ANNALES

de la
SOCIÉTÉ SUISSE DE ZOOLOGIE
et du
MUSÉUM D'HISTOIRE NATURELLE
de la Ville de Genève

tome 118
fascicule 2
2011

REVUE SUISSE DE ZOOLOGIE

SWISS JOURNAL OF ZOOLOGY

GENÈVE JUIN 2011 ISSN 0035 - 418 X

REVUE SUISSE DE ZOOLOGIE

TOME 118— FASCICULE 2

Publication subventionnée par:
Académie suisse des Sciences naturelles (SCNAT)
Ville de Genève
Société suisse de Zoologie

Le comité soumet chaque manuscrit pour évaluation à des experts d'institutions suisses ou étrangères selon le sujet étudié.

La préférence sera donnée aux travaux concernant les domaines suivants: taxonomie, systématique, faunistique, phylogénie, évolution, morphologie et anatomie comparée.

Administration

MUSÉUM D'HISTOIRE NATURELLE
1211 GENÈVE 6

Internet: http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm

Prix de l'abonnement:

SUISSE Fr. 225.— UNION POSTALE Fr. 250.—
(en francs suisses)

Les demandes d'abonnement doivent être adressées
à la rédaction de la *Revue suisse de Zoologie*,
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

ANNALES

de la
SOCIÉTÉ SUISSE DE ZOOLOGIE
et du
MUSÉUM D'HISTOIRE NATURELLE
de la Ville de Genève

tome 118
fascicule 2
2011

SWISS JOURNAL OF ZOOLOGY

REVUE SUISSE DE ZOOLOGIE

GENÈVE JUIN 2011 ISSN 0035 - 418 X

REVUE SUISSE DE ZOOLOGIE

TOME 118—FASCICULE 2

Publication subventionnée par:
Académie suisse des Sciences naturelles (SCNAT)
Ville de Genève
Société suisse de Zoologie

Le comité soumet chaque manuscrit pour évaluation à des experts d'institutions suisses ou étrangères selon le sujet étudié.

La préférence sera donnée aux travaux concernant les domaines suivants: taxonomie, systématique, faunistique, phylogénie, évolution, morphologie et anatomie comparée.

Administration

MUSÉUM D'HISTOIRE NATURELLE
1211 GENÈVE 6

Internet: http://www.ville-ge.ch/musinfo/mhng/page/rsz.htm

Prix de l'abonnement:

SUISSE Fr. 225.— UNION POSTALE Fr. 250.—
(en francs suisses)

Les demandes d'abonnement doivent être adressées
à la rédaction de la *Revue suisse de Zoologie*,
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Suisse

Revue suisse de Zoologie 118 (2): 207-221; juin 2011

The spider genus *Hersilia* in Thailand, with descriptions of two new species (Araneae, Hersiliidae)

Pakawin DANKITTIPAKUL* & Tippawan SINGTRIPOP
Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai 50200, Thailand.
*Corresponding author, e-mail: pakawin@gmail.com

The spider genus *Hersilia* in Thailand, with descriptions of two new species (Araneae, Hersiliidae). - Our examination of a hersiliid spider collection from Thailand revealed eight species of which two species are new (*Hersilia serrata* sp. n. ♂, ♀, *H. thailandica* sp. n., ♂). Extended geographic ranges are recorded for *H. sundaica* Baehr & Baehr, 1993 and *H. martensi* Baehr & Baehr, 1993, which are reported from Thailand for the first time. *H. asiatica* Song & Zheng, 1982, which was previously documented from northeastern Thailand, is now also found in northern and southern Thailand. A substantial number of females from Thailand are similar to *H. striata* Wang & Yin, 1985, previously known from China, but can be distinguished by slight differences in their genital morphology.

Keywords: Taxonomy - new taxa - new record - biodiversity - distribution range.

INTRODUCTION

To date ten species of Hersiliidae were found in Thailand. All of them belong to the cosmotropical spider genus *Hersilia* Audouin. Prior to this study six species were known from Thailand. Unfortunately, the first hersiliid spider that was described from Thailand, *Hersilia siamensis* Simon, 1886, known only from the female type collected at 'Canal de Bangkok, Siam', is currently regarded as a *nomen dubium* (Baehr & Baehr, 1993: 78). This because the type is presumably lost (not found in the Muséum National d'Histoire Naturelle, Paris, France, or in the Museo Civico di Storia Naturale "Giacomo Doria", Genoa, Italy), and because the original description given by Simon (1886) did not include satisfactory taxonomic information to recognize or distinguish this species from its congeners (Baehr & Baehr, 1993). The other five taxa are: *H. vicina* Baehr & Baehr, 1993, *H. asiatica* Song & Zheng, 1982, *H. simplicipalpis* Baehr & Baehr, 1993, *H. striata* Wang & Yin, 1985 and *H. clypealis* Baehr & Baehr, 1993.

The present study treats six *Hersilia* species, two of which are new and two others recorded from Thailand for the first time. Therefore, a total of nine hersiliid species (excluding the doubtful *H. siamensis*) are currently known to occur in Thailand. Following Baehr & Baehr (1993), they can be separated into five species-groups: 1) the *albomaculata*-group (*H. martensi* and *H. vicina*); 2) the *asiatica*-group (*H. asiatica*); 3) the *savignyi*-group (*H. simplicipalpis*, *H. striata*, *H. clypealis*, *H. ser-*

Manuscript accepted 24.09.2010

rata sp. n.); 4) the *pectinata*-group (*H. thailandica* sp. n.); 5) the *impressifrons*-group (*H. sundaica*). This indicates not only a species-rich hersiliid fauna in Thailand, it also reveals that this fauna is superficially known and more taxonomic work needs to be done. This study also revealed that some *Hersilia* species have broad distribution ranges.

This article is the second in a series on faunistic and taxonomic studies on the Southeast Asian hersillids deposited in the spider collection of the Muséum d'histoire naturelle de la Ville de Genève, Switzerland.

MATERIAL AND METHODS

Morphological observation and illustration were made using Olympus SZX-9 and Nikon SMZ 800 stereomicroscopes, and an Olympus BX-40 compound microscope, each equipped with a drawing tube. Measurements of leg segments were taken from the dorsal side. All measurements are in millimeter. Epigynes were drawn in natural and cleared state (after immersing them in lactic acid for 10-20 minutes). Sizes of eyes are given as proportions of AME (= 1.00) in the following order: AME: ALE: PME: PLE. Leg measurements are given as: total length (femur, patella, tibia, metatarsus, tarsus).

Abbreviations used in text and in the figures are as follows: AF, apical flange of TA; ALE, anterior lateral eyes; AME, anterior median eyes; AP, apical projection of TA; BS, bulbose sacs of spermathecae; bS, basal segment of posterior spinneret; CO, copulatory orifice; DMP, dorsal muscular pits; E, embolus; FD, fertilization duct; lP, lateral process of TA; lPf, membranous flange on lateral process of TA; lPp, prong on lateral process of TA; lPr, projection on lateral process of TA; lPt, tubercle on lateral process of TA; mP, median process of TA; mPa, apical prong on median process of TA; mPb, basal prong on median process of TA; NP, national park; PLS, posterior lateral spinnerets; PME, posterior median eyes; PLE, posterior lateral eyes; SD, insemination ducts; SR, seminal receptacle; TA, tegular apophysis; tS, terminal segment of posterior spinneret; VMP, ventral muscular pits. In the text 'Fig.' refers to a figure herein, while 'fig.' refers to a figure published elsewhere.

The material examined will be deposited in the spider collection of the Muséum d'histoire naturelle de la Ville de Genève, Switzerland (MHNG) and in the Thailand Natural History Museum (TNHM) of the National Science Museum, Pathumthani Province, Thailand.

TAXONOMY

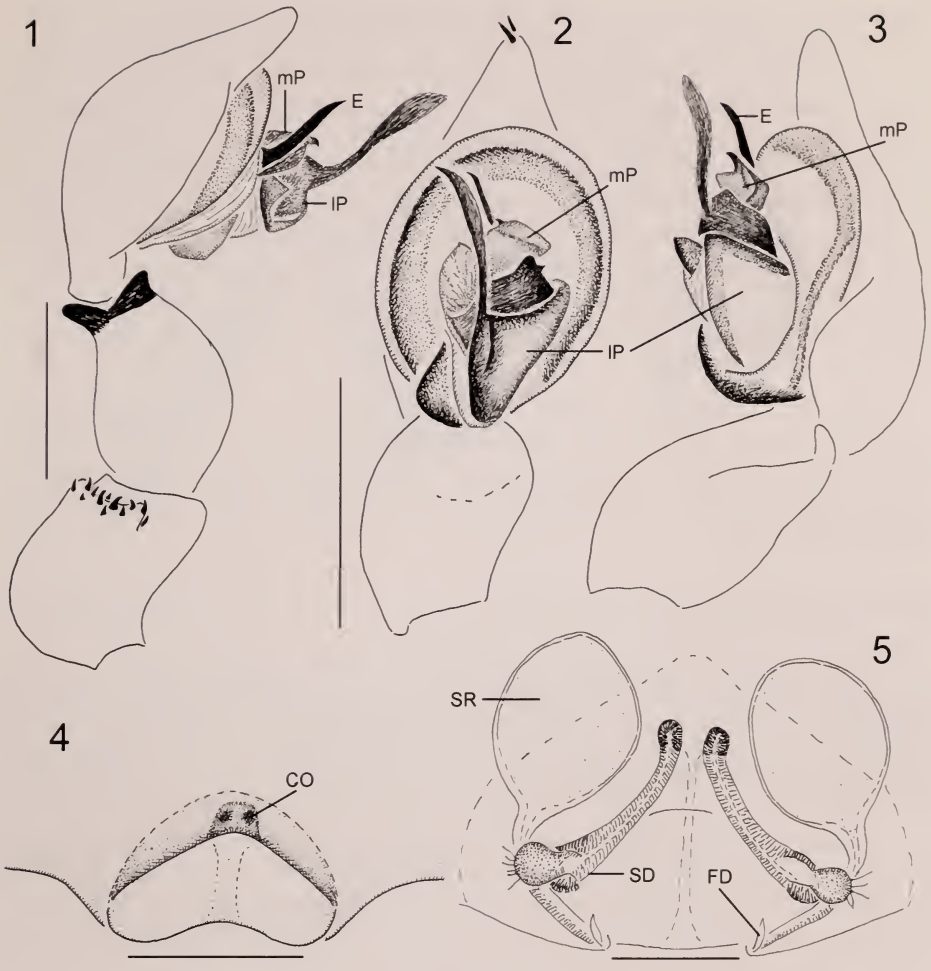
HERSILIIDAE THORELL, 1870

Hersilia Audouin, 1826

Hersilia asiatica Song & Zheng, 1982 Figs 1-5, 27

Hersilia asiatica Song & Zheng, 1982: 40, figs 1-5; Hu, 1984: 81, figs 74.1-5. – Song, 1987: 116, fig. 78; Feng, 1990: 48, figs 23.1-6. – Chen & Zhang, 1991: 78, figs 69.1-5. – Baehr & Baehr, 1993: 25, figs 20c-f. – Chen, 1994: 1, figs 1A-F. – Song, Zhu & Chen, 1999: 80, figs 32I-J, 33C-D. – Chen, 2007: 14, figs 1, 5-12.

NEW MATERIAL: MHNG-PDC-0254542121111111; Thailand, Chiang Mai Province, Chiang Mai District, Doi Suthep-Pui NP, Doi Pui, Huay Khok Ma Watershed Station, 1200-1300



FIGS 1-5

Hersilia asiatica. (1) Left male palp, prolateral view. (2) Ditto, ventral view. (3) Ditto, retrolateral view. (4) Epigyne, ventral view. (5). Vulva, dorsal view. Scale lines = 1.0 mm.

m; 1 male, 2 females; from a tree trunk in evergreen hill forest (closed canopy); 8.8.1999; leg. P. Dankittipakul. – MHNG-PDC-541354654020213163; Thailand, Nakhon Sri Thammarat Province, Tha Sala District, Khao Nan NP, 100-200 m; 1 female; beating shrub in dry lowland evergreen forest; 17.8.2006; leg. P. Dankittipakul. – TNHM-PDC-54651516514654; Thailand, Phetchabun Province, Lomsak District, Nam Nao NP, forests behind park headquarters, 600 m; 1 female; 16.-17.vii.2005; leg. P. Dankittipakul.

REMARKS: *Hersilia asiatica* is an extremely long-legged species. Males are recognized by: palpal patella with strongly sclerotized ridge carrying short erect spines, the ridge is recognized by a broad cleft (Fig. 1); embolus linear (Figs 1-3); median process of TA with prolateral denticle (Figs 1-2); lateral process of TA with sharply pointed anterior margin, and carrying an elongate process (Fig. 2). Females are

recognized by: epigyne a distinctly elevated mound with sclerotized anterior margin (Fig. 4); copulatory orifices situated anterior to sac-like membranous part of epigyne (Fig. 4); elongate tubular insemination ducts originating antero-medially, descending postero-laterally, connected to basal perforate sinusoids (Figs 5, 27); ovoid receptacula originating posteriorly, with tubular stalks (Fig. 5); fertilization ducts situated close to epigastric furrow, connected to vulva via short tubular ducts running obliquely (Fig. 5). Apart from the diagnostic characters given above and mentioned by Baehr & Baehr (1993), an additional feature was observed in the males examined: the lateral process of the TA bears a prolateral petal-shaped denticle (Figs 1, 3), its apex directed mesad. This structure is heavily sclerotized and sharply pointed in lateral view (Fig. 3); it is easily distinguishable from the median process of the TA which is less sclerotized and pigmented.

DISTRIBUTION: China, Thailand and Laos. *Hersilia asiatica* was previously recorded from northeastern Thailand (Khao Yai NP, Nakhon Ratchasima Province and Phu Kradueng NP, Loei Province) by Baehr & Baehr (1993). New localities reported herein extend the known distribution range of this species southwards to southern Thailand (Fig. 32).

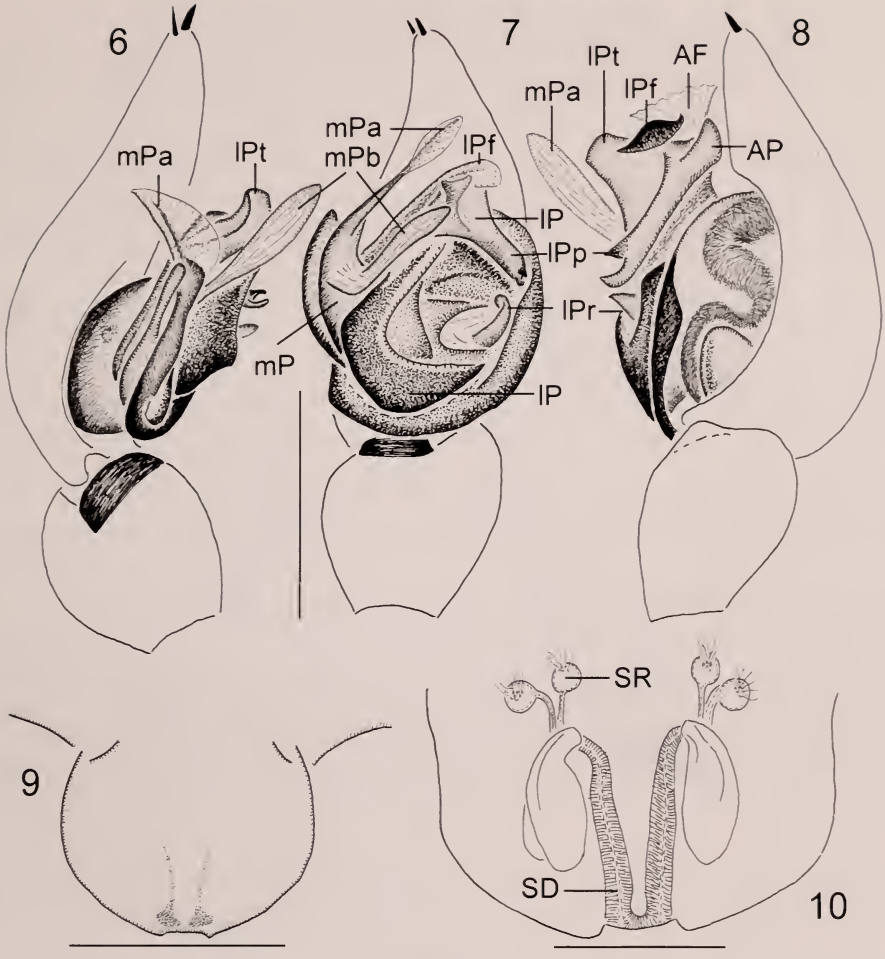
Hersilia sundaica Baehr & Baehr, 1993 Figs 6-10, 28, 31

Hersilia sundaica Baehr & Baehr, 1993: 58, figs 38c-f.

