-	0	0	0	1	1.0	0/0	1.0
25	0	0	1	0	1	2	2	1	0	1	1	1	3	.67	.75	.75
26	0	0	1	1	1	0	0	0	1	2	2	2	3	.67	.80	.75
27	1	0	0	0	1	1	1	1	0	1	1	1	2	.50	.67	.75
28	0	0	1	2	1	2	2	1	2	1	0	1	5	.40	.40	.50
29	0	0	0	1	1	1	1	1	1	1	1	1	2	.50	.50	.75
30	-	-	-	2	0	1	1	1	0	1	1	1	2	1.0	1.0	1.0
31	0	1	0	0	1	1	1	1	0	1	1	1	2	.50	.67	.75
32	0	2	0	0	0	0	1	0	0	0	0	0	2	1.0	0/0	1.0
33	0	0	0	1	1	1	1	1	0	1	0	1	3	.33	.50	.60
34	0	0	0	0	1	0	0	0	1	0	0	0	2	.50	0.0	.75
35	1	1	0	0	1	0	0	0	0	0	0	0	2	.50	.50	.75
36	0	0	0	0	0	1	1	1	0	1	1	1	1	1.0	1.0	1.0
37	0	0	1	1	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0
38	0	0	1	1	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0
39	0	0	1	1	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0
40	1	0	0	0	0	0	0	0	0	0	0	0	1	1.0	0/0	1.0
41	1	0	1	1	0	0	0	0	0	0	0	0	2	.50	.50	.75
42	0	1	1	1	0	1	1	1	1	1	1	1	2	.50	0.0	.75
43	0	0	1	1	0	0	0	0	0	0	0	0	1	1.0	1.0	1.0
44	0	0	0	0	0	0	0	0	0	1	1	1	1	1.0	1.0	1.0
45	1	1	0	0	0	0	0	0	0	0	0	0	1	1.0	1.0	1.0
46	0	0	0	0	0	1	1	1	1	1	1	1	2	.50	.75	.75
47	0	0	0	0	1	0	0	0	0	0	0	0	1	1.0	0/0	1.0
48	1	0	0	0	-	0	0	0	1	1	1	1	3	.33	.50	.60
49	0	0	0	0	1	1	1	1	1	0	0	0	2	.50	.75	.75
50	0	1	2	2	-	3	3	3	4	5	5	5	5	1.0	1.0	1.0
51	0	1	1	1	-	0	0	0	1	0	0	0	2	.50	.67	.75
52	0	0	0	1	1	0	0	0	1	1	1	1	3	.33	.60	.60
53	0	0	1	1	0	0	0	0	0	0	0	0	1	1.0	1.0	1.0
54	0	0	?	1	1	1	1	1	1	1	1	1	1	1.0	1.0	1.0
55	-	-	?	0	2	1	1	1	2	1	1	1	2	1.0	1.0	1.0
56	0	0	0	0	1	0	0	0	1	0	0	0	2	.50	0.0	.75

Polymorphisms between square brackets.
Missing entries entered as "?".
Unapplicable character states entered as "-".

A few a posteriori character weighting approaches were also applied. Successive approximations character weighting based on *ci* (CARPENTER, 1988; FARRIS, 1969, 1989) was implemented in NONA 2.0, invoking the command **run[swt amb- mult*500**. The programme stabilised on iteration 2, finding a single most parsimonious tree (tree 1), with weighted length 7487.

Implied weighting (GOLOBOFF, 1993) was performed in PeeWee 2.6 (**amb-; mult*500**, using **max*** was not necessary). With the default value for the concavity constant (**conc 3**) in effect, tree 1 was found as fittest tree in all 500 random addition sequences executed, with fit 402.5. Applying implied weighting under default concavity in PAUP, using **condense collapse=minbrlen** and **pset gpeewee=yes** (emulating peewee) or **pset goloboff=yes** (more accurate) and **hsearch addseq=random nreps=1000** produced the same tree in all 1000 random addition sequences executed, the only difference being that PAUP attributes a negative sign to the fit value calculated. The same fittest tree (tree 1) is found when the concavity constant in PeeWee is increased to 4, 5 or 6. When the concavity constant is lowered to 1, four other fittest trees are found, which differ from tree 1 by details in the relations between the *Zoropsis* species and by the fact that *Akamasia* and *Takeoa* are grouped in one clade, which also includes the *Acanthoctenus* species in two of the trees. With the concavity constant set to 2, a set of five fittest trees is found, encompassing the same four trees found with concavity constant 1, in addition to tree 1. However, under these low concavity values, implied weighting weighs so strongly against homoplastic characters that excessive weight is given to a small set of mutually consistent characters. For that reason, these solutions are not preferred.

Another weighting technique, "Strongest Evidence" (SALISBURY, 1999), was also applied. Strongest Evidence weights characters based on their APS. The APS of a character on a particular tree is the inverse \log_{10} of its probability of being at least as parsimonious on that same tree when its states would be randomly shuffled across the taxa (SALISBURY, 1999: 139). Although this null model-based method has been debated (FARRIS, 2000; SALISBURY, 2000b), it seemed worthwhile to compare its results with the trees obtained by more conventional approaches, especially because the relatively small number of taxa in the matrix under study allowed this computationally-demanding method to be executed within a reasonable period of time. SEPAL 1.1 was run in "Strongest Evidence" mode, with five random addition orders and TBR in effect. SEPAL always returns a strict consensus "Strongest Evidence tree", which had APS 53.930 in this case. This tree is similar to tree 2, having *Griswoldia urbensis*, *Acanthoctenus gaujoni*, *Acanthoctenus sp.*, *Akamasia cyprogenia* and *Takeoa nishimurai* branch off in sequence below the clade grouping all *Zoropsis* species. The Strongest Evidence tree dif-

fers from tree 2 in details in the arrangement of the individual *Zoropsis* species.

Tree 1, which is found under equal weighting, *ci*-based successive weighting, and implied weighting with a PeeWee concavity constant of 3-6, is our preferred solution. The node numbers given in Fig. 2, which illustrates the preferred tree, are also used to designate the clades that originate from those nodes. In Table 2, the last four columns give the number of steps and, rounded to two significant digits, *ci*, *ri* and Goloboff fit (GOLOBOFF, 1993) for each character on the preferred tree. Cladogram robustness for this tree was examined by calculating decay values ("Bremer support", BREMER, 1988, 1994) in NONA and PeeWee (with concavity 3) using the **bsupport** command. The equal weighting, successive weighting and implied weighting decay values, respectively, are shown in sequence below branches in Fig. 2.

Clade 2 in the preferred tree is supported by a high decay value under all weighting schemes. The most important of the 11 non-homoplasious character state changes that support clade 2 are: presence of a *ti I* median and terminal *pl* and *rl* spine in females (11:1 and 12:1), presence of a cribellum (21:0), absence of a protruding basal half of the tegulum (35:0, reversed in *Takeoa nishimurai*), absence of an isolated sclerite next to the embolus base (37:1), presence of a bristle mat and a *rl* marginal bump on the cymbium (38:1, 39:1), absence of a lateral tooth on the epigyne (45:0), and presence of ovoid bodies in the vulva (54:1).

The genus *Acanthoctenus* (clade 4) branches off at the base of clade 2 and is supported by the presence of a swollen palpal patella (43:1) and a complex cavity of the spermatheca (53:1). Sister group to clade 4 is clade 3, supported by a shallow trochanter notch (17:0) and the presence of a sclerotised base plate in the central depression of the epigyne (49:1, reversed in clade 7). Clade 3 groups all the taxa in the present study that are considered to belong to the family Zoropsidae. Branching off at the base of clade 3 is the monospecific genus *Akamasia*, which will be described below and which accommodates the species described previously as *Zoropsis cyprogenia*. The most striking feature setting *Akamasia* apart from the rest of Zoropsidae is the absence of a conductor in the male palp (23:1).

Sister group to *Akamasia* is clade 5, supported by five homoplasious changes: absence of a terminal *do* spine on the male *ti I* (4:0, paralleled in *Griswoldia urbensis* and reversed in *Zoropsis lutea*), median insertion of the embolus (25:1, paralleled in *Acanthoctenus gaujoni* and transformed to 25:2, apical, in clade 9), presence of an embolar lamella (27:1, also present in *Ctenus sp.*), presence of a MTP (31:1, paralleled in *Griswoldia urbensis*), and a protruding proximal *pl* part of the tegulum (33:1, paralleled in *Acanthoctenus sp.* and reversed in *Zoropsis media*). *Takeoa nishimurai* branches off at the base of clade 5. This enigmatic species differs from the other

Zoropsidae by the presence of eight vsp on ti I of males and females (5:2, 7:2), the absence of a ti I terminal pl and rl spine in females (12:0), the presence of a protruding basal part of the tegulum (35:1), a mesal RTA (42:0), and an epigyne that lacks a median scape (47:1).

Sister group to *Takeoa nishimurai* is clade 6 (the genus *Zoropsis*), supported by the presence of a male tibial crack (1:1, paralleled in *Griswoldia urbensis* and lacking in *Zoropsis media*), a MA with a bifid tip and an unsclerotised base (30:1, 36:1), and anterior ovoid bodies (55:1).

Discussion

From the results of the cladistic analysis, a taxonomic conclusion is drawn: *Zoropsis cyprogenia* does not fit in *Zoropsis* and is transferred to a new genus, *Akamasia*. *Akamasia cyprogenia* differs from *Zoropsis* by the absence of a conductor, an embolar lamella and a MTP (23:1, 27:0, 31:0); by the presence of a MA with a simple tip and a sclerotised base (30:0, 36:0); a protruding proximal rl part of the tegulum (34:1); a short, mushroom-shaped epigynal scape (51:1, 50:4); laterally positioned ovoid bodies (55:2); and a long, contorted insemination duct (56:1).

Another striking feature of the preferred cladogram obtained is the sister group relationship of the genus *Acanthoctenus* (clade 4) and the family Zoropsidae (clade 3), an arrangement also encountered in cladograms presented by CODDINGTON & LEVI (1991), GRISWOLD (1993), and GRISWOLD et al. (1999). However, no taxonomic conclusions should be drawn from this topology, since many of the close relatives of the genus *Acanthoctenus*, for example the ctenid genera *Nothroctenus* and *Viracucha*, have not been included in the analysis presented here. Only a far more elaborate cladistic analysis including a large number of ctenid genera can give sufficient insight into the relationships and the proper placing of the enigmatic genus *Acanthoctenus*.

DESCRIPTIONS

Akamasia n. gen. (Figs 3c, 4a-b)

Type species. *Zoropsis cyprogenia* Bosselaers, 1997.