NEW MATERIAL: MHNG-PDC-1488756462151465454; Thailand, Phetchabun Province, Khao Kho NP, forest behind park headquarters, 650 m; 1 male; 10.-15.11.2006; collected by Malaise trap; leg. P. Dankittipakul. – MHNG-PDC-545464654545787; Thailand, Sakon Nakhon Province, Phu Phan NP, 800 m; 1 female; 12.-15.9.2007; collected by Malaise trap; leg. P. Dankittipakul. – TNHM-PDC-8782511532551454514; Thailand, Loei Province, Phu Kradueng NP, 1200 m; 1 female; 18.-20.9.2007; collected by Malaise trap; leg. P. Dankittipakul.

REMARKS: *Hersilia sundaica* belongs to the *impressifrons*-group which can be easily recognized by the peculiar structure of the male palp: the TA is complicated, provided with: 1) a membranous apical flange with serrated margin (Fig. 8, AF), and a bifurcated apical prong directed postero-retrolaterad (Fig. 8, AP); 2) lateral process of TA (lP) a large sclerotized, C-shaped plate, partially membranous, retrolaterally with a spoon-shaped projection (Figs 6-8, lPr), anteriorly with a median tubercle clearly visible in retrolateral view (Fig. 8, lPt), a membranous flange (Figs 7-8, lPf), and an elongated prong directed posteriad, its apex bifurcated (Fig. 7, lPp); 3) median process of TA (mP) with two large prongs, a basal prong abruptly bent, obliquely directed anteriad (Fig. 7, mPb), apical prong elongated, its apex membranous, fan-like (Fig. 7, mPa). Females are recognized by the protruded epigyne extending posteriorly (Fig. 9), copulatory orifices situated close to excavated posterior margin; vulva (Figs 10, 28) provided with parallel insemination ducts running mid-longitudinally, ascending anteriorly then curving laterally to form large glandular apparatus (Fig. 28); two pilose, spherical receptacula (Fig. 31) with short stalks situated anteriorly. The females examined lack a glandular patch which is present in the female paratype from Indonesia.

NATURAL HISTORY: All specimens examined were collected by means of a Malaise trap suggesting that this species is rather active and does not stay on the same tree as previous observations made us believe.



FIGS 6-10

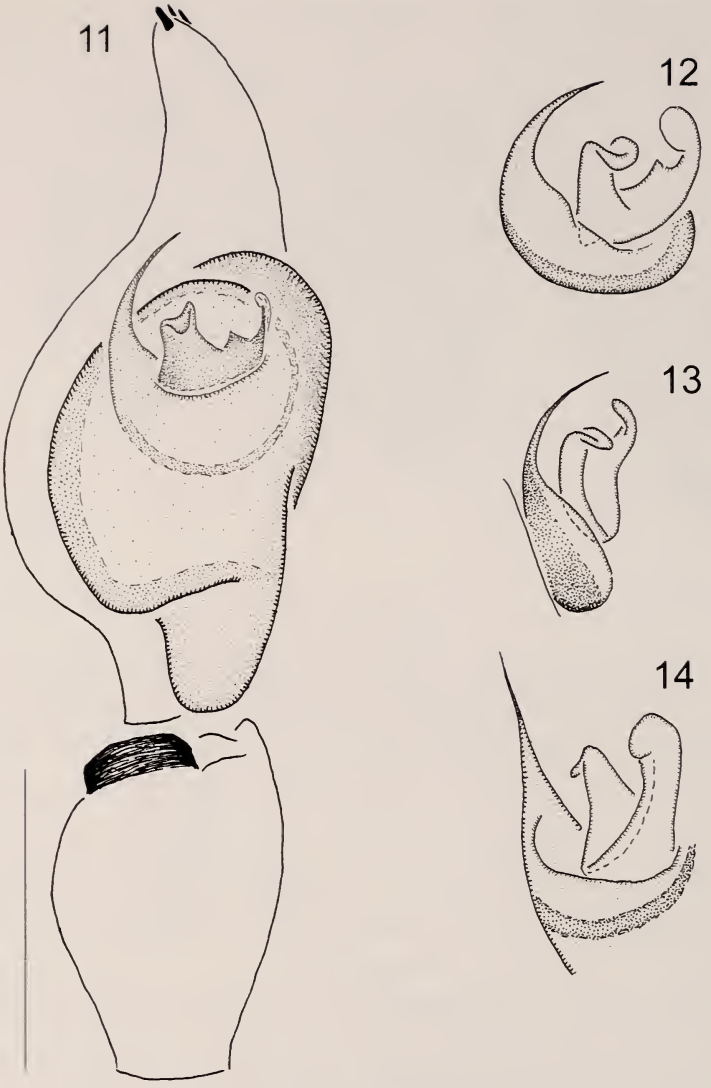
Hersilia sundaica. (6) Left male palp, prolateral view. (7) Ditto, ventral view. (8) Ditto, retrolateral view. (9) Epigyne, ventral view. (10) Vulva, dorsal view. Scale lines = 1.0 mm.

DISTRIBUTION: Indonesia (Lombok, Sumbawa) and Thailand (new record, Fig. 32). Although strong resemblance in genital morphology leave no doubt that the specimens examined belong to this species, it is important to note that the new specimens were collected very far away from the type localities on the Lesser Sunda Islands. *Hersilia sundaica* seems to have a broad distribution range. Additional material will hopefully become available from SE Asian countries in the future to confirm this.

Hersilia martensi Baehr & Baehr, 1993 Figs 11-14

Hersilia martensi Baehr & Baehr, 1993: 21, figs 17c-d.

NEW MATERIAL: MHNG-PDC-78754131421545; Thailand, Phetchabun Province, Nam Nao NP; 1 male; 18.7.2006; beating in forest with open canopy behind park headquarters; leg. P. Dankittipakul.



FIGS 11-14

Hersilia martensi. (11) Left male palp, ventral view. (12) TA, ventral view. (13) Ditto, prolateral view. (14) Ditto, retrolateral view. Scale line = 1.0 mm.

REMARKS: The male of this species is recognized by a retrolateral extension on the male bulb (Fig. 11), by a curved embolus gradually narrowing towards its sharply pointed apex (Figs 11-14), and by the TA carrying a lightly sclerotized prolateral process and a membranous retrolateral flange (Figs 12-14).

DISTRIBUTION: Nepal and Thailand (new record, Fig. 32). As *H. sundaica*, this species is apparently widely distributed. It was described from Nepal and, as the first new record since its original description, is here documented from a forest in north-eastern Thailand.

Hersilia serrata sp. n. Figs 15-19, 30

HOLOTYPE: MHNG-PDC-244545122222-109; Thailand, Chiang Mai Province and District, Chiang Mai University campus, Ang Kaew, 300-350 m; 1 male; 4.10.2007; on a tree trunk in an open area; leg. P. Dankittipakul.

PARATYPES: MHNG-PDC-875415454545987321; from the type locality; 1 female; 10.11.2007; leg. P. Dankittipakul. – MHNG-PDC-457857181554543222-256; Thailand, Chiang Mai Province, Chomthong District, Doi Inthanon NP, Doi Inthanon, on a tree trunk in degraded natural forest interspersed with pine trees behind a guest house, 1200-1300 m; 1 female; 1.-4.7.2002; leg. P. Dankittipakul. – MHNG-PDC-515432321544142114789; Thailand, Phitsanulok Province, Nakhon Thai District, Thung Salaeng Luang NP, Kaeng So Pha Waterfalls, 200-250 m, on tree trunk in dry deciduous forest close to a stream; 1 female; 2.5.2001; leg. P. Dankittipakul.

ETYMOLOGY: The Latin adjective "serratus -a, -um" (= saw like, serrated, saw toothed), refers to the serrated margin of the baso-median process on the TA of the male palp.

DIAGNOSIS: *Hersilia serrata* sp. n. clearly belongs to a presumably monophyletic clade consisting of 10 closely related species known as the *savignyi*-group. The male palpal patella of the *savignyi*-group is characterized by the presence of an elevated dorsal projection carrying minute erect spines (Fig. 15). The male of *H. serrata* sp. n. is distinguished from other members of the *savignyi*-group by the serrated baso-median process of the TA; females by the very broad and heavily sclerotized apices of the bulbose sacs of the spermathecae.

DESCRIPTION

Male holotype: Prosoma 2.5 long, 2.4 wide; opisthosoma 4.0 long, 2.5 wide. PLS 6.9 long, bS 0.9 long, tS 6.0 long.

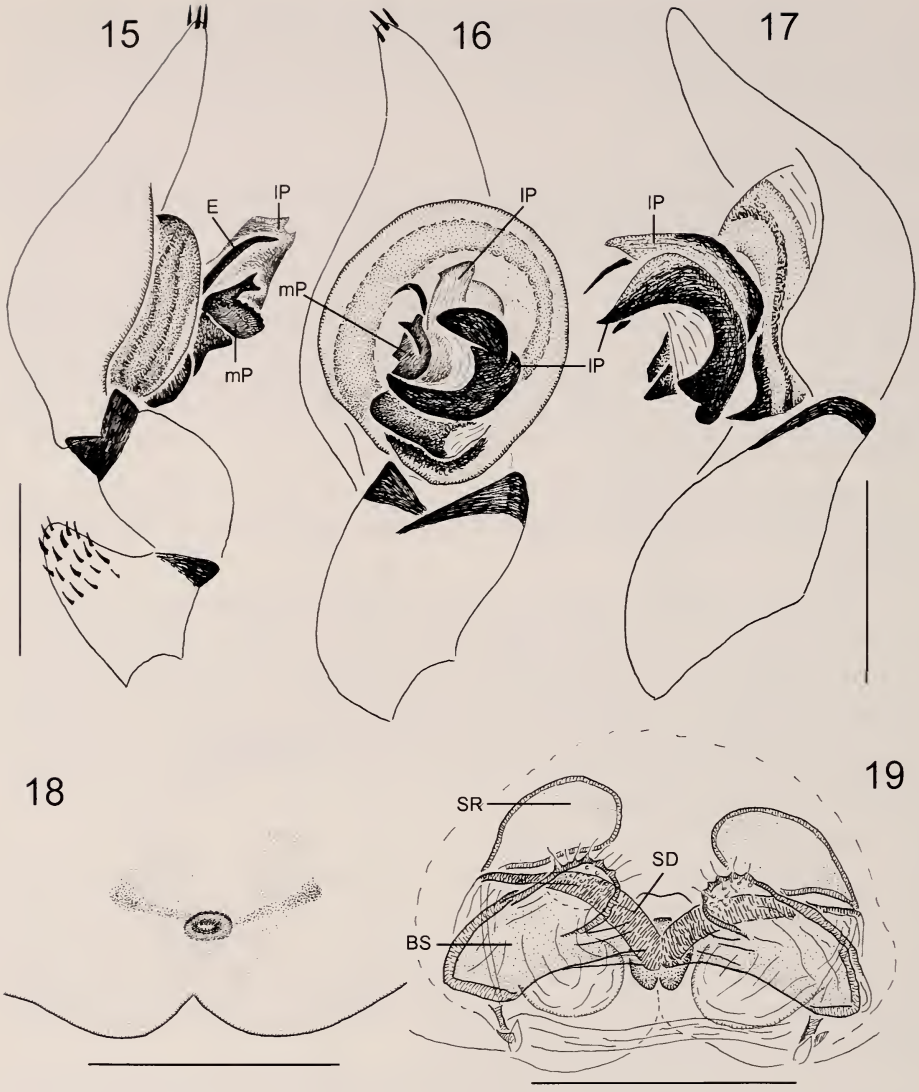
Prosoma: Prosoma almost disc-shaped, as long as wide, with distinct clypeal projection; ocular region relatively low; clypeus about half length of ocular region; chelicerae elongated, slightly less than two times longer than wide; sternum triangular, anterior margin with shallow median incision.

Eye size and interdistances: AME distinctly larger than PME; ALE = PLE > PME; eye ratio: 1.0: 0.80: 0.38: 0.88. AME = 1.0; AME-AME = 0.48; AME-ALE = 0.68; PME = 1.0; PME-PME = 0.62; PME-PLE = 0.84.

Opisthosoma: Opisthosoma ovoid, longer than wide, widest in the middle, posteriorly with triangular anal tubercle; dorsum with four pairs of large circular DMP, second pair largest, first and fourth pairs subequal, slightly smaller than third pair; VMP numerous, forming parallel longitudinal lines but distinctly narrower posteriorly.

Spinnerets: PLS elongated, slightly less than twice as long as opisthosoma; other spinnerets slightly shorter than bS.

Leg measurements: I, 21.64 (5.50, 1.24, 5.82, 8.1, 0.98); II, 22.08 (5.8, 1.1, 5.96, 8.2, 1.02); III, 5.60 (1.84, 0.58, 1.12, 1.32, 0.74); IV, 12.96 (4.88, 0.96, 2.92, 3.22, 0.98).



FIGS 15-19

Hersilia serrata sp. n., holotype (15-17), paratype (18-19). (15) Left male palp, prolateral view. (16) Ditto, ventral view. (17) Ditto, retrolateral view. (18) Epigyne, ventral view. (19) Vulva, dorsal view. Scale lines = 1.0 mm.

Male palp (Figs 15-17): Patella with dorsal projection carrying several short spines. Tibia prolaterally with bifurcated apical portion. Cymbium slender, with three stout apical spines. Bulbus almost globular, posteriorly narrowed. Embolus slender, linear, apex slightly curved, pointing downwards. TA with two processes: baso-median process strongly sclerotized, with bifurcated projection and serrated margin; apico-

retrolateral process with columnar membrane situated apically, and with larger, concave, sclerotized part situated retrolaterally, its apex sharply pointed, directed mesad.

Female paratype (from Chiang Mai): Prosoma 2.8 long, 2.6 wide; opisthosoma 4.2 long, 2.6 wide. PLS 7.52 long, bS 1.10 long, tS 6.42 long.

Prosoma: Prosoma circular, clypeal area protruded, frontal clypeal margin semicircular; ocular region relatively low; clypeus approximately of same height as ocular region; chelicerae elongated, almost twice as long as wide; sternum triangular, anterior margin with shallow median incision.

Eye size and interdistances: Eyes almost subequal; AME largest > ALE = PLE > PME; ratio: 1.0: 0.94; 0.28; 0.90. AME = 1.0; AME-AME = 0.48; AME-ALE = 0.66; PME = 1.0; PME-PME = 0.68; PME-PLE = 0.88.

Opisthosoma: Opisthosma longer than wide, widest posteriorly, triangular anal tubercle indistinct; dorsum with four pairs of large circular DMP, fourth pair slightly smaller, others subequal; VMP numerous, forming V-shaped longitudinal lines.

Spinnerets: PLS elongated, slightly longer than opisthosoma; other spinnerets shorter than bS.

Leg measurements: I, 21.18 (5.10, 2.02, 5.20, 7.98, 0.88); II, 21.32 (5.62, 1.02, 5.66, 8.1, 0.98); III, 5.02 (1.66, 0.48, 1.02, 1.22, 0.64); IV, 12.4 (4.66, 0.88, 2.86, 3.12, 0.88).

Epigyne and vulva (Figs 18-19, 30): Epigyne an elevated membranous mound, posteriorly slightly higher than in anterior region, posterior margin with deep median incision; oval copulatory orifices situated medially, its margin rebordered, with reddish bands directed obliquely in antero-prolateral and antero-retrolateral direction. Vulva with broad and thickened insemination ducts, directed anteriad, then descending laterad. Receptacula widely separated, ovoid, with tubular stalks. Bulbose sacs of spermathecae rectangular, inclined towards each other, with digitiform pilose apices.