Etymology: the genus name refers to the uninhabited Akamas peninsula on Cyprus, where the holotype of the type species was found.

Diagnosis: differs from all other Zoropsidae by the absence of a conductor and the possession of a short, mushroom-shaped epigynal scape. Differs from *Takeoa* and *Acanthoctenus* by the presence of six instead of eight or nine ti I vsp and from *Takeoa* and *Zoropsis* by the absence of an embolar lamella or a MTP. Can be distinguished from *Zoropsis* by the presence of a fully sclerotised MA with a simple tip and from *Takeoa* by a distally

inserted RTA, a flat basal half of the tegulum and the presence of an epigynal scape.

Description

Medium sized spiders (6-8) with linear, bipartite cribellum and oval calamistrum. Carapace yellow-brown, somewhat darker in cephalic part between eyes. Covered with short, dark, forward pointing hairs, except on radial striae. Thoracic groove short but pronounced. Clypeus narrow. Eyes ringed with black, in two rows. In do view anterior row slightly recurved, posterior row strongly recurved. In frontal view, both eye rows slightly recurved. MOQ widest posteriorly. Chelicerae dark greyish brown, with yellow border at fang groove. Three promarginal teeth, small one near fang base, large one in middle, another small one furthest from fang base. Two retromarginal teeth, medium-sized one closest to fang base, large one further from fang base. Sternum shield-shaped, pale yellow with some dark spots, sparsely covered with dark, pointed setae. Labium wider than long, obtuse, rounded anteriorly, with thickened, white margin. Maxillae yellow, parallel-sided. Abdomen dorsally with dark, arrow-shaped median mark on anterior half, dark chevrons on posterior half. Legs stout, heavily spined, yellow with darker markings. Ti I and II with five or six vsp, mt I and II with four vsp. All tarsi bearing scopulae and thick terminal claw tufts. Leg formula 4 1 2 3. Male palp (Figs 4a-b) with simple, distal RTA, simple, slender embolus without lamella and fully sclerotised MA with simple, pointed tip. No conductor, no MTP. Epigyne (Fig. 3c) with central depression containing a flat, sclerotised base plate to which a stalked, mushroom-shaped scape is attached. Lateral sclerotised lobes of epigyne with small pocket, meeting posteriorly, behind stalked scape. Internal genitalia (BOSSELAERS, 1997: Figs 9-10): spermathecae elongated, robust, of uniform texture throughout, laterally flattened. Lateral ovoid body connected to posterior end of each spermatheca. Anterior end of spermatheca connected to long tortuous insemination duct with thick, sclerotised wall and posterior entrance.

Discussion

Akamasia is monospecific and only contains the type species *Akamasia cyprogenia*. The male of this species has recently been discovered and is described here for the first time. The female is redescribed; a few errors in the original description (number of retromarginal cheliceral teeth and an occasional misinterpretation of a spine position) are corrected.

Akamasia cyprogenia (Bosselaers, 1997), n. comb. (Figs 3c, 4a-b)

Zoropsis cyprogenia BOSSELAERS, 1997: 164, Figs 2-10 (female holotype from Avakas Gorge, Akamas peninsula, Cyprus, examined).

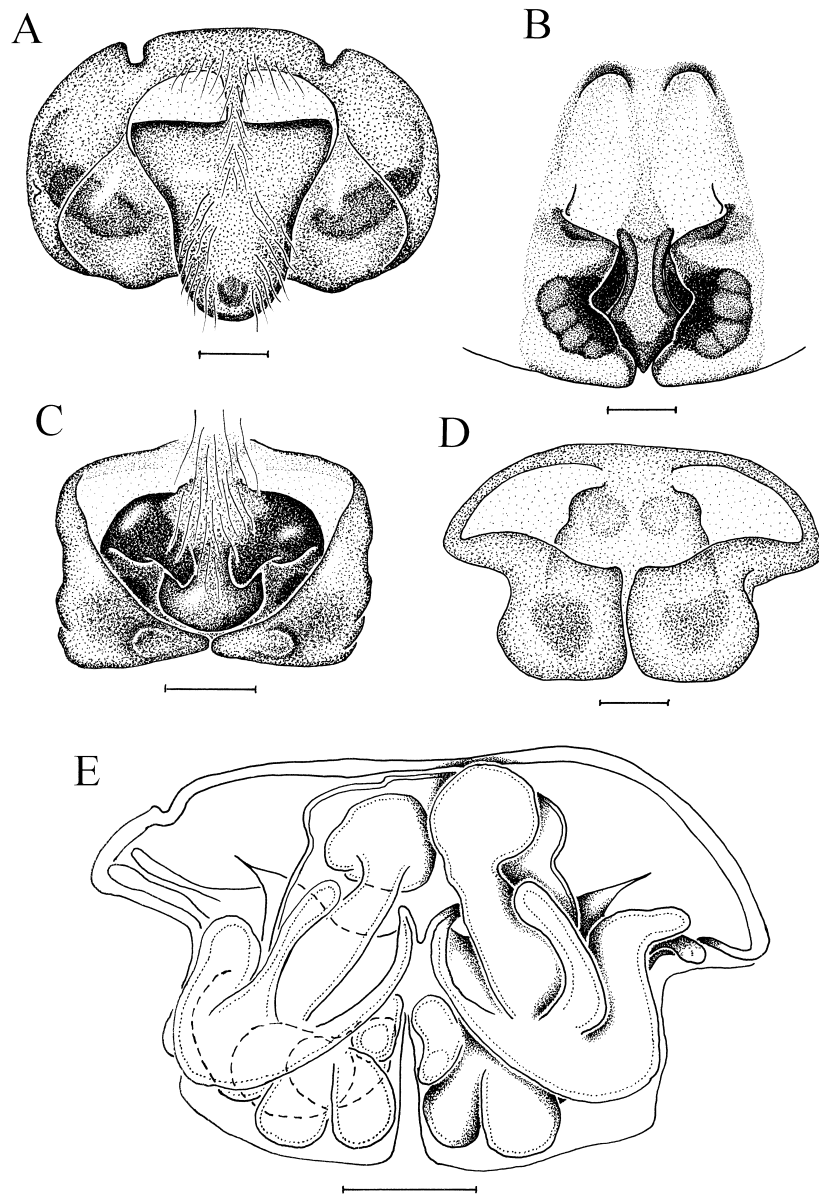


Fig. 3. – A. *Zoropsis media*, epigyne. – B. *Acanthoctenus gaujoni*, epigyne. – C. *Akamasia cyprogenia*, epigyne. – D. *Takeoa nishimurai*, epigyne. – E. *Takeoa nishimurai*, vulva, dorsal view. Scale bars = 0.25 mm.

Material: Holotype female: Cyprus, Akamas peninsula, Avakas Gorge, in leaf litter on the bank of Avgas river, elev. 20 m, 5 April 1997, J. Bosselaers leg. (RBINS 28515). Male: Cyprus, Akamas peninsula, Neo Chorion, March 1998, Martin Askins leg. (CMA).

Description

Male. Total length: 6.15. Carapace length: 3.5; width: 2.65. Colour as in generic description. Width of clypeus: 0.1. Width of anterior eye row: 0.87; width of posterior row: 0.97. Depth of entire ocular field in frontal view: 0.66. MOQ, anterior width: 0.37; posterior width: 0.53; depth: 0.53. Diameter of individual eyes: anterior row, medians: 0.16; laterals: 0.18; posterior row, medians:

0.19; laterals: 0.15. Chelicerae as in generic description. Sternum length: 1.55; width: 1.4. Pale yellow with seven marginal black spots between leg bases and group of seven central black spots forming a circle. Labium length: 0.5; width: 0.6. Maxillae length: 0.95; width: 0.53. Abdomen: do side reddish brown, peppered with black dots, bordered with black, sparsely covered with dark, pointed setae, anterior half with dark brown, more or less arrow-shaped median mark pointing backwards, posterior half almost completely darkened by several wide, black transversal chevrons, ve side black, bordered by pale yellowish brown. Legs yellow, covered with thin grey setae. Femora and patellae with some dark markings. All tibiae and metatarsi with one sub-basal and one terminal, wide, dark ring.

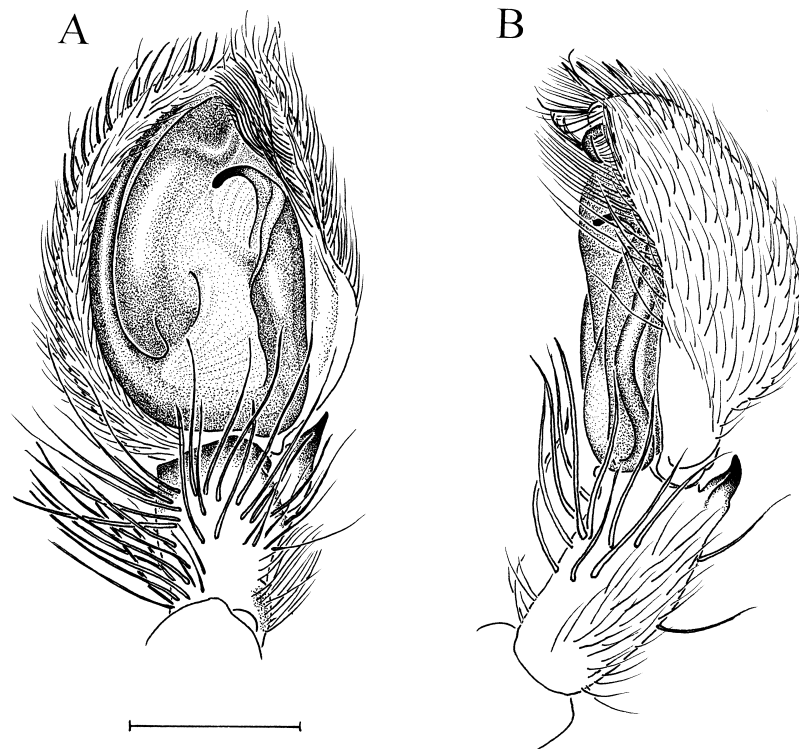


Fig. 4. – *Akamasia cyprogenia*, left male palp. – A. Ventral view. – B. Retrolateral view. Scale bar = 0.5 mm.