TAXONOMIC REMARKS: Males of the new species closely resemble those of *H. nentwigi* Baehr & Baehr, 1993 (known from Sumatra, Java and Krakatau) in the general shape of the male palp and the possession of baso-median and apico-retrolateral processes on the TA (Fig. 16). Males of both species can be distinguished by the apico-retrolateral process provided with an elongated apical membranous portion directed distad (Figs 16-17) (columnar in ventral view, beak-shaped in retrolateral view in *H. serrata* sp. n., but completely absent in *H. nentwigi*), and by the sclerotized baso-median process with a serrated margin (carrying a bifurcated projection in *H. serrata* sp. n., Fig. 15, serrated area absent in *H. nentwigi*). The TA of the male palp also closely resembles that of *H. feai* Baehr & Baehr, 1993 (from Burma) in having an elongated membranous part and a sclerotized, beak-shaped projection directed mesad on the apico-retrolateral process of the TA (Fig. 16); the TA of the new species can be distinguished by the baso-median process being triangular and lacking a bifurcated projection. Males of *H. striata* Wang & Yin, 1985 (from China, Myanmar, Thailand to Java and Sumatra) differ from males of the new species by the TA without a membranous apical part on the apico-retrolateral process and by the baso-median process lacking a serrated area.

Females of the new species are most similar to those of *H. nentwigi* but can be distinguished by the elongated, rectangular bulbose posterior sacs of their spermathecae which are provided with broad, bluntly pointed apices (Figs 19, 30) (apices and bulbose sacs not visible in *H. nentwigi*). Females clearly differ from those of *H. simplicipalpis* (from Khao Yai NP and Doi Suthep-Pui NP) and *H. striata* in the different shapes of their vulvae: large bulbose sacs are present in *H. simplicipalpis*, thickened bulbose sacs in *H. striata*.

DISTRIBUTION: Northern Thailand (Chiang Mai and Phitsanulok Provinces).

Hersilia thailandica sp. n. Figs 20-24

HOLOTYPE: MHNG-PDC-65465444442244741976-109; Thailand, Chiang Mai Province, Mae Rim District, Queen Sirikit Botanic Garden, 600-700 m, on a tree trunk in degraded forest in front of museum building; 1 male; 6.-13.10.2006; leg. P. Dankittipakul.

PARATYPES: MHNG-PDC-12546554574875655; same data as for holotype; 3 males.

ETYMOLOGY: The specific name is an adjective ("thailandicus, -a, -um") and refers to the presence of this species in Thailand.

DIAGNOSIS: *Hersilia thailandica* sp. n. belongs to the *pectinata*-group, which is easily recognized by the male palpal patella being short, and the palpal tibia with an elevated dorsal projection carrying a group of long erect spines (Figs 21-23). The new species is most similar to *H. pectinata* Thorell, 1895 from Burma in the similar male palp with an enlarged, ovoid bulbus, an elongated, curved embolus thickening and a T-shaped TA. *Hersilia thailandica* sp. n. can be distinguished from *H. pectinata* by: seven large erected spines on palpal tibia directed anteriad (Figs 21, 23) instead of laterad (almost perpendicular to the axis of the tibia in *H. pectinata*); the embolus terminally abruptly bending distad, gradually narrowing towards its bluntly pointed apex (Figs 20, 22); the ovoid bulbus with enlarged tubular TA (Fig. 22) instead of being a reniform plate.

DESCRIPTION

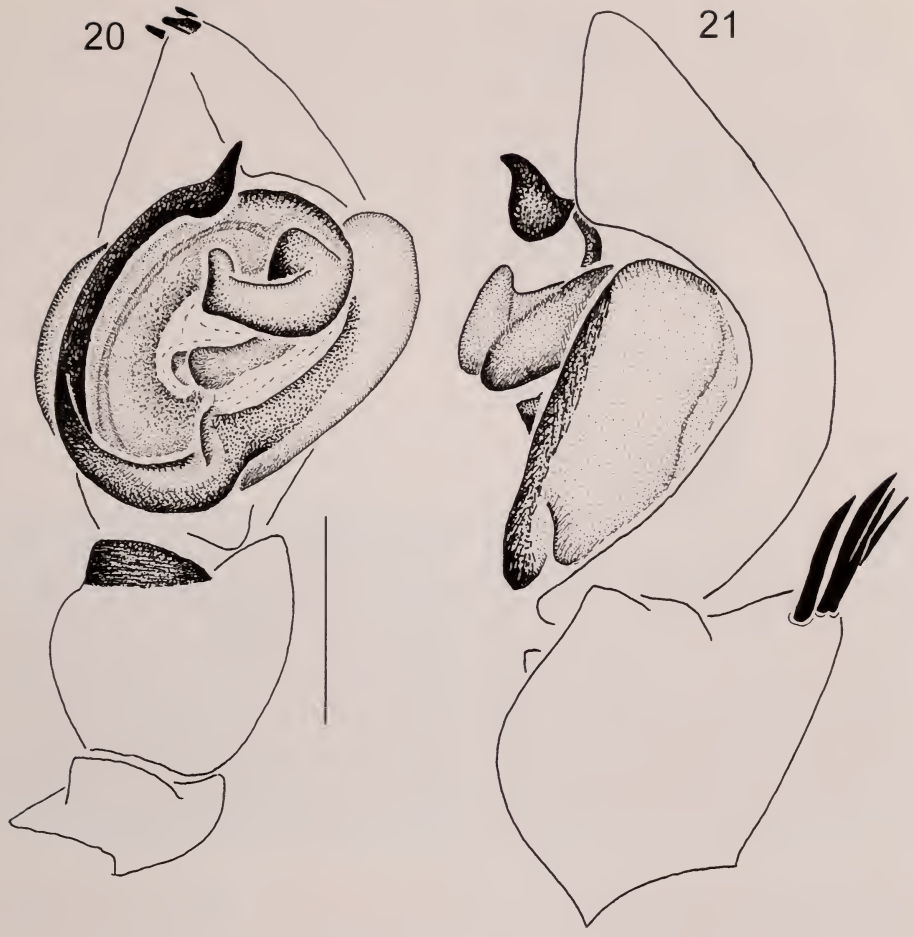
Male holotype: Prosoma 2.8 long, 2.6 wide; opisthosoma 4.4 long, 2.8 wide. PLS 7.3 long, bS 1.1 long, tS 6.2 long.

Prosoma: Prosoma pear-shaped, posteriorly distinctly disc-shaped; ocular region relatively low; clypeus slightly shorter than ocular region; chelicerae elongated, twice as long as wide; sternum triangular, anterior margin with shallow median incision.

Eye size and interdistances: Eyes almost subequal; AME slightly larger than PME; ALE = PLE < AME; eye ratio: 1.0: 0.82: 0.84: 0.96. AME = 1.0; AME-AME = 0.78; AME-ALE = 0.98; PME = 1.0; PME-PME = 0.68; PME-PLE = 0.72.

Opisthosoma: Opisthosoma longer than wide, widest behind the middle, anterior margin almost straight, posteriorly with triangular anal tubercle; dorsum with four pairs of large circular DMP, second pair slightly larger, others subequal; VMP numerous, forming parallel longitudinal lines but distance distinctly narrower posteriorly.

Spinnerets: PLS elongated, twice as long as opisthosoma; other spinnerets not visible in dorsal view.

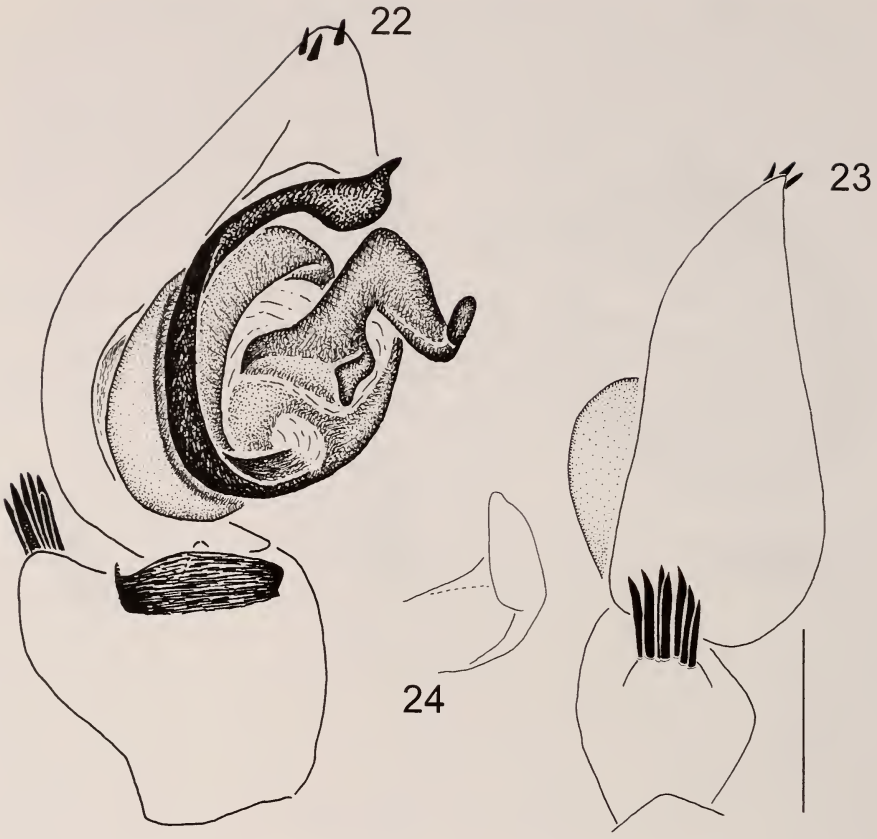


FIGS 20-21

Hersilia thailandica sp. n., holotype. (20) Left male palp, ventral view. (21) Ditto, retrolateral view. Scale lines = 1.0 mm.

Leg measurements: I, 20.24 (4.96, 1.92, 5.02, 7.58, 0.76); II, 20.7 (5.42, 0.98, 5.44, 7.98, 0.88), III, 4.52 (1.46, 0.42, 0.98, 1.12, 0.54), IV 11.7 (4.46, 0.8, 2.58, 3.08, 0.78).

Male palp (Figs 20-24): Tibia short, dorsally with elevated projection carrying seven long erect spines directed anteriad (Fig. 23). Cymbium with three stout apical spines. Bulbus large, ovoid; lateral borders rounded. Embolus broad, heavily pigmented, without accessory process, originating postero-medially, curving in anticlockwise direction (on left palp), terminally abruptly bending distad, gradually narrowing towards it bluntly pointed apex (Figs 20, 22). TA developed as a large elongated prong, its base broad, with a retro-basal ridge, narrowing to form a tubular stalk and abruptly bending mesad (Figs 20, 22), apex spoon-shaped, curling inwards (Fig. 24).



FIGS 22-24

Hersilia thailandica sp. n., holotype. (22) Left male palp, proventral view. (23) Ditto, dorsal view. (24) Apex of TA, prolateral view. Scale lines = 1.0 mm.

Female: Unknown.

DISTRIBUTION: Known only from the type locality in Chiang Mai Province (Fig. 32).

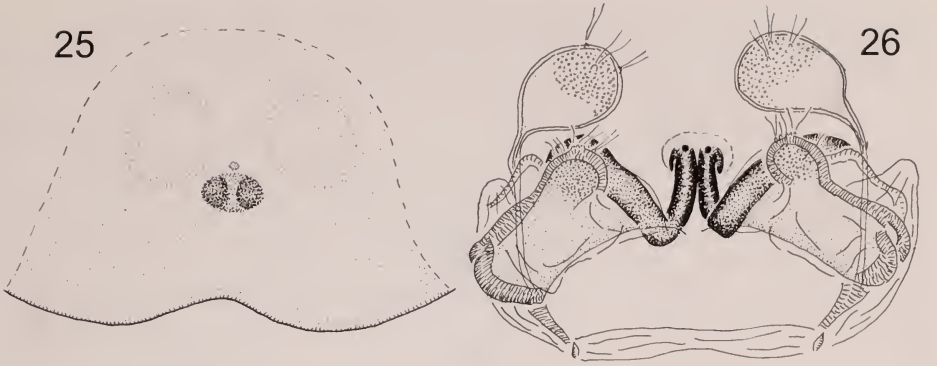
Hersilia cf. *striata* Wang & Yin, 1985

Figs 25-26, 29

Hersilia striata Wang & Yin, 1985: 45, figs 1A-E. – Song, 1987: 117, fig. 79. – Baehr & Baehr, 1993: 37, figs 26c-g. – Song, Zhu & Chen, 1999: 80, figs 12C, 32K-L, 33E. – Chen, 2007: 17, figs 2, 13-18.

MATERIAL EXAMINED: MHNG-PDC-74164642342654656687; Thailand, Prae Province, Long District, on a trunk of teak in a deciduous dipterocarp forests en route to Prae City; 1 female; 26.5.2002; leg. P. Dankittipakul.

REMARKS: The female examined belongs to the *savignyi*-group on the basis of genital morphology. It is most similar to *H. striata* in having the insemination ducts curving downwards and then ascending laterad, the rectangular bulbose sacs of the



FIGS 25-26
Hersilia cf. *striata*. (25) Epigyne, ventral view. (26) Vulva, dorsal view. Scale lines = 1.0 mm.

FIGS 27-31
Hersilia asiatica (27), *H. sundaica* (28, 31), *H.* cf. *striata* (29), *H. serrata* sp. n., paratype (30). (27-28) Vulva, dorsal view. (29-30) Right half of vulva, dorsal view. (31) Seminal receptacle.

spermathecae with pilose apices and the ovoid receptacula separated from one other. However, the female examined slightly differ in the shape of the apices on the bulbose sacs which are round and clearly separate from the remaining membranous parts by thickenings (Figs 26, 29). The separation is indistinct and the thickening of the apices

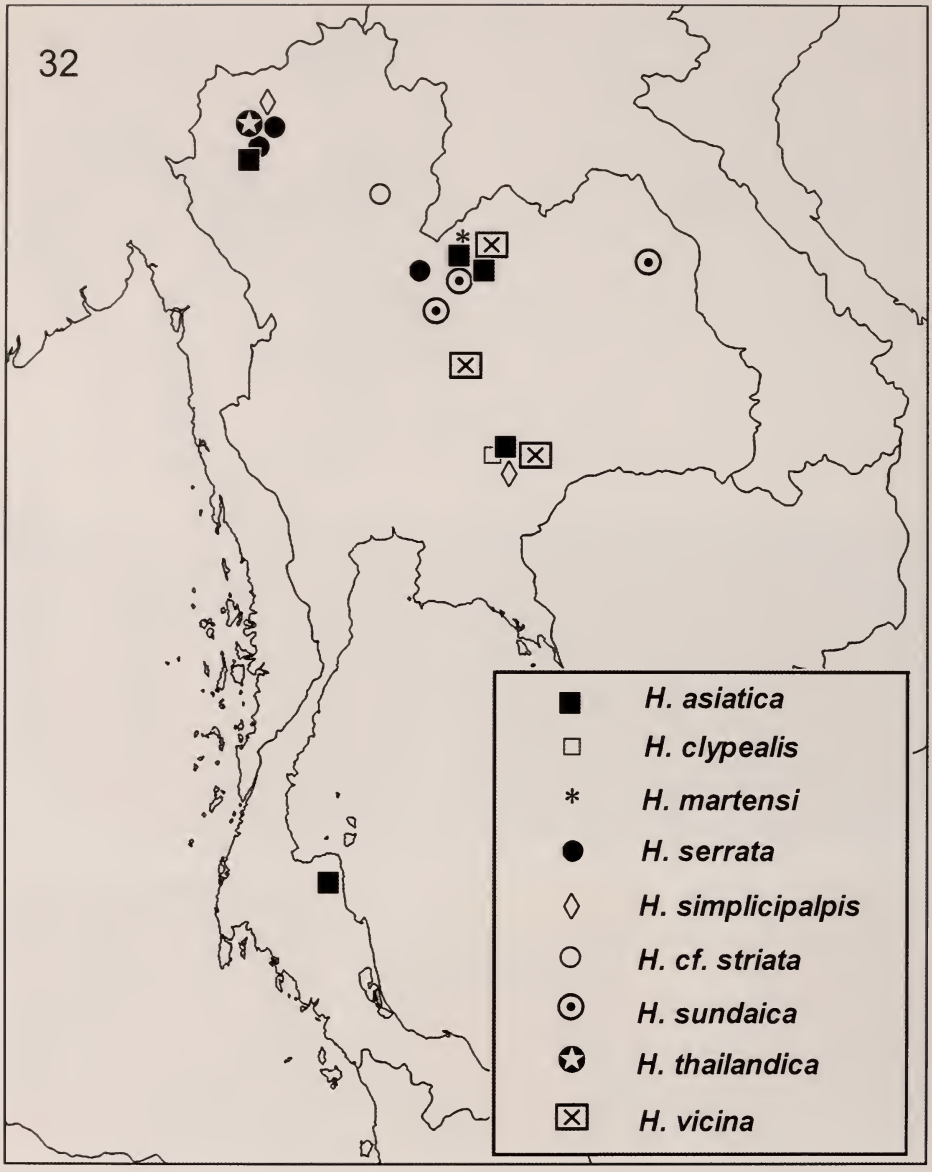


FIG. 32
Currently known *Hersilia* localities in Thailand.

is not prominent in females of *H. striata*. Therefore, the female examined from Thailand cannot be identified with certainty pending an examination of the Chinese types.

DISTRIBUTION: China, Myanmar, Thailand (Sam Roi Yod NP, Prachuap Kirikhan Province, and Doi Inthanon NP, Chiang Mai Province, given by Baehr & Baehr, 1993; Long, Prae Province), Indonesia (Java, Sumatra).

Hersilia spp.

Females of two additional, presumably undescribed species of the *savignyi*-group were found in the provinces of Lampang and Kanchanaburi. They will be formally described as soon as conspecific males are available. Three other *Hersilia* species previously recorded from Thailand are not included in the present study because no new material is available. These taxa are: *H. clypealis* (Khao Yai NP), *H. simplicipalpis* (Khao Yai NP, Doi Suthep-Pui NP), *H. vicina* (Khao Yai NP, Pa Hin Ngam NP, Nam Nao NP).

ACKNOWLEDGEMENTS

We thank Dr Peter Schwendinger for the allowing us to deposit the type specimen at MHNG. He and Dr Barbara Baehr (University of Newcastle, Australia) kindly provided constructive comments on earlier versions of the manuscript. The Thailand Research Fund provided a grant through the Royal Golden Jubilee Ph. D. Program (PHD/0017/2551) to T.S. and P.D. The Graduate School and the Faculty of Science of Chiang Mai University supported P.D. during his study. The Royal Forest Department gave permission to collect spider specimens in national parks and other protected areas. P.D. wishes to express his sincerer gratitude to Dr Angoon Lewvanich (The Royal Academy of Thailand, Bangkok) and Christopher J. Sain (The University of Auckland, New Zealand) for their support throughout the years.

REFERENCES

AUDOUIN, V. 1826. Explication sommaire des planches d'arachnides de l'Egypte et de la Syrie publiées par Jules-César Savigny; offrent un exposé des charactères naturels des genres, avec la distinction des espèces (pp. 99-186, pl. 1-9). *In*: SAVIGNY, J. C. (ed.). Description de l'Egypte. *Histoire Naturelle, Animaux invertébrés* (Paris) 1 (4): 1-339.

BAEHR, M. & BAEHR, B. 1993. The Hersiliidae of the Oriental Region including New Guinea. Taxonomy, phylogeny, zoogeography (Arachnida, Araneae). *Spixiana* Supplement 19: 1-95.

CHEN, S. H. 2007. Spiders of the genus *Hersilia* from Taiwan (Araneae: Hersiliidae). *Zoological Studies* 46: 12-25.

SIMON, E. 1886. Arachnides recueillis par M. A. Pavie (sous-chef du service des postes au Cambodge) dans le royaume de Siam, au Cambodge et en Cochinchine. *Actes de la Société linnéenne de Bordeaux* 40: 137-166.

SONG, D. X. 1987. Spiders from agricultural regions of China (Arachnida: Araneae). *Agriculture Publishing House, Beijing*, 376 pp.

SONG, D. X. & ZHENG, S. X. 1982. A new spider of the genus *Hersilia* from China (Araneae: Hersiliidae). *Acta Zootaxonomica Sinica* 7: 40-42.

SONG, D. X., ZHU, M. S. & CHEN, J. 1999. The Spiders of China. *Hebei Science and Technology Publishing House, Shijiazhuang*, 640 pp.

THORELL, T. 1870. On European spiders. *Nova Acta Regiae Societatis Scientiarum Upsaliensis* (3)7: 109-242.

WANG, J. F. & YIN, C. M. 1985. Two new species of spiders of the genus *Hersilia* from China (Araneae: Hersiliidae). *Acta Zootaxonomica Sinica* 10: 45-49.

Revue suisse de Zoologie 118 (2): 223-230; juin 2011

Two new species of *Amynthas* (Clitellata: Megascolecidae) from lettuce fields of Mt. Taebaek, Korea

Yong HONG
Department of Agricultural Biology, College of Agriculture & Life Sciences, Chonbuk National University, Jeonju 561-756, Korea

Two new species of *Amynthas* (Clitellata: Megascolecidae) from lettuce fields of Mt. Taebaek, Korea. - Two new species of earthworms were found in a survey of lettuce cultivation fields, created by slash and burn. *Amynthas hasamensis* sp. n. and *Amynthas samgaki* sp. n. have simple intestinal caeca and no genital markings. *Amynthas hasamensis* sp. n. keys to the *hawayanus* group in Sims & Easton (1972) with three pairs of spermathecae in VI, VII, and VIII. Its male field areas in XVIII are complex with paired oval male discs bearing two transverse ridges with seminal grooves between the ridges. *Amynthas samgaki* sp. n. keys to the *morrisi* group with two pairs of spermathecae in VI and VII, and has a male field with large egg-shaped raised pads with transverse seminal grooves.

Keywords: Earthworms - *Amynthas* - Megascolecidae - Clitellata - Korea - lettuce fields - taxonomy.

INTRODUCTION

Korean earthworm communities in forests and agricultural ecosystems are dominated by species of the genus *Amynthas* (Megascolecidae). Many new Korean species have been described recently, further expanding the genus *Amynthas* (Hong & James, 2001a, b; Hong & Lee, 2001; Hong *et al.*, 2001; Hong & Kim, 2002a, b; Hong, 2007; Hong & James, 2009). The shape of the male pore region, especially the male discs, is useful for taxonomy of Korean *Amynthas* and has been used throughout the history of this taxon. Species with male discs were reported in Hong & James (2001a) and Hong (2007). In this study, I describe two species with male discs: *Amynthas hasamensis* sp. n. and *Amynthas samgaki* sp. n. Exotic *Drawida* species (Moniligastridae) were also found in the area, so I conclude that endemic and exotic species are living together. An earlier report of the earthworm fauna from Mt. Taebaek found only one species, *Amynthas taebaekensis* (Hong & James, 2001a).

Mt. Taebaek is located to the north of Seoul in Gangwon Provincial Park, which has natural forests. Among its big mountains are Janggun peak (1,567 m), Munsoo peak (1,517 m), and Busoe peak (1,546 m). Specimens were collected by digging and hand sorting in June 2006 and July 2007 in slash-and-burn fields used for lettuce cultivation. Taxonomy in this paper follows Sims & Easton (1972), and Easton (1979). In the location data the terms "dong" and "ri" refer to successively smaller Korean political divisions and do not have direct English equivalents. The "ri" division is

Manuscript accepted 08.12.2010

preceded by a number if there is more than one ri of a particular name. In this paper, "Hasam 2-ri" indicates the second ri named Hasam. Illustrations are of anatomical views containing important features, prepared with a camera lucida. Descriptions are based on the external examination and dorsal dissection under the stereomicroscope. Holotype and some paratypes are deposited in the National Institute of Biologocal Resources, Korea (NIBR), and other paratypes are deposited in the Museum of Natural History of Geneva (MHNG).

DESCRIPTION

Family Megascolecidae Rosa, 1891
Genus ***Amynthas*** Kinberg, 1867

Amynthas hasamensis sp. n. Figs 1A-B

Material: Holotype; clitellate (NIBRIV0000224640); Korea, Gangwon province, Taebaek municipality, Samsu-dong, Hasam 2-ri, Mt. Taebaek (37° 14.074'N, 128° 59.151'E), 600-800 m, fields cleared for cultivation by burning, soil and litter layers, 29 June 2006, Y. Hong coll. – Paratypes: 1 clitellate (NIBRIV0000224641), 1 clitellate (MHNG INVE 75339); same data as for holotype. – Nontype material; 2 clitellate specimens, Taebaek municipality, Samsu-dong, Hasam 2-ri, Mt. Taebaek (37° 14.074'N, 128° 59.151'E), 600-800 m, soil and litter layers, 4 July 2007, Y. Hong coll.

Etymology: The species is named for Hasam 2-ri, its type locality.

Diagnosis: Three pairs of spermathecal pores in 5/6-7/8; male discs each with two transverse low ridges, short diagonal seminal groove between ridges, no other genital markings.

Description: Dimensions 80-130 mm by 5.5-6.5 mm at segment X, 6.0-6.5 mm at segment XXX, 6.0-8.0 mm at clitellum; body cylindrical, segments 59-109. Setae regularly distributed around segmental equators numbering 31-35 at VII, 63-66 at XX, 0 between male pores, setal formula AA:AB:ZZ:YZ= 2:2:4:3 at XIII. Female pore single in XIV, within 0.8-1.0 mm circular porophore. Prostomium epilobic with tongue open, clitellum coffee color, formalin preservation. First dorsal pores at 12/13, one individual 11/12. Clitellum annular XIV-XVI; setae invisible externally.

Male field composed of paired male discs, each approximately ovate with longer axis transverse; each disc with two narrow transverse ridges, one equatorial, centered to slightly lateral of center on disc; one on posterior margin of disc, almost as long as long axis of disc. Surface between ridges and within outer margins of discs generally depressed; midventral gap between discs even more depressed. Seminal grooves short, from just posterior to medial end of equatorial ridge, diagonally posterior, lateral in a short arc convex anterior-laterally across depressed area between ridges to meet posterior ridge. Male pores at medial ends of seminal grooves, close to equatorial ridges, 0.15 circumference apart. Spermathecal pores in 5/6-7/8, 0.16 circumference apart, each with small tongue-like appendage within furrow; thickened lips immediately adjacent to each pore; ventral surface of VI-VIII thickened, slightly rugose, faintly pigmented.

Septa 5/6-7/8 thick, 8/9/10 absent, 10/11-13/14 thinly muscular. Gizzard large in VIII-X. Intestine begins in XV; lymph glands not found. Typhlosole medium sized

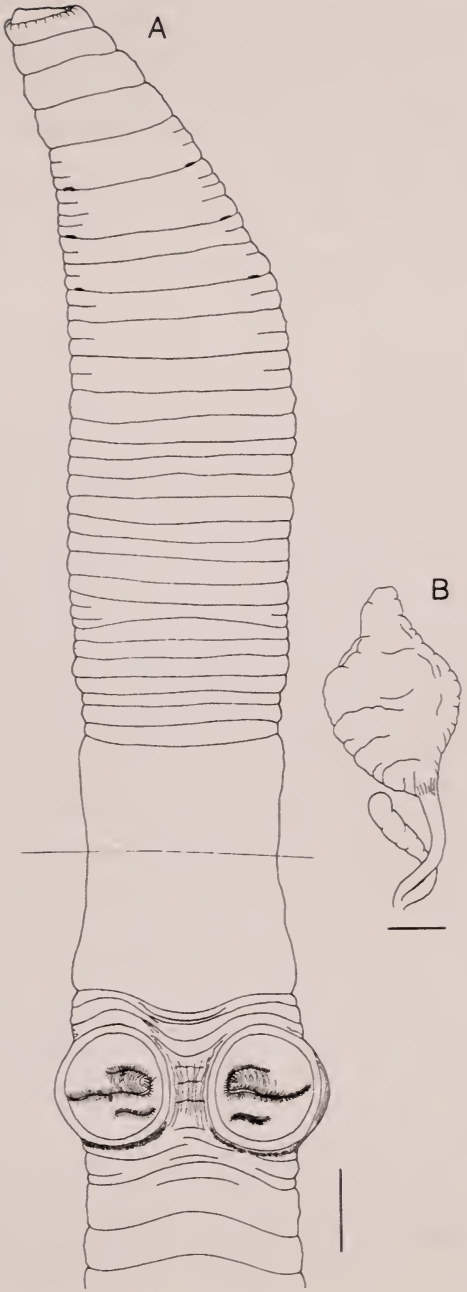


FIG. 1

Amynthas hasamensis sp. n. (A) Ventral view. (B) Spermathecae and diverticulum. Scale bars = 2.5 mm (A), 2 mm (B).

from XXVI. Intestinal caeca originating in XXVII and extending anteriorly about to XXII, simple finger-shaped sac. Oesophageal hearts three pairs in XI-XIII; X, only one side. Male sexual system holandric, testes and funnels in ventrally joined sacs in X-XI. Seminal vesicles two pairs in XI-XII medium sized with dorsal lobes. Prostates in XVIII, extending over XVI-XIX, stout ducts, both glands consist of two main lobes, each divided again into many small lobes.

Ovaries in XIII. Paired spermathecae in VI-VIII, VI smallest; ampulla surface wrinkled egg-shaped, duct slender, shorter than ampulla, diverticulum chamber clavate, almost transparent with slender stalk shorter than ampulla, no nephridia on spermathecal ducts. Genital marking glands not found.

Remarks: In Sims & Easton (1972), *Amynthas hasamensis* sp. n. keys to the *hawayanus* (*gracilis*) group. The new species is not *A. gracilis* (Kinberg 1867) or its possible and actual synonyms (Blakemore, 2003), all of which have several small genital markings in the spermathecal and male field segments, and lack the large porophores with seminal grooves. The *gracilis* species group includes 13 species found in Korea and/or Japan: *A. acinctus* (Goto & Hatai, 1899), *A. agrestis* (part) (Goto & Hatai, 1898), *A. carnosus* (Goto & Hatai, 1899), *A. communissimus* (Goto & Hatai, 1899), *A. hilgendorfi* (part) (Michaelsen, 1892), *A. kamitai* (Kobayashi, 1934), *A. pa - pulosus* (Rosa,1896), *A. phaselus* (Hatai, 1930), *A. serratus* (Kobayashi, 1936), *A. vallis* (Kobayashi, 1936), *A. palgongensis* Hong, 2001, *A. minjae* Hong, 2001, and *A. jamesi* Hong, 2007. Most of these lack large porophores with seminal grooves and most have small genital markings in spermathecal and/or male field segments. *Amynthas communissimus* has manicate caeca. Only *A. vallis*, *A. jamesi*, and A. *palgongensis* have seminal grooves on large porophores. Annular testes sacs are present in *A. vallis* and *A. palgongensis*, but *A. vallis* has very long diagonal seminal grooves extending back towards 18/19. The new species is similar to *A. palgongensis*, but has a different shape of the spermathecal diverticulum, a shorter diverticulum relative to the ampulla, fewer setae per segment at VII, and no setae between male pores (0 vs. 1-4). The T-shaped seminal grooves of *A. palgongensis* are also very distinct. Looking beyond the rather superficially-defined species groups in Sims & Easton (1972), the species is similar to *A. cuneatus* Hong & James, 2001, whose male field consists of male discs with short seminal grooves of the same orientation. It differs from *A. cuneatus* in having the transverse ridges and in not having the male discs mounted on large alate extensions of XVIII. The two species differ in number of spermathecal pores, and the thickened rugose slightly pigmented areas of VI-VIII (genital patches) are lateral in *A. cuneatus*, rather than ventral.

Chen (1933; 1936; 1938; 1946) reported ten species of the *gracilis* group in China. *Amynthas hasamensis* sp. n. is similar to the Chinese *A. muticus* (Chen, 1938) and *A. magnificus* (Chen, 1936) by having male discs, but the disc shapes and spermathecal characters are different, and there are no ridges in the discs of either Chinese species.