Leg measurements:

	fe	pa	ti	mt	ta	total
I	3.40	1.30	3.80	3.45	1.15	13.10
II	3.00	1.30	3.15	2.95	1.05	11.45
III	2.60	1.25	2.30	2.40	0.95	9.50
IV	3.40	1.30	3.35	3.95	1.20	13.20

Leg spination. Leg I: fe with one pl spine and nine do spines in three rows. Pa spineless. Ti with six vsp, two pl and two or three rl spines. Mt with four vsp, one pl and one rl spine. Leg II: fe with ten do spines in three rows. Pa spineless. Ti with six vsp, three pl and three rl spines. Mt with four vsp, one pl and one rl spine. Leg III: fe with ten do spines in three rows. Pa with one rl spine. Ti with three vsp, one do spine, two pl and two rl spines. Mt with two rows of three ve spines and one terminal median ve spine, one do spine, three pl and three rl spines. Leg IV: fe with ten do spines in three rows. Patella with one rl spine. Ti with three vsp, one do spine, two pl and two rl spines. Mt with two rows of three ve spines and one terminal median ve spine, one do spine, three pl and three rl spines. Male palp (Figs 4a-b) as in genus description.

Female. Total length: 8.0. Carapace length: 4.0; width: 3.15. Colour as in generic description. Some small, light grey spots on margin and along radial striae. Width of clypeus: 0.1. Width of anterior eye row: 1.11; width of posterior row: 1.28. Depth of the entire ocular field in frontal view: 0.72. MOQ, anterior width: 0.48; posterior width: 0.59; depth: 0.57. Diameter of individual eyes: anterior row, medians: 0.18; laterals: 0.22; posterior row,

medians: 0.21; laterals: 0.19. Chelicerae as in generic description. Sternum length: 1.75; width: 1.65. Pale yellow, with some small grey spots in centre and along margin. Labium length: 0.65; width: 0.75. Maxillae length: 1.03; width: 0.65. Abdomen: do side reddish brown, peppered with black dots and sparsely covered with dark, pointed setae, anterior half with red-brown, more or less arrow-shaped median mark with dark border, pointing backwards, on posterior half several transversal dark chevrons and three pairs of white dots, ve side yellow-brown, sparsely dotted with black spots. Cribellum bipartite. Legs yellow, covered with thin grey setae, femora with some grey spots.

Leg measurements:

	fe	pa	ti	mt	ta	total
I	3.00	1.40	3.15	2.65	0.90	11.10
II	2.75	1.35	2.65	2.35	0.85	9.95
III	2.25	1.25	1.85	1.95	0.85	8.15
IV	3.15	1.30	2.60	3.35	1.00	11.40

Leg spination. Leg I: fe with one pl spine and five do spines in three rows. Pa spineless. Ti with six vsp, two pl and two or three rl spines. Mt with four vsp, one pl and one rl spine. Leg II: fe with eight or nine do spines in three rows. Pa spineless. Ti with six vsp, two pl and three rl spines. Mt with four vsp, one pl and one rl spine. Leg III: fe with nine do spines in three rows. Pa with one rl spine. Ti with three vsp, one do spine, two pl and two rl spines. Mt with two rows of three ve spines and one terminal median ve spine, one do spine, three pl and three rl

spines. Leg IV: fe with six or seven do spines in three rows. Patella with one rl spine. Ti with three vsp, one do spine, two pl and two rl spines. Mt with two rows of three ve spines and one terminal median ve spine, one do spine and oval calamistrum, three pl and three rl spines. Female genitalia: epigyne (Fig. 3c) and internal genitalia as in genus description.

Distribution: Only known from Akamas peninsula, Cyprus.

In the course of this study, the types of *Acanthoctenus gaujoni* Simon, 1906 were seen. Because this species has been described only summarily (SIMON, 1906: 290) and

no illustrations have ever been published of it, it is redescribed here.

***Acanthoctenus gaujoni* Simon, 1906**

(Figs 3b, 5a-b)

Acanthoctenus gaujoni SIMON, 1906: 290 (male holotype and female paratype from Zamora, Loja, Ecuador, examined).

Acanthoctenus gaujoni MELLO-LEITÃO, 1936: 194.

Material: Holotype male: Ecuador, Loja, Zamora, Gaujon leg. (MNHN AR5168). Paratype female: Ecuador, Loja, Zamora, Gaujon leg. (MNHN AR5168).

Description

Male. Total length: 12.15. Carapace length: 5.6; width: 4.5. Carapace yellow-brown with two darker longitudinal bands and short but pronounced fovea. Width of clypeus: 0.45. Eyes all ringed with black, in three rows, in typical ctenid pattern: anterior laterals adjacent to posterior medians. Row of long white hairs between median eyes. Width of anterior eye row: 1.65; width of posterior row: 1.75. Depth of entire ocular field in frontal view: 1.5. MOQ, anterior width: 0.9; posterior width: 1.0; depth: 0.95. Diameter of individual eyes: anterior row, medians: 0.37; laterals: 0.24; posterior row, medians: 0.39; laterals: 0.60. Chelicerae greyish brown, with three promarginal teeth, small one near fang base, large one in middle, another small one furthest from fang base, and three subequal retromarginal teeth, largest one closest to fang base, smallest one furthest from fang base. Sternum yellow, shield-shaped, length: 2.8; width: 2.5. Labium mushroom-shaped, with thickened white rim, length: 0.95; width: 0.85. Maxillae widening towards front, length: 1.7; width: 0.9. Abdomen slender, do side yellow-brown with darker, narrow, median triangular mark pointing backward on anterior half and four rows of two circular brown spots on posterior half. Covered with silky white hairs interspersed with shorter, stiff brown hairs. Ve side yellow, bordered by dark brown. Legs yellow-brown, tarsi with dense claw tufts. Leg formula 1 4 2 3.