Amynthas samgaki sp. n. Figs 2A-B

Material: Holotype; clitellate (NIBRIV0000224642); Korea, Gangwon province, Taebaek municipality, Samsu-dong, Hasam 2-ri, Mt. Taebaek (37° 14.074'N, 128° 59.151'E),

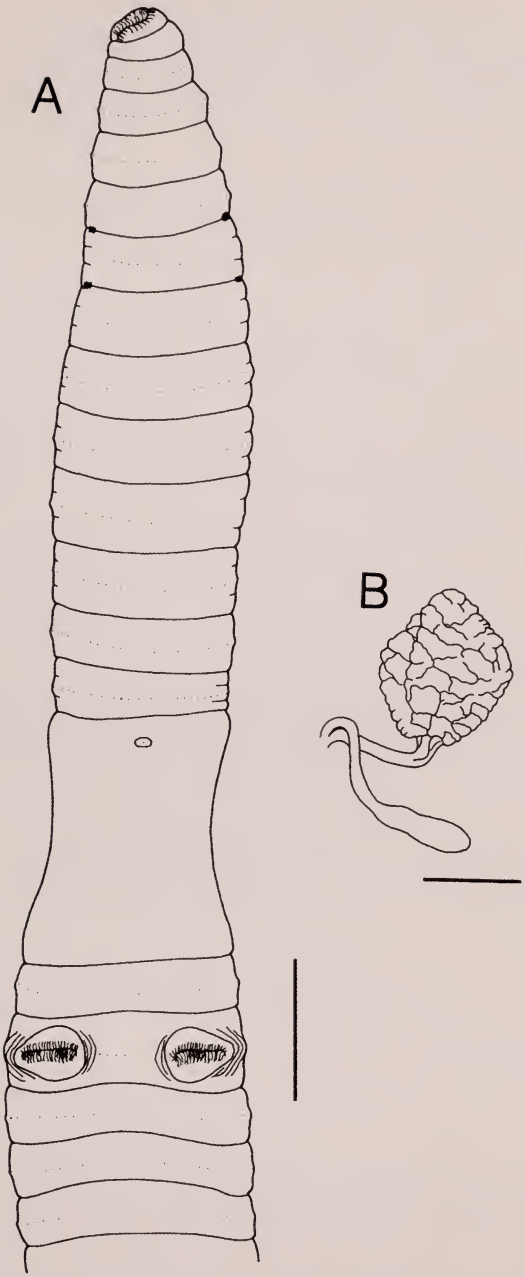


FIG. 2

Amynthas samgaki sp. n. (A) Ventral view. (B) Spermathecae and diverticulum. Scale bars = 4 mm (A), 2 mm (B).

600-800 m, soil and litter layers, 29 June 2006, Y. Hong coll. – Paratypes; 1 clitellate (NIBRIV0000224643), 1 clitellate (MHNG INVE 75338); same data as for holotype. – Nontype material; 1 clitellate specimen, Taebaek municipality, Samsu-dong, Hasam 2-ri, Mt. Taebaek (37° 14.074'N, 128° 59.151'E), 600-800 m, soil and litter layers, 4 July 2007, Y. Hong coll.

Etymology: The species is named after Sim Samgak, whose farm is its type locality.

Diagnosis: Paired spermathecal pores in 5/6, 6/7; male field with large egg-shaped raised pads with transverse seminal groove across pad center, 2.5-3.0 mm distance between male pores, testes sacs ventral, paired.

Description: Dimensions 77-110.5 mm by 4.5-4.7 mm at segment X, 6.0-6.5 mm at segment XXX, 5.5-6.5 mm at clitellum; segments 64-79. Setae regularly distributed around segmental equators, numbering 24-32 at VII, 52-63 at XX, 7 between male pores, setal formula AA:AB:ZZ:YZ= 2.5:2:2:2 at XIII. Female pore single in XIV, on 0.6-0.9 mm circle or oval. Prostomium epilobic with tongue open, clitellum coffee color, formalin preservation. First dorsal pore at 12/13. Clitellum annular XIV-XVI; setae invisible externally.

Male field with large egg-shaped raised pads, narrow end lateral, with transverse seminal groove from center of pad to just inside lateral edge, male pore at medial end of groove. Three to four concentric arcs around lateral end of pad, 2.5-3.0 mm distance between male pores. Paired spermathecal pores in 5/6 and 6/7, lateral, minute. Genital markings lacking.

Septa 5/6-7/8 thick, 8/9, 9/10 absent, 10/11-12/13 thickened. Gizzard large in VIII-X. Intestine begins in XV, lymph glands not found. Typhlosole medium sized from XXVI. Intestinal cecum originating in XXVII and extending anteriorly about to XXIV, bent down to ventral body wall, simple finger-shaped. Oesophageal hearts four pairs in X-XIII; X, XII and XIII large. Male sexual system holandric, testes and funnels in ventrally paired sacs in X-XI. Seminal vesicles two pairs in XI-XII medium sized. Prostates in XVIII, extending through XVII-XIX, long stout duct, glands divided into small lobes.

Ovaries in XIII. Paired spermathecae in VI, VII; each ampulla roughly ovate, flattened, wrinkled on surfaces, slender duct as long as ampulla; diverticulum chamber club-shaped, white; slender stalk as long as ampulla, no nephridia on spermathecae ducts. Genital marking glands not found.

Remarks: *Amynthas samgaki* sp. n. keys to the *morrisi* group in Sims & Easton (1972), which is composed of 30 species. Chen (1933; 1936; 1938; 1946) recorded 12 species of the *morrisi* group from China. Among them, none has male pores on discs or similar pads. *Amynthas oculatus* (Chen, 1938) has a large pair of postsetal genital papillae but the male pores lie outside these. Two species of the *canaliculatus*-group, *A. jangbogoi* and *A. jindoensis*, also have male discs with seminal grooves, and the pairs of spermathecal pores are intrasegmental on VI and VII, rather than in 5/6/7. In *A. jangbogoi* the disc is bowling-pin shaped. The spermathecal diverticulum stalk of the latter has numerous tight kinks, as opposed to straight. I include this comparison because the *canaliculatus*-group could include morrisi-group species with independently evolved intrasegmental spermathecal pores.

The following Korean *morrisi*-group species are known: *A. fibulus fibulus* (Kobayashi, 1936), *A. fibulus ranunculus* (Kobayashi, 1936), *A. kobayashii* (Kobayashi, 1938), *A. koreanus* (Kobayashi, 1938), *A. geojeinsulae* (Song & Paik, 1970), *A. draconis* Hong & James, 2001, *A. naejangensis* Hong & James, 2001, *A. assimilis* Hong & Kim 2002, and *A. gyeryongensis* Hong & Kim, 2002. *Amynthas assimilis* and *A. naejangensis* have male discs with seminal grooves. In *A. assimilis* the disc and groove are oriented diagonally. *Amynthas naejangensis* is larger and has more segments (116-153 mm vs 77-110 mm, 96-117 vs 64-79 respectively) but is very similar in most respects. The following details of *A. naejangensis* are to be contrasted to the description of *Amynthas samgaki* sp. n.: testes sacs dorsally united in X and XI, and enclosing seminal vesicles of XI, lymph glands present, male discs encroaching on adjacent segments, dorsal setal gap present, as indicated in the setal formula YZ:ZZ = 2.5:4. Clearly the two species are quite similar and could be regionally-differentiated descendants of a common ancestor.

Amynthas samgaki sp. n. is probably an endemic species, but more distributional and ecological data are needed to establish its relationships to soils and land use patterns. Further investigations are needed on its phylogenetic relationships with other *Amynthas* species, particularly *A. naejangensis*.

ACKNOWLEDGEMENTS

The author would like to express appreciation to Dr Samuel W. James, University of Kansas, USA, who kindly shared valuable bionomical information and reviewed the taxonomic descriptions in the manuscript. This work was supported by a grant from Rural Development Administration, Korea (2006).

REFERENCES

BLAKEMORE, R. J. 2003. Japanese earthworms (Annelida: Oligochaeta): a review and checklist of species. *Organisms, Diversity and Evolution 3. Electronic Supplement* 11: 1-43.

CHEN, Y. 1933. A preliminary survey of the earthworms of the Lower Yangtze valley. *Contributions of the Biology Laboratory Sciences Society of China (Zoology), Nanking* 9: 178-296.

CHEN, Y. 1936. On the terrestrial Oligochaeta from Szechwan II with the notes on Gates' types. *Contributions of the Biology Laboratory Sciences Society of China (Zoology), Nanking* 11: 269-306.

CHEN, Y. 1938. Oligochaeta from Hainan, Kwangtung. *Contributions from Biological Laboratory of Science Society of China (Zoological series)* 12: 375-427.

CHEN, Y. 1946. On the terrestrial Oligochaeta from Szechwan III. *Journal of the West China Border Research Society* 16: 83-141.

EASTON, E. G. 1979. Acaecate earthworms of the *Pheretima* group (Megascolecidae: Oligochaeta): *Archipheretima*, *Metapheretima*, *Planapheretima*, *Pleionogaster* and *Polypheretima*. *Bulletin of the British Museum of Natural History (Zoology)* 35(1): 1-126.

HONG, Y. 2007. Some new earthworms of the genus *Amynthas* (Oligochaeta: Megascolecidae) with male discs from Bogildo Island, Korea. *Revue suisse de Zoologie* 114: 721-728.

HONG, Y. & JAMES, S. W. 2001a. New species of Korean *Amynthas* Kinberg, 1867 (Oligochaeta, Megascolecidae) with two pairs of spermathecae. *Revue suisse de Zoologie* 108: 65-93.

HONG, Y. & JAMES, S. W. 2001b. Five new earthworms of the genus *Amynthas* Kinberg (Megascolecidae) with four pairs of spermathecae. *Zoological Studies* 40: 269-275.

Hong, Y. & James, S. W. 2009. Some new Korean megascolecoid earthworms (Oligochaeta). *Journal of Natural History* 43: 1229-1256.

Hong, Y. & Kim, T. H. 2002a. Three new earthworms of the genus *Amynthas* (Megascolecidae) from Mt. Gyeryong, Korea. *Revue suisse de Zoologie* 109: 483-489.

Hong, Y. & Kim, T. H. 2002b. Four new earthworms of the genus *Amynthas* (Oligochaeta: Megascolecidae) from Korea. *Korean Journal of Biological Science* 6: 195-199.

Hong, Y. & Lee, W. K. 2001. Description of three new Korean earthworms of the genus *Amynthas* Kinberg, 1867 (Oligochaeta, Megascolecidae) with multiple genital markings. *Revue suisse de Zoologie* 108: 283-290.

Hong, Y., Lee, W. K. & Kim, T. H. 2001. Four new species of the genus *Amynthas* Kinberg (Oligochaeta: Megascolecidae) from Korea. *Zoological Studies* 40: 263-268.

Sims, R. W. & Easton, E. G. 1972. A numerical revision of the earthworm genus *Pheretima* auct. (Megascolecidae: Oligochaeta) with the recognition of new genera and an appendix on the earthworms collected by the Royal Society North Borneo Expedition. *The Biological Journal of the Linnean Society, London* 4: 169-268.

Revue suisse de Zoologie 118 (2): 231-249; juin 2011

Long-term study on the variability in duration of larval period and timing of metamorphosis in a salamander: a way to regulate dispersal

Michael R. WARBURG
Dept. of Biology, Technion- Israel Institute of Technology, Haifa 32000, Israel.
E-mail: Warburg@tx.technion.ac.il

Long-term study on the variability in duration of larval period and timing of metamorphosis in a salamander: a way to regulate dispersal. - In all animals undergoing complex life cycles (CLC) timing of emergence and completion of metamorphosis is critical for survival of the juveniles since the time available for dispersal is generally both spatially and temporally limited. Metamorphosis was studied in the laboratory over many years in several half-sib larval cohorts (*i.e.* each larval cohort born to a single mother on the same day, so that it consists of half-sib larvae of the same age). These larvae were born to freshly-collected females of an endangered salamander species *Salamandra infraimmaculata* Martens, 1885. The larvae were raised resource-independent (singly and food unlimited) and allowed to metamorphose. The post-metamorphs within the same cohort, varied in numbers, age, and size (mass, length) at metamorphosis. Moreover, cohorts differed among themselves in all these aspects. The findings show variability in timing of metamorphosis both within and among cohorts. An attempt is made to assess the evolutionary significance of this developmental aspect to dispersal of the post-metamorphs which is date-limited, and to the survival of the species.

Keywords: *Salamandra* - caudata - dispersal - larval cohorts - long-term study - metamorphic timing.

INTRODUCTION

Complex life cycles (CLCS)

Life history theory is concerned with investigating and explaining by examination of the variations in life history traits (Crump, 1989). Reproductive strategies vary largely in response to environmental conditions. Different life histories are one way to spread the risk of reproductive failure which may be a result of unpredictable duration of unfavourable environment (Lampert & Linsenmair, 2002).

Many aquatic taxa including amphibians have a complex life cycle (CLC) a term coined by Wilbur (1980) for such animals that undergo a dramatic change during their life cycle (mostly insects not only aquatic). CLCs are abundant in the animal kingdom or ubiquitous and they have adaptive mechanisms allowing each phase to respond independently to different selective forces (Moran, 1994). It can be viewed as

Manuscript accepted 27.01.2011

an adaptation that allows a species to exploit two or more different ecological environments (Wassersug, 1975; Wilbur & Collins, 1973). The main ecological feature of CLC is the shift in niches that occurs at metamorphosis (Werner & Gilliam, 1984; Werner, 1986). Animals may change their use of resources and their niches during their life cycle, utilizing different niches during different life stages (Ebenman, 1992). Thus, alternate phases occupy different niches where each alternating phase has a separate niche (Moran, 1994). These changes include ontogenetic changes in the individual animal's morphology, physiology and behaviour associated with a major change in habitat. Larvae and adults of organisms undergoing CLC evolve somewhat independently of each other having different body plans (Ebenman, 1992; Werner, 1986). Consequently, an ontogenetic niche shift takes place (Moran, 1994), and these species occupy two different niches: one by the adult (a terrestrial niche), and the other by the larva (an aquatic niche). They are different animals in many respects but belong to the same species having the same genome in spite of the fact that each developmental stage occupies a different ecological niche. Amphibians that have a CLC inhabiting two different environments exhibit plasticity in timing of, and in achieving an optimal size at metamorphosis (Wilbur & Collins, 1973).

Terminology used in describing the time element in metamorphosis

Five different terms have been used to describe the elements of time in studies on metamorphosis.

1. Duration: the duration of the larval period, measured from the day the egg hatches or the larva was born, to the time of metamorphosis.
2. Date: meaning the chronological date during which metamorphosis takes place.
3. Time: or the actual time it takes to metamorphose presumably from the date of birth.
4. Age: meaning the actual age at metamorphosis measured from the larval birth-date or the day the egg hatched (the day the egg was laid is generally not known in nature).
5. Timing: this vague term implies a certain date or condition suitable for metamorphosis.

Objectives of the study

The objectives of this study are to clarify two main points involved in metamorphosis:

1. Do age and mass at metamorphosis vary within a cohort and if so to what extent?
2. What could be the significance of the variability in metamorphosis, for timing the dispersal of post-metamorphs and for the survival of the species.

For statistical analyses both t-tests and regression analysis were used. The relationship between age and dimension at metamorphosis was tested by regressions analysis, whereas the statistical difference between the age groups was tested using t-tests.

MATERIALS AND METHODS

The adult population of *Salamandra infraimmaculata* Martens, 1855, was studied at a single breeding site on Mt. Carmel for 25 years 1974-1999. The site, about 60 x 100m, surrounds four shallow (50-100cm deep) rock-pools which are one of the main breeding sites for the salamanders in this area.

The climate in this region is characterized by irregular and interrupted rainfall pattern resulting in intermission in the rains after the onset of the rainy season in mid-autumn. This results in a cyclic pattern of dehydration of the breeding ponds (Warburg, 1992).

Annual rainfall ranged between 397-1160 mm averaging 690 mm over the 25-year study period (1974-1999). Of this 449 mm (65.1%) rain fell during the breeding season October-January, and the remaining 241mm (34.9%) during the rest of the rainy season (until the end of February). The later rains are of the utmost significance to the larvae that need at least six weeks to complete their metamorphic cycle (Warburg, 2010). The larvae might not be able to complete metamorphosis once the pond water warms up and/or dries out. Conditions for this urodele, are part of the time suboptimal (*i.e.* winter is rather short, with dry and warm periods), as it has a rather short breeding season, and there is a limited time period suitable (cool and wet) for dispersal of post-metamorphs.

Adult salamanders were observed near their breeding sites on stormy winter nights throughout the entire breeding season. The breeding season lasted for 10-12 weeks from the 2nd half of October to the beginning of January starting at the onset of the rainy season (October or November) and continuing until mid-January. The ovo-viviparous females laid their eggs into rock-pools and the larvae hatched immediately upon contact with the water (Warburg *et al.*, 1978/79). Females that bore their young in the laboratory were released back to nature on the same, or the following night (Warburg, 2007b, 2008a).

This salamander is well adapted to life in a xeric habitat both as adult (Warburg, 1986a, 1986b, 1994, 1997, 2006, 2007a, 2007b, 2008a, 2008b, 2009a, 2009b, 2009c), and as larva (Warburg, 1992, Cohen *et al.*, 2005, 2006).

During the long-term study (1974-1998) period, a total of 74 cohorts of half-sib larvae were born in the laboratory (see Warburg, 2010). These cohorts contained 4085 larvae that were all born to freshly-collected females. Some of the larvae were kept in the laboratory and were raised to metamorphosis. Of these some were used for experiments (Cohen *et al.*, 2005, 2006), whereas others (70 larvae) were raised to metamorphosis and for an additional 3-4 years to be released later as juveniles back to nature in order to replenish the dwindling population of this rare salamander (Warburg, 2007b, 2008a). All remaining larvae were released back to the ponds where their mothers were captured the night before.

The present report is based on a study of 396 of these larvae which were raised in the laboratory to metamorphosis. They were kept singularly and fed ad-libitum on beef liver and *Tubifex* until they metamorphosed.

RESULTS

The percentage of both half-sib larvae and cohorts born each month, are given in Figs 1A and 1B respectively. Most cohorts were born during November (41.9%) and December (40.5%) (see Fig 1A). Most larvae were born during November-December compared to (Fig. 1B).

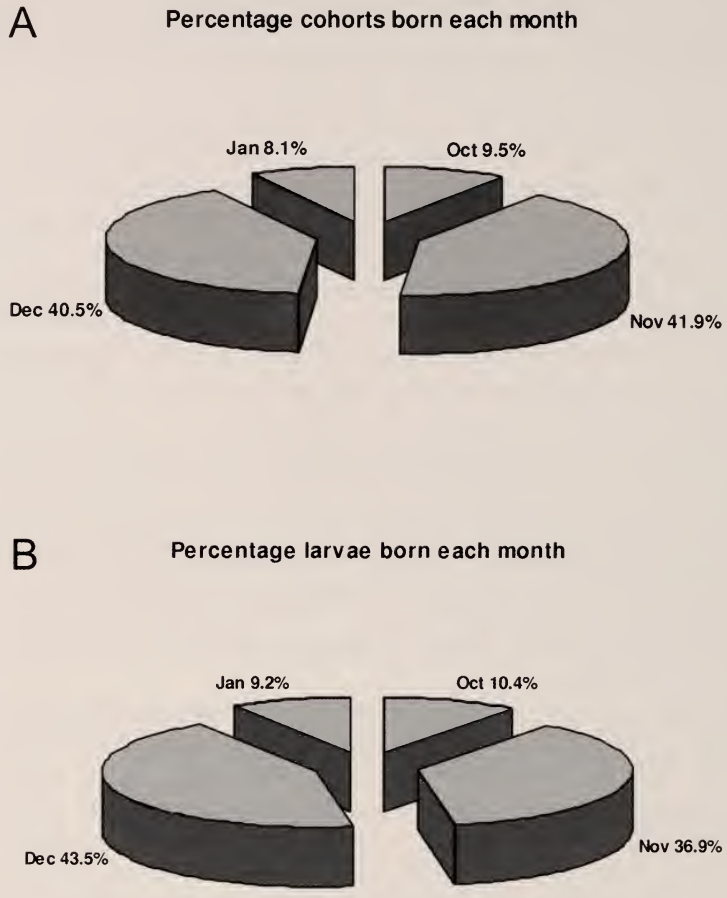


FIG. 1

Percentage of cohorts and larvae born each month of the breeding season: Most cohorts (41.9%) were born in November (A) whereas most larvae (43%) in December (B).

The larvae that were born in November metamorphosed at the latest during the 1st week in January (Fig 2A), whereas most larvae born later metamorphosed by mid-February (Fig. 2B).

The numbers of post-metamorphs and their age are given for four larval cohorts (F-69, F-163, F-168, F-233 see Fig. 3). Both numbers and ages differed among the cohorts ($P<0.05$, ANOVA). Only in one of the cohorts (F-163) was there a significant positive relationship between the numbers of post-metamorphs and their age.

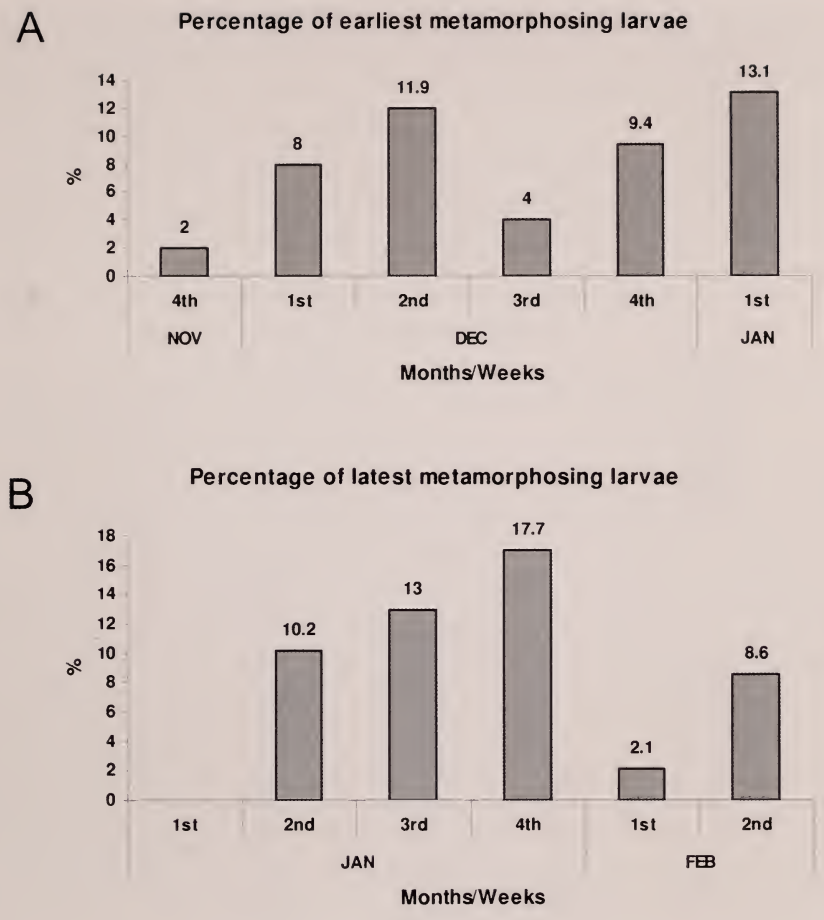


FIG. 2

Percentage of earliest (Oct-Nov) and latest (Dec-Jan) metamorphs: Early-born larvae metamorphosed starting from the 4th week in November to the 1st week in January (A). Most (17.7%) of the late-born larvae metamorphosed during the 4th week in January until mid-February (B).

AGE AT METAMORPHOSIS

The number of metamorphosing larvae and their age at metamorphosis are given in Fig. 4A for 130 post-metamorphs. There was no significant relationship between their numbers of and their age ($P<0.05$, ANOVA). When grouped into 10-day age groups (Fig. 4B), a significant relationship was noticed between the number of larvae metamorphosing and their age ($R^2 = 0.8823$ logarithmic n = 130) meaning that most larvae (n = 70 or 54.8 %) metamorphosed when 40-60 days old. No such significant difference was noted when the number metamorphosing was compared between the remaining different age groups.

Age at metamorphosis differed significantly among cohorts. Four cohorts are compared (F-163, F-168, F-69, F-233 see Fig. 5A-B). Thus, age of cohort F-69 differed

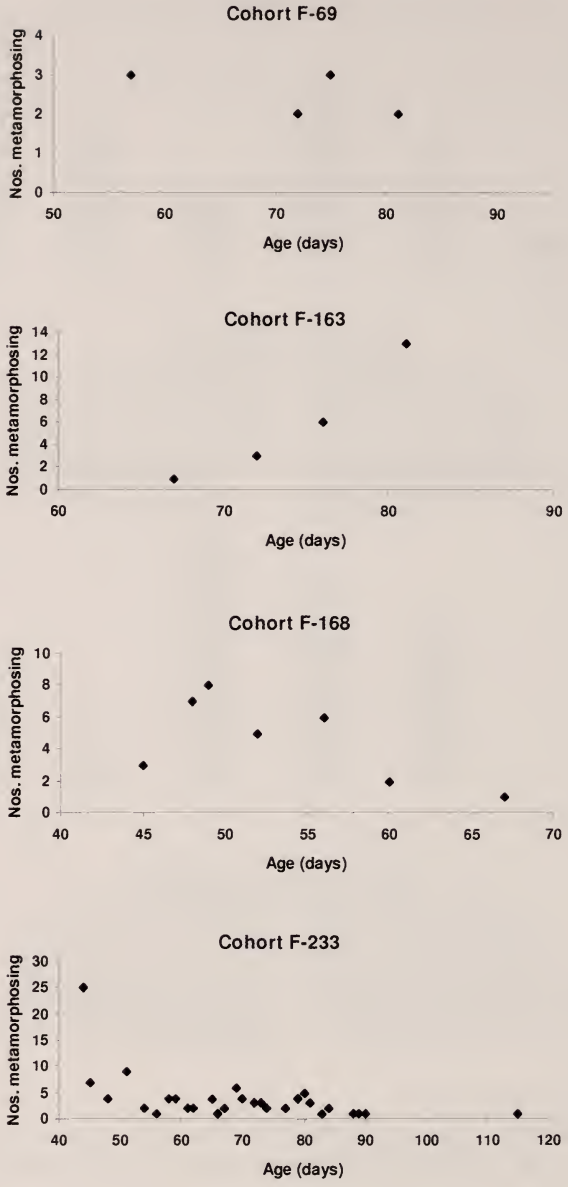


FIG. 3

Numbers and age at metamorphosis in four cohorts born in December: Note the variability between the four cohorts, in both numbers and age at metamorphosis

from F-163 (T value= -3.27; P value= 0.002; DF=31), and from cohort F-168 F (T value= 8.18; P value < 0 0001; DF=40), and age of cohort F.163 differed from cohort F-168 (T value= 20.9; P value < 0.0001; DF=53).

Duration of metamorphosis or the metamorphosis span *i.e.* from the time the first larva metamorphosed (minimal time) until the last larva metamorphosed (maximal time), ranged between 14 days in cohort F-163 to 71 days in cohort F-233 (Fig. 5A).

Age and mass at metamorphosis

The relationship between the average mass and the age at metamorphosis in two half-sib larval cohorts (F-69, F-163) both born in the laboratory, is depicted in Figs 6A-B. In one cohort (F-69), no significant relationship could be found between age and mass of metamorphosing larvae, whereas in the second cohort (F-163) mass related significantly to age (R^2 = 0.9071 power). A significant difference (t-tests) between mass of post-metamorphs was also observed in some age classes (Table 1).

Table 1. Differences (t-tests) between mass of metamorphs (grouped in age groups), values in bold are significant

Age groups (days)	40-49	50-59	60-69	70-79	80-89
50-59					
T	0.275				
P	0.784				
DF	107				
60-69					
T	4.38	2.98			
P	**0.0001**	**0.004**			
DF	109	56			
70-79					
T	5.88	4.03	0.055		
P	**0.0001**	**0.0001**	**0.582**		
DF	121	68	70		
80-89					
T	3.06	2.37	0.18	-1.87	
P	**0.003**	**0.02**	**0.85**	**0.85**	
DF	88	35	37	49	
90-99					
T	2.28	1.76	-1.04	-0.38	-0.25
P	**0.025**	**0.087**	0.967	0.71	0.807
DF	85	32	34	46	13

Mass and length at metamorphosis

Average length showed no significant relationship with average mass (see Fig. 7). There was a significant difference (t-tests) between length of post-metamorphs when arranged in age classes (Table 2).

Age-mass-length relationships

No significant relationship could be seen between either mass or length with age at metamorphosis in larvae born in the laboratory belonging to either a single cohort (F-168 see Fig. 8A), or for metamorphs belonging to six different cohorts in Fig. 8B.

TABLE 2. Differences (t-tests) between length of metamorphs (grouped in age groups), values in bold are significant.

	Age groups (days)	40-49	50-59	60-69	70-79	80-89
	50-59					
T		0.346				
P		0.97				
DF		111				
	60-69					
T		7.515	5.13			
P		**0.0001**	**0.0001**			
DF		108	59			
	70-79					
T		11.961	7.9	3.06		
P		**0.0001**	**0.0001**	**0.003**		
DF		121	72	69		
	80-89					
T		2.393	1.667	-1.67	-3.27	
P		0.19	0.103	0.1	**0.002**	
DF		88	39	36	49	
	90-99					
T		1.972	1.41	-1.66	-2.91	-0.088
P		0.052	0.168	**0.002**	**0.005**	0.931
DF		85		49	46	13

MONTHS OF DISPERSAL

Most of the earliest born larvae (mid-October-November) will metamorphose 50 days later *i.e.* during December-January, and the latest born will metamorphose and disperse by the end of March. Most metamorphosis (83%) will take place during January-February (Fig. 9A). Rainfall dropped significantly during this period from 33% during December to 15% in March (Fig. 9B).

DATE OF METAMORPHOSIS (MONTH/WEEKS)

A scheme depicting larval period in the ponds, and putative earliest and latest dates of metamorphosis is given in Fig. 10A-B. The earliest larvae are born in the 4th week of October (Fig. 10A) provided that there had been sufficient rain to form the ponds (Fig. 10B). The last larvae were born at the beginning of January. This scheme assumes the maximal time it takes to metamorphose to be 11 weeks. Based on such an assumption, the larvae born in October will have metamorphosed by the 4th week in February, whereas those born in January will have metamorphosed by the end of May. This is not realistic since the ponds usually dry out long before then, even during rainy years. As indicated by the average monthly rainfall during the breeding season (October-January) with most rains falling during December-January (Fig. 10B).

DISCUSSION

The onset of the breeding season is the egg-laying period (in oviparous species), or the period during which larvae are born (in ovoviviparous and viviparous species). The date an egg was laid or a larva was born or hatched, is the start of the breeding

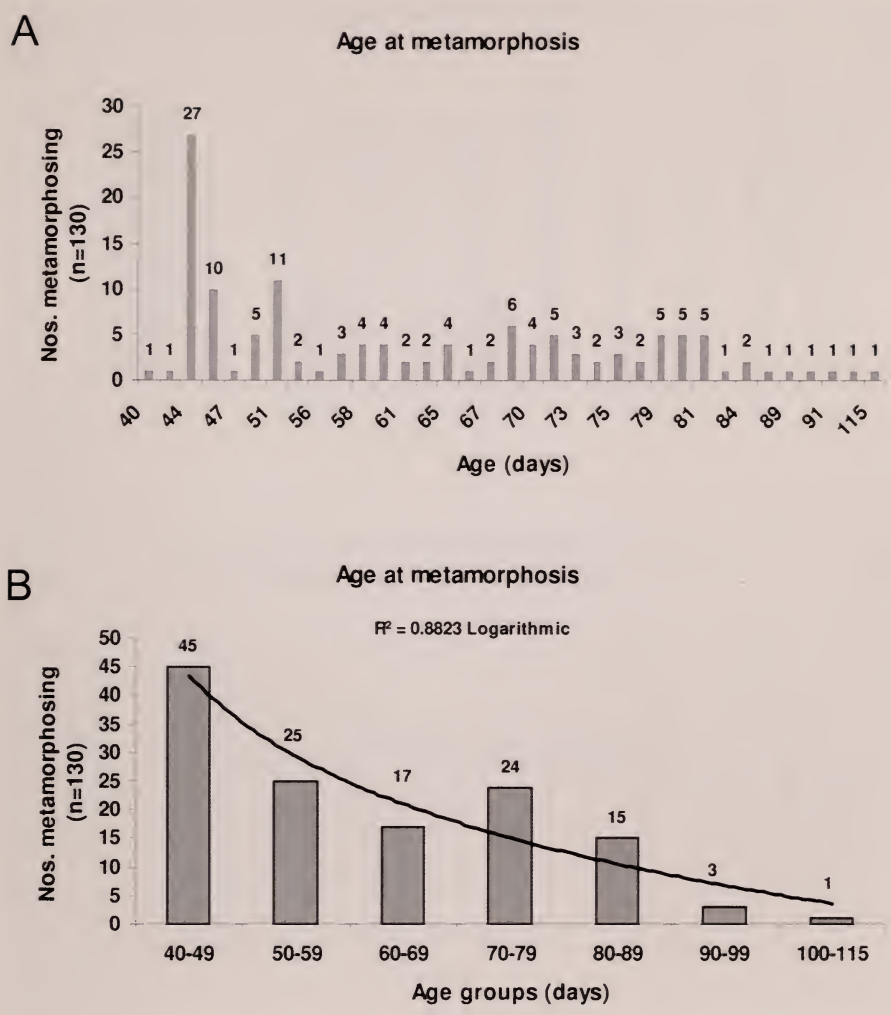


FIG. 4

Numbers and age at metamorphosis: Of the 130 metamorphs most (27) were 46 days old (A). The majority (45) metamorphosed when 40-49 days old (B). Note the remarkable range in age at metamorphosis (40-115 days).

season. Hatching, or the date the egg hatched is the onset of the larval period in egg-laying animals with CLCs.