Leg measurements:

	fe	pa	ti	mt	ta	total
I	8.50	2.50	10.30	9.90	2.75	33.95
II	7.35	2.50	7.75	7.40	2.30	27.30
III	5.75	2.00	5.10	6.00	2.00	20.85
IV	7.75	2.00	7.25	9.75	3.05	29.80

Leg spination. Leg I: fe with two pl spines and 11 do spines in three rows. Pa with one rl spine. Ti with nine vsp, three pl, three do and two rl spines. Mt with five vsp, two pl and one rl spine. Leg II: fe with one pl spine and ten do spines in three rows. Pa with one rl spine. Ti with nine vsp, three pl, two do and four rl spines. Mt with five vsp, two pl and one rl spine. Leg III: fe with 11 do spines in three rows. Pa with one pl and one rl spine. Ti with

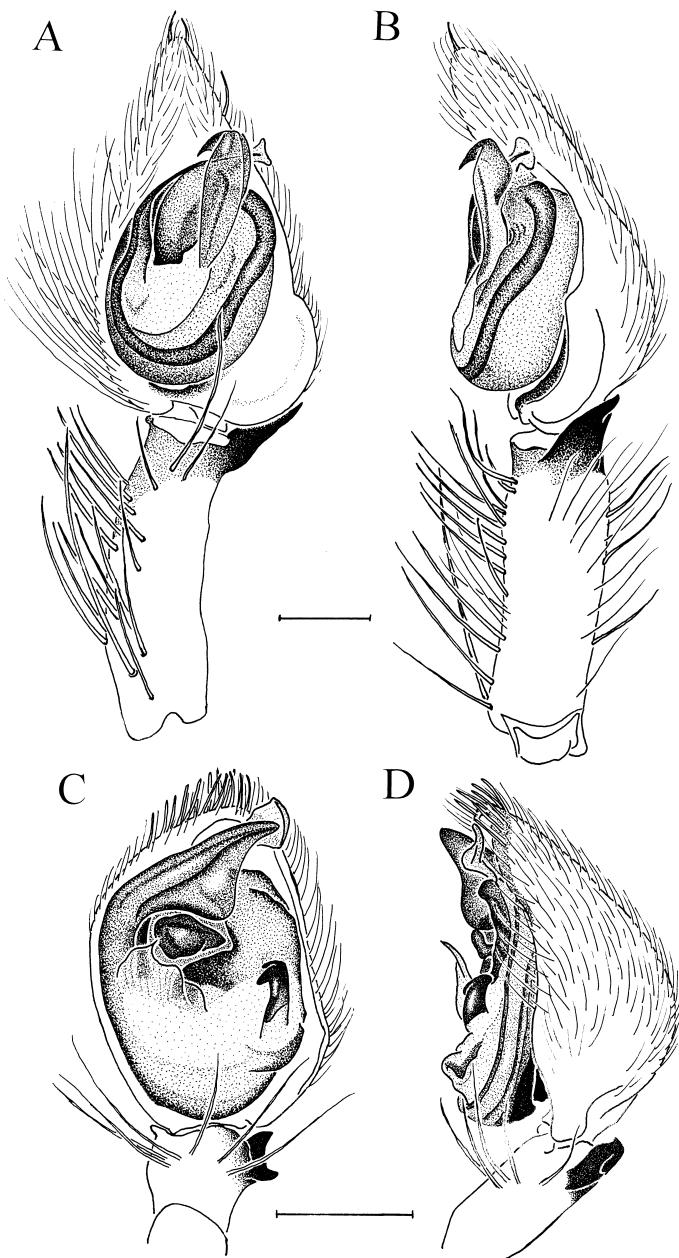


Fig. 5. — *Acanthoctenus gaujoni*, left male palp. — A. Ventral view. — B. Retrolateral view. — *Zoropsis media*, left male palp. — C. Ventral view. — D. Retrolateral view. Scale bars = 0.5 mm.

three vsp, three do spines, one pl and three rl spines. Mt with three vsp, four pl and four rl spines. Leg IV: fe with nine do spines in three rows. Patella with one pl and one rl spine. Ti with three vsp, three do spines, three pl and four rl spines. Mt with three vsp, three pl and three rl spines. Male palp (Figs 5a-b) as illustrated, with pronounced rl cymbial bulge, slender, pointed embolus and cup shaped MA.

Female. Total length: 13.15. Carapace length: 5.75; width: 4.4. Carapace coloured as in male. Width of clypeus: 0.38. Eyes all ringed with black, disposed as in male, but no long white hairs between median eyes. Width of anterior eye row: 1.85; width of posterior row: 2.15. Depth of the entire ocular field in frontal view: 1.45. MOQ, anterior width: 0.88; posterior width: 1.05; depth: 0.95. Diameter of individual eyes: anterior row, medians: 0.29; laterals: 0.24; posterior row, medians: 0.37; laterals: 0.45. Chelicerae chestnut brown, somewhat inflated, cheliceral teeth as in male. Sternum yellow, shield-shaped, length: 2.55; width: 2.65. Labium mushroom-shaped, with a thickened white rim, length: 1.0; width: 0.95. Maxillae widening towards front, length: 1.85; width: 1.05. Abdomen oval, coloured as in male. Legs yellow-brown, femora with faint darker rings, tarsi with dense claw tufts.