BIRTH AND HATCHING

There is rather little information on hatching dates in urodele amphibians. More information is available on the aquatic dragonfly larvae. Hatching was found to be asynchronous spreading over 25 days, thereby producing a broad range of larval size-distribution (Hopper *et al.*, 1996). In the salamander studied here, the variation in new-

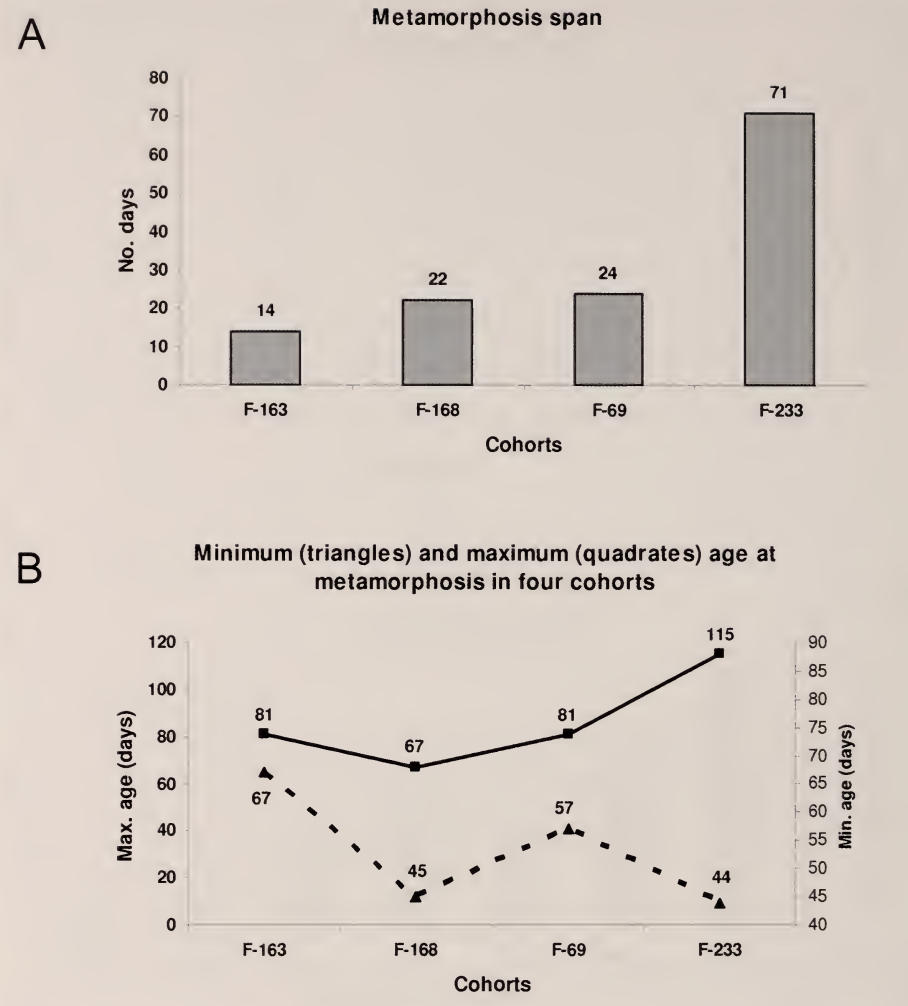


FIG. 5

Metamorphosis span and minimal and maximal age in four cohorts: The span in number of days between the minimum and maximum age at metamorphosis (see A) ranged between 14 days in one cohort (F-163) and 71 days in another (F-233) (A). The maximum and minimum age at metamorphosis in the same cohorts (see B) differed in the four cohorts. The minimal age ranged between 44 days (in cohort F-233), and 67 days (in cohort F-163). The maximal age ranged between 81 days to 115 day.

born larval size varies and there are half-sib cohorts in which this variance is larger (Degani & Warburg, 1995). The reasons for this are discussed at length in Cohen *et al.* (2005).

THE LARVAL PERIOD

It is well known that the pre-metamorphosis (first 3-4 weeks of life) of amphibian larvae is entirely dedicated to growth (Etkin, 1963). The following 5-6 weeks are dedicated to differentiation.

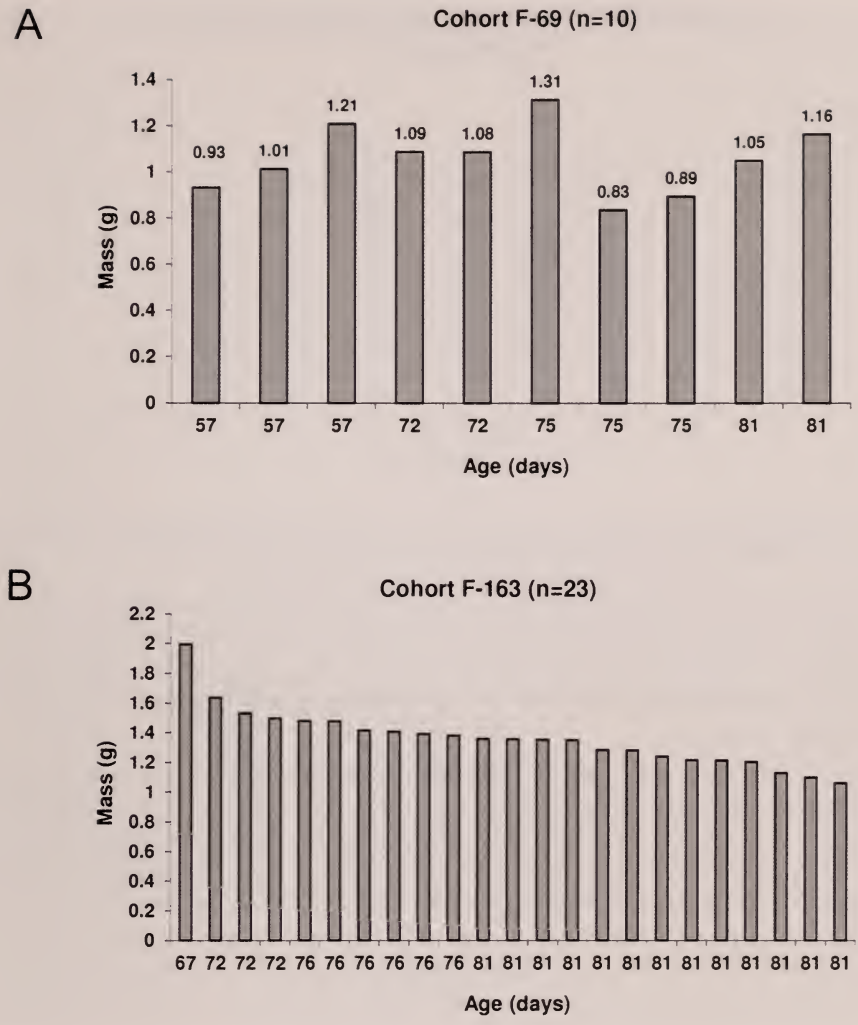


FIG. 6

Age and mass at metamorphosis in two cohorts: Mass at metamorphosis is shown in two cohorts: F-69 (n=10, see A) and F-163 (n=23 see B). In both cohorts there is no significant relationship between age and mass at metamorphosis.

LARVAL GROWTH

The growth of larvae belonging to cohorts known to be of the same age and of a single maternal origin (thereby lowering variability), was followed by raising them under conditions in which both food, and density conditions remained constant throughout larval life, and growth inhibitory factors (excreted by other larvae in the pond see Warburg, 1997) were eliminated (by daily changing the water).

It was possible to calculate the percentage of mass added during larval life. This way different growth modes could be identified and described. As a result, it was

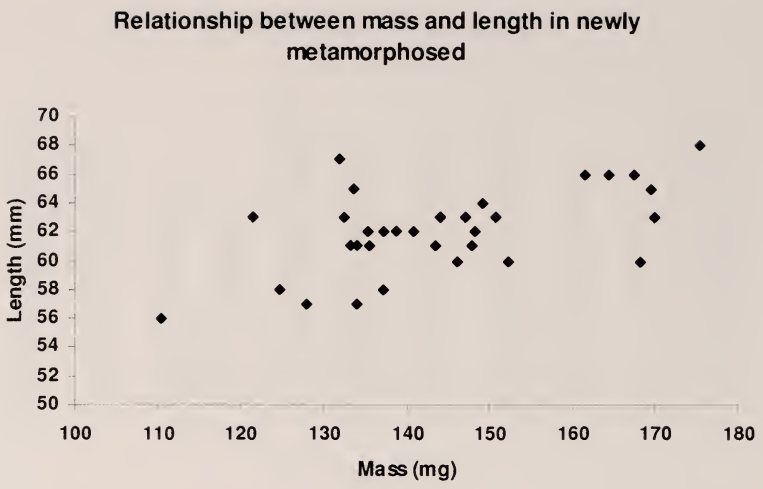


FIG. 7

Mass and length at metamorphosis: There was no significant relationship between length and mass at metamorphosis.

shown that half-sib larvae belonging to a single cohort (born at the same time to one mother) grow at more than one growth rate. Some grow fast whereas others grow slow (Cohen *et al.*, 2006). The duration of the larval period (*i.e.* their age), as well as their size at metamorphosis depend on their larval growth history (Cohen *et al.*, 2005, 2006).

DIFFERENTIATION

Differentiation during the pro-metamorphosis period (that starts at 5-6 weeks age see Etkin, 1963), results in the formation of three main organs that are essential in physiological adaptation of amphibians to terrestrial life (skin, lungs and kidneys). These differentiate and become functional at metamorphic climax, enabling terrestrial breathing and functional excretion organs. Metamorphosis does not seem possible until a minimum size is attained. Age and size at metamorphosis are inversely correlated (Koop & Baur, 2000). The onset of metamorphosis depends on larvae reaching the appropriate developmental stage when these organs essential for survival on land are ready (lungs, see Warburg, 1997; skin, see Warburg *et al.*, 1994; kidney, see Gealekman & Warburg, 2000). The time table involved in organogenesis is largely variable.

METAMORPHOSIS

There are several risks involved in successful completion of metamorphosis, these are:

1. The onset of pond formation. This depends on the date of first heavy rains which determines the onset of the breeding season. A delay in rains can disrupt the entire breeding season.
2. The amount of rain sufficient to fill the ponds. Will rains come early enough and in sufficient quantities to fill the ponds? This will determine the extent of the breeding season. Will the ponds fill with sufficient water to sustain larval growth until the completion of metamorphosis?

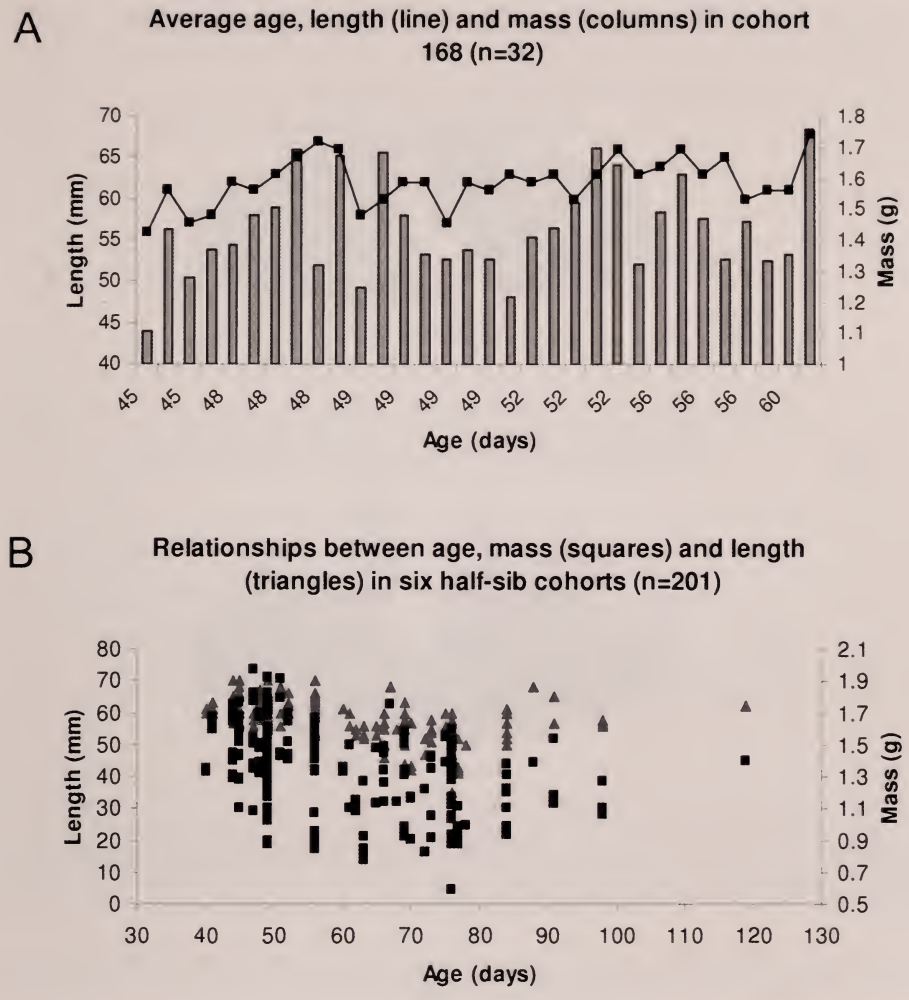


FIG. 8

Mass, length and age at metamorphosis in a single cohort (F-168) (A), and in six different cohorts (B): There was no significant relationship between length, mass and age at metamorphosis when compared in either metamorphs of a single cohort: F-168 (A), or in six cohorts (B).

3. The pattern of rainfall *i.e.* the timing and extent of intermissions in rainfall (Warburg, 1986b). Will the break in rainfall happen too soon after the larvae were born? This determines survival of early-born larvae? Will the break in rain be short enough so that larvae born early will be able to survive? (Warburg, 1992)?
4. Will there be enough food in the ponds to enable larval growth, and will larval density enable rapid development (see Cohen *et al.*, 2006; Warburg, 2009b)?

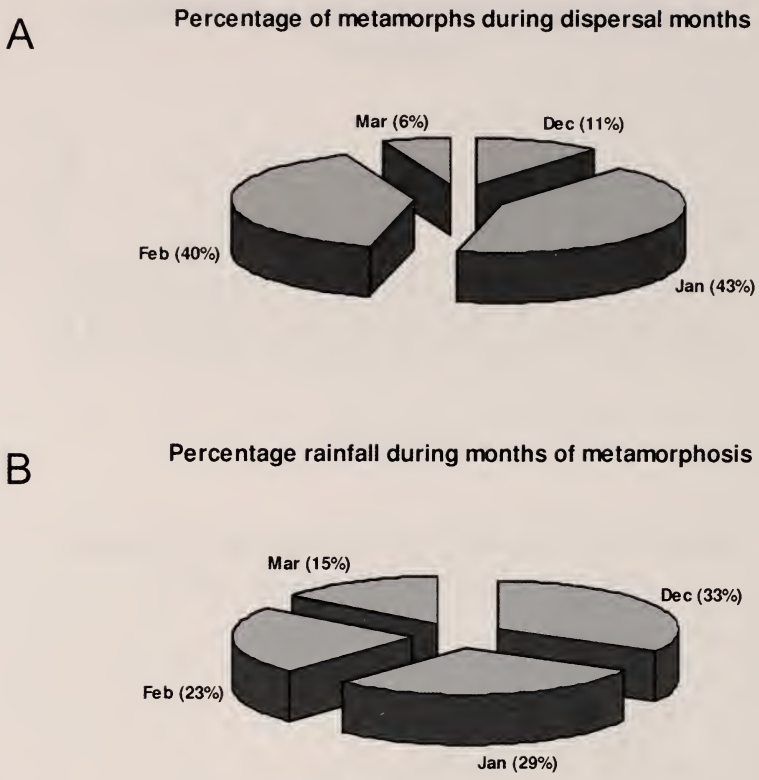


FIG. 9

Percentage of metamorphs (A) and rainfall (B) during months of dispersal: The majority of metamorphs emerged and dispersed during January (43%) and February (40%) (A). Most rain fell during December (33%) and January (29%) (B).