Leg measurements:

	fe	pa	ti	mt	ta	total
I	6.20	2.50	6.50	5.00	1.65	21.85
II	5.15	2.15	5.10	4.40	1.50	18.30
III	4.60	1.85	3.85	4.25	1.55	16.10
IV	6.25	2.10	5.00	-	-	-

Leg spination. Leg I: fe with two pl spines and ten do spines in three rows. Pa with one rl spine. Ti with nine vsp, four pl and three rl spines. Mt with five vsp, one pl and one rl spine. Leg II: fe with one pl spine and 11 do spines in three rows. Pa with one rl spine. Ti with nine vsp, four pl and four rl spines. Mt with five vsp, two pl and one rl spine. Leg III: fe with 11 do spines in three rows. Pa with one pl and one rl spine. Ti with three vsp, two do spines, two pl and four rl spines. Mt with three vsp, five pl and four rl spines. Leg IV: fe with nine do spines in three rows. Patella with one pl and one rl spine. Ti with three vsp, three do spines, two pl and two rl spines. Rest of fourth legs missing. Epigyne (Fig. 3b) as illustrated, with lozenge-shaped scape. In order not to damage the unique paratype specimen, the vulva was not studied. But the complex, chambered spermathecae can be observed through the semi-transparent epigyne.

Acanthoctenus gaujoni is obviously closely related to *Acanthoctenus spinipes* Keyserling, 1877, as can be judged by comparing the illustrations presented here (Figs 3a, 5a-b) with those of *Paracanthois virginea* Kraus, 1955 (= *Acanthoctenus spinipes*) in Kraus (1955: Figs 134-137).

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REFERENCES

- BOSSELAERS, J. (1997). *Zoropsis cyprogenia* sp. n., a new, probably endemic spider species from Cyprus (Araneae, Zoropsidae). *Phegea*, 25 (4): 162-168.
- BREMER, K. (1988). The limits of amino acid sequence data in angiosperm phylogenetic reconstruction. *Evolution*, 42 (4): 795-803.
- BREMER, K. (1994). Branch support and tree stability. *Cladistics*, 10: 295-304.
- BRIGNOLI, P.M. (1983). *A catalogue of the Araneae described between 1940 and 1981*. Manchester University Press.
- CARPENTER, J.M. (1988). Choosing among multiple equally parsimonious cladograms. *Cladistics*, 4: 291-296.
- CHEN, Z.F. & Z.H. ZHANG (1991). *Fauna of Zhejiang: Araneida*. Zhejiang Science and Technology Publishing House.
- CODDINGTON, J.A. & H.W. LEVI (1991). Systematics and evolution of spiders (Araneae). *Annu. Rev. Ecol. Syst.*, 22: 565-592.
- CODDINGTON, J.A. & N. SCHARFF (1994). Problems with zero-length branches. *Cladistics*, 10: 415-423.
- DAHL, F. (1901a). Ueber de Wert des Cribellums und Calamistrums für das System der Spinnen und eine Uebersicht der Zoropsiden. *Sitzungsber. Ges. Naturforsch. Freunde Berlin*, 9: 177-199.
- DAHL, F. (1901b). Nachtrag zur Uebersicht der Zoropsiden. *Sitzungsber. Ges. Naturforsch. Freunde Berlin*, 9: 244-255.
- DIPPENAAR-SCHOEMAN, A.S. & R. JOCQUÉ, (1997). *African spiders. An identification manual. Plant Protection Research Institute Handbook 9*. Biosystematics Division, ARC - Plant Protection Research Institute, Pretoria.
- FARRIS, J.S. (1969). A successive approximations approach to character weighting. *Systematic Zoology*, 18: 374-385.
- FARRIS, J.S. (1989). The retention index and the rescaled consistency index. *Cladistics*, 5: 417-419.
- FARRIS, J.S. (2000). Corroboration versus "Strongest Evidence". *Cladistics*, 16 (4): 385-393.
- GOLOBOFF, P.A. (1993). Estimating character weights during tree search. *Cladistics*, 9: 83-91.
- GOLOBOFF, P.A. (1997a). *Pee-Wee version 2.6*. [Computer programme and documentation]. Programme available from J. M. Carpenter, Dep. Entomology, American Museum of Natural History, New York.