5. Will late-born larval cohorts be lost because they provide food for early-born cannibal larvae (see Cohen *et al.*, 2005)?

The successful survival of post-metamorphs depends on the survival of the larvae in spite of all these risks.

Two main points emerge from this study:

1. The significance in timing of metamorphosis.
2. The variability observed during all phases of the metamorphic cycle.

TIMING OF EMERGENCE

It is not surprising that as a result of asynchronous hatching followed by differential growth rates, the subsequent emergence of aquatic larvae from the water onto land, spreads over a longer period of time. Thus, in some dragonfly species emergence lasted 4-7 days (Ubukata, 1974, cited in Corbet, 1980), in others emergence spread over 11 days (Suhling, 1995), or 24 days (Falk & Johansson, 2000). Aoki (1999) describes temporal variation in emergence lasting about 26 days, whereas Suhling

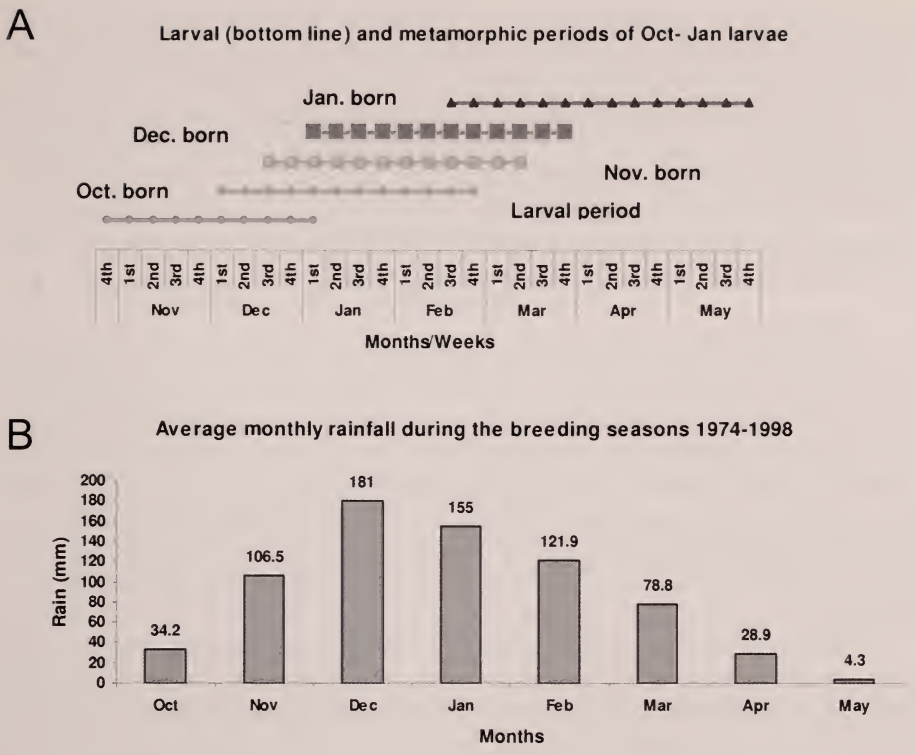


FIG.10

Earliest and latest dates of larval and metamorphosis periods and average monthly rainfall: This scheme (A) depicts the larval period (bottom) followed by the periods during which larvae that were born from October to January, metamorphosed. The last of the January-born larvae metamorphosed during the 4th week in May. The average monthly rainfall is given in B showing how very dangerous it is to metamorphose late in the season (after March).

et al. (2004) found that duration of larval stages from oviposition to emergence ranged between 38-70 (up to 285) days in some dragonfly species.

The young urodelan post-metamorphs will have to time their emergence onto land so that temperatures will be sufficiently low and the soil will be still moist to enable successful dispersal. This depends on the amount of rains until then, and on the season. Emergence in winter is preferable to spring emergence. Thus, the timing of emergence to fit a certain date is of great significance. Moreover, both their age at metamorphosis (measured from their birth in the laboratory), as well as the duration of the larval period (*i.e.* the time it takes to metamorphose), are of great significance. Finally, the size attained by the larvae before metamorphosing is of great consequence to the survival of the post-metamorphs. The survival of the young post-metamorphs depends on the following three factors: Date of birth, time or timing of metamorphosis, and age at metamorphosis

In *Nothophthalmus viridescens* the timing of post-metamorphs' emigration is strongly influenced by rainfall (Healy, 1975). Likewise, the hydroperiod significantly

affected timing of metamorphosis in *Ambystoma texanum* (Ryan, 2007), and *Ambystoma talpoideum* can adjust the timing of metamorphosis in response to water level (Semlitsch & Wilbur, 1988). Hurlbert (1970) noted that extended breeding period in *N. viridescens* (10 wks) influence timing of metamorphosis (160-200 dys). It appears that the variations in growth rates induce variation in metamorphic timing in *Desmognathus quadramaculatus* (Holbrook) (see Hichersion *et al.*, 2005). Timm *et al.*, (2007a) found considerable intra-specific variation in several urodeles, in the timing of emigration over the years. These variations may be due to ambient conditions (Timm *et al.*, 2007a, 2007b).

Dispersal

Post-metamorphic dispersal is an ecological phenomenon of fundamental importance to population biology because of its significance in juvenile recruitment. However, it is notoriously difficult to measure especially in amphibians, because of technical problems involved in marking the delicate larvae. Very little is known about dispersal timing in nature of young salamander post-metamorphs (as indeed also of any other taxa). This post-metamorphs' dispersal or 'emigration' depends on both time and size of the juveniles that will enable them to disperse as soon as possible and to maximal distance. The chance of the species' survival depends on its potential as a colonizer.

There is one exception perhaps, in dragonflies (Anholt, 1990). Unlike amphibians, dragonfly larvae are unique in that emergence from water can be noted accurately since marking larvae with paint allows identification of their exuviae (cast skins) after emergence following their completion of metamorphosis (Corbet *et al.*, 1960). Similar studies are not possible in amphibians. There, the only technique used is by collecting animals emigrating from the ponds by drift fences. (This however was not possible in the present study because of the ponds proximity to a high-security prison). Conrad *et al.* (1999) studied dispersal in seven dragonfly species and found that it differed significantly among species.

After metamorphosis, the post-metamorphs need to disperse and emigrate as soon and as far as possible during the suitable season since dispersal is limited both spatially and temporally. The sooner the larvae metamorphose and the farther away they disperse, their chance of survival and of successful colonization will increase. Size of the juveniles is crucial in enabling them to disperse to maximal distance. All these are of great significance because of the need to disperse before the onset of heat-spells in spring

The latest born salamander larvae were in mid-January. Since the maximal time it takes to metamorphose is about three months they will have to disperse by mid-April. As an example: larvae of female F-233 were born on 20 Dec. 1998. Consequently the first ones to metamorphose after 40 days dispersed late January and the last ones dispersed mid March after 88 days. All these are of great significance because of the need to disperse before the onset of heat-spells in late spring.

REFERENCES

ANHOLT, T. B. R.1990. Size-biased dispersal prior to breeding in a damselfly. *Oecologia* 83: 385-387.

AOKI, T. 1999. Larval development, emergence and seasonal regulation in *Asiagomphus pryeri* (Selys) (Odonata: Gomphidae). *Hydrobiologia* 394: 179-192.

COHEN, M., FLAM, R., SHARON, R., IFRACH, H., YEHESKELY-HAYON, D. & WARBURG, M. R. 2005. The evolutionary significance of intra-cohort cannibalism in larvae of a xeric-inhabiting salamander: an inter-cohort comparison. *Current Herpetology* 24: 55-66.

COHEN, M., YEHESKELY-HAYON, D., WARBURG, M. R., DAVIDSON, D., HALEVI, G. & SHARON, R., 2006. Differential growth identified in salamander larvae half-sib cohorts: a survival strategy? *Develoment, Growth & Differentiation* 48: 537-548.

CONRAD, K. F., WILLSON, K. H., HARVEY, I. F., THOMAS, C. J. & SHERRATT, T. N. 1999. Dispersal characteristics of seven odonate species in agricultural landscape. *Ecography* 22: 524-531.

CORBET, P. S. 1980. Biology of Odonata. *Annual Review of Entomology* 25: 189-217.

CORBET, P. S., LONGFIELD, C. & MOORE, N. W. 1960. *Dragonflies*. Collins, London.

CRUMP, M. L. 1989. Effect of habitat drying on the developmental time and size at metamorphosis in *Hyla pseudopuma*. *Copeia* 1989: 794-797.

DEGANI, G. and WARBURG, M. R. 1995. Variation in brood size and birth rate of *Salamandra salamandra* L. (Amphibia, Urodela) from different habitats in northern Israel. *Amphibia/Reptilia* 16: 341-349.

EBENMAN, B. 1992. Evolution in organisms that change their niches during the life cycle. *American Naturalist* 139: 990-1021.

ETKIN, W. 1963. Metamorphosis-activating system of the frog. Science, 139, 810-814.

FALCK, J. & JOHANSSON, F. 2000, Patterns in size, sex ratio and time of emergence in a South Swedish population of *Sympetrum sanguineum* (Odonata). *Aquatic Insects* 22: 311-317.

GEALEKMAN, O. & WARBURG, M. R. 2000. Changes in numbers and dimensions of glomeruli during metamorphosis of *Pelobates syriacus* (Anura; Pelobatidae). *European Journal of Morpholology* 38: 80-87.

HEALY, W. R. 1975. Breeding and postlarval migrations of the red-spotted newt, *Notophthalmus viridescens*, in Massachusetts. *Ecology* 56: 673-680.

HICKERSON, C-A. M., BARKER, E. L. & BEACHY, C. K. 2005. Determinants of metamorphic timing in the black-bellied salamander, *Desmognathus quadramaculatus*. *Southeastern Naturalist* 4: 33-50.

HOPPER, K. R., CROWLEY, P. H. & KIELMAN, D. 1996. Density dependence, hatching synchrony, and within-cohort cannibalism in young dragonfly larvae. *Ecology* 77: 191-200.

HURLBERT, S. H. 1970. The post-larval migration of the red-spotted newt *Notophthalmus viridescens* (Rafinesque). Copeia 1970: 515-528.

KOPP, M. & BAUR, B. 2000. Intra- and inter-litter variation in life-history traits in a population of fire salamanders (*Salamandra salamandra terrestris*), *Journal of Zoology London* 250: 231-236.

LAMPERT, K. P. & LINSENMAIR, K. E. 2002. Alternative life cycle strategies in the West African reed frog *Hyperolius nitidulus*: the answer to an unpredictable environment? *Oecologia* 130: 364-372.

MARTENS, E. VON 1885. Über Vorkommen und Zeichnungs-Varietäten von *Salamandra maculosa*. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1884: 193-195.

MORAN, N. A. 1994. Adaptation and constraint in the complex life cycles of *animals*. *Annual Review of Ecology & Systematic* 25: 573-600.

RYAN, T. J. 2007. Hydroperiod and metamorphosis in small-mouthed salamanders (*Ambystoma texanum*). *Northeast. Naturalist* 14: 619-628.

SEMLITSCH, R. D. & WILBUR, H. M. 1988. Effects of pond drying time on metamorphosis and survival in the salamander *Ambystoma talpoideum*. *Copeia* 1988: 978-983

SUHLING, F. 1995. Temporal patterns of emergence of the riverine dragonfly *Onychogomphus uncatus* (Odonata: Gomphidae). *Hydrobiologia* 302: 113-118.

SUHLING, F., SCHENK, K., PADEFFKE, T. & MARTENS, A. 2004. A field study of larval development in a dragonfly assemblage in African desert ponds (Odonata). *Hydrobiologia* 528: 75-85.

TIMM, B. C., MCGARIGAL, K. & GAMBLE, L. R., 2007a. Emigration timing of juvenile pond-breeding amphibians in western Massachsetts. *Journal of Herpetology* 41: 243-250.

TIMM, B. C., MCGARIGAL, K. & COMPTON, B. W. 2007b. Timing of large movement events of pond-breeding amphibians in western Massachsetts, USA. *Biological Conservation* 136: 442-454.

WARBURG, M. R. 1986a. A relic population of *Salamandra salamandra* on Mt. Carmel: A ten-year study. *Herpetologica* 42: 174-179.

WARBURG, M. R. 1986b. Observations on a relic population of *Salamandra salamandra* on Mt. Carmel during eleven years. *In*: Z. Roček (ed.). *Studies in Herpetology*. Charles University Press, Prague, pp 389-394.

WARBURG, M. R. 1992. Breeding patterns in a fringe population of fire salamanders, *Salamandra salamandra*. *Herpetological Journal* 2: 54-58.

WARBURG, M. R. 1994. Population ecology, breeding activity, longevity and reproductive strategies of *Salamandra salamandra* (Urodela; Salamandridae), during an 18-year long study of an isolated population on Mt.Carmel. *Mertensiella Monographs* 4: 399-452

WARBURG, M. R. 1997. *Ecophysiology of amphibians inhabiting xeric environments*. Springer Verlag, Heidelberg, Germany, 182 pp.

WARBURG, M. R. 2006. Breeding site tenacity during a quarter of a century, in a rare, xeric-adapted salamander within an isolated metapopulation. *Bulletin de la Societe Herpetologique Francaise* 118: 1-18.

WARBURG, M. R. 2007a. Longevity in *Salamandra infraimmaculata* from Israel with a partial review of life expectancy on urodeles. *Salamandra* 43: 21-43.

WARBURG, M. R. 2007b. The phenology of a rare salamander (*Salamandra infraimmaculata*) in a population breeding under unpredictable conditions: a 25 year study. *Acta Herpetologica* 2: 247-257.

WARBURG, M. R. 2008a. Changes in recapture rate of a rare salamander in an isolated metapopulation studied for 25-years. *Russian Journal of Herpetology* 15: 11-18.

WARBURG, M. R. 2008b. Temporal variations in body dimensions followed for 25 years in a breeding population of adult salamanders, with a partial review on other Urodela. *Senckenbergiana Biologica* 88: 81-105.

WARBURG, M. R. 2009a. Long-term study on the reproductive strategy of *Salamandra infraimmaculata* (Amphibia: Urodela: Salamandridae) females in a single population breeding under precarious ambient conditions. *Herpetozoa* 22: 27-42.

WARBURG, M. R. 2009b. Age and size at metamorphosis of half-sib *Salamandra infraimmaculata* larvae born in the laboratory and raised singly under three different food regimes. *Belgian Journal of Zoology* 139: 156-165.

WARBURG, M. R. 2009c. Variations in sex ratio studied in a single breeding population of an endangered salamander: a long-term study. *Revue suisse de Zoologie* 116 (3-4): 359-377.

WARBURG, M. R. 2010. Studies on 74 half-sib larval cohorts born to individually identifiable *Salamandra infraimmaculata* females belonging to a single population; a long-term study. *Journal of Zoology London* 280: 332-342.

WARBURG, M. R., DEGANI, G. & WARBURG, I. 1978/79. Ovoviviparity in *Salamandra salamandra* (L.) (Amphibia, Urodela) from northern Israel. *Vie et Milieu* 28/29C: 247-257.

WARBURG, M. R., LEWINSON, D.& ROSENBERG, M. 1994. Ontogenesis of amphibian epidermis. *In*: H. Heatwole & G.T. Barthalmus (eds.). *Amphibian Biology* vol.1. The Integument.), Surrey Beattty & Sons, Sydney, pp 33-63.

WASSERSUG, R. J. 1975. The adaptive significance of the tadpole stage with comments on the maintenance of complex tadpole stage with comments on the maintenance of complex life cycles in anurans. *American Zoologist* 15: 405-417.

WERNER, E. E. 1986. Amphibian metamorphosis: growth rate, predation risk and the optimal size at transformation. *American Naturalist* 128: 319-341.

WERNER, E. E. & GILLIAM, J. F. 1984. The ontogenetic niche and species interactions in size structured populations. *Annual Review of Ecology & Systematic* 15: 393-425.

WILBUR, H. M. 1980. Complex life cycles. *Annual Review of Ecology & Systematics* 11: 67-93.

WILBUR, H. M. & COLLINS, J. P. 1973. Ecological aspects of amphibian metamorphosis. *Science*, 182: 1305-1314.

Revue suisse de Zoologie 118 (2): 251-256; juin