- GOLOBOFF, P.A. (1997b). *NONA version 2.0*. [Computer programme and documentation]. Programme available from J.M. Carpenter, Dep. Entomology, American Museum of Natural History, New York.
- GRISWOLD, C.E. (1991). A revision and phylogenetic analysis of the spider genus *Machadonia* Lehtinen (Araneae: Lycosoidea). *Ent. Scand.*, 22 (3): 305-351.
- GRISWOLD, C.E. (1993). Investigations into the phylogeny of the lycosoid spiders and their kin (Arachnida: Araneae: Lycosoidea). *Smith. Contr. Zool.*, 539: 1-39.
- GRISWOLD, C.E. & D. UBICK (2001). Zoropsidae: a spider family newly introduced into the USA (Araneae, Entelegynae, Lycosoidea). *Journal of Arachnology*, 29 (1): 111-113.
- GRISWOLD, C.E., J.A. CODDINGTON, N.I. PLATNICK & R.R. FORSTER (1999). Towards a phylogeny of entelegyne spiders (Araneae, Araneomorphae, Entelegynae). *Journal of Arachnology*, 27 (1): 53-63.
- HAWKINS, J.A., C.E. HUGHES & R.W. SCOTLAND (1997). Primary homology assessment, characters and character states. *Cladistics*, 13: 275-283.
- KITCHING, I.J., P.L. FOREY, C.J. HUMPHRIES & D.M. WILLIAMS (1998). *Cladistics: the theory and practice of parsimony analysis*. 2nd ed. Oxford: Oxford Univ. Press.
- KRAUS, O. (1955). Spinnen aus El Salvador (Arachnoidea, Araneae). *Abh. senckenb. naturf. Ges.*, 493: 1-112.
- LEDoux, J.-C. & A. CANARD (1991). *Initiation à l'étude systématique des araignées*. J.-C. Ledoux, imprimeur & éditeur, Aramon.
- LEHTINEN, P.T. (1967). Classification of the cribellate spiders and some allied families, with notes on the evolution of the suborder Araneomorpha. *Ann. Zool. Fenn.*, 4 (3): 199-468.
- LEVY, G. (1990). On the cribellate spider *Zoropsis lutea* in Israel (Araneae, Zoropsidae). *Bull. Br. Arachnol. Soc.*, 8 (5): 139-143.
- MADDISON, W.P. (1993). Missing data versus missing characters in phylogenetic analysis. *Systematic Biology*, 42 (4): 576-581.
- MADDISON, W. P., M.J. DONOGHUE & D.R. MADDISON (1984). Outgroup analysis and parsimony. *Systematic Zoology*, 33(1): 83-103.
- MELLO-LEITÃO, C. De (1936). Essai monographique de la famille Acanthothenidae. *Ann. Ac. Brasil. Sci.*, 8 (3): 179-203.
- NIXON, K.C. (2002). *Winclada version 1.0*. [Computer programme and documentation]. Published by the author, Ithaca, NY. Available from <http://www.cladistics.com>.
- NIXON, K.C. & J.M. CARPENTER (1996). On consensus, collapsibility, and clade concordance. *Cladistics*, 12: 305-321.
- PETRUNKEVITCH, A. (1923). On families of spiders. *Annals N. Y. Acad. Sci.*, 29: 145-180.
- PETRUNKEVITCH, A. (1928). Systema Araneorum. *Trans. Connect. Acad. Arts Sci.*, 29: 1-270.
- PLATNICK, N. (1993). *Advances in spider taxonomy 1988-1991*. The New York Entomological Society and The American Museum of Natural History, New York.
- PLATNICK, N. (2002). *The world spider catalog, version 2.0*. <http://research.amnh.org/entomology/spiders/catalog81-87/INTRO1.html>.
- ROEWER, C.F. (1954). *Katalog der Araneae von 1758 bis 1940, bzw. 1954. 2. Band*. Royal Belgian Institute for Natural Sciences, Brussels.
- SALISBURY, B.A. (1999). Strongest Evidence: maximum apparent phylogenetic signal as a new cladistic optimality criterion. *Cladistics*, 15 (2): 137-149.
- SALISBURY, B.A. (2000a). *SEPAL: strongest evidence and parsimony analyzer. Version 1.1*. Department of Ecology and Evolutionary Biology, Yale University, New Haven. <http://jkim.eeb.yale.edu/salisbur/SEPAL.html>.
- SALISBURY, B.A. (2000b). Strongest Evidence revisited. *Cladistics*, 16 (4): 394-402.
- SIERWALD, P. (1990). Morphology and homologous features in the male palpal organ in Pisauridae and other spider families, with notes on the taxonomy of Pisauridae (Arachnida: Araneae). *Nemouria*, 35: 1-59.
- SIMON, E. (1892). *Histoire Naturelle des Araignées*. Librairie Encyclopédique de Roret, Paris. 1 (1): 227-230.
- SIMON, E. (1903). *Histoire Naturelle des Araignées*. Librairie Encyclopédique de Roret, Paris. 2 (4): 669-1080.
- SIMON, E. (1906). Étude sur les araignées de la section des cribellates. *Ann. Soc. Ent. Belg.*, 50: 284-308.
- SWOFFORD, D.L. (1999). *PAUP* Phylogenetic Analysis under Parsimony (*and other methods) version 4.0 beta 4a*. Sinauer Associates, Sunderland, MA.
- THALER, K. & B. KNOFLACH (1998). *Zoropsis spinimana* (Dufour), eine für Österreich neue Adventivart (Araneae, Zoropsidae). *Ber. nat.-med. Verein Innsbruck*, 85: 173-185.
- WATROUS, L.E. & Q.D. WHEELER (1981). The out-group comparison method of character analysis. *Systematic Zoology*, 30 (1): 1-11.
- WILKINSON, M. (1995). Arbitrary resolutions, missing entries, and the problem of zero-length branches in parsimony analysis. *Systematic Biology*, 44 (1): 108-111.
- WUNDERLICH, J. (1986). *Spinnenfauna gestern und heute*. Erich Bauer Verlag bei Quelle & Meyer, Wiesbaden.
- WUNDERLICH, J. (1994). Zur Kenntnis der West-paläarktischen Arten der Gattung *Zoropsis* Simon 1878 (Arachnida: Araneae: Zoropsidae). In: Wunderlich (ed.), *Beiträge zur Araneologie 4*, Verlag Jörg Wunderlich, Straubenhardt: 723-727.

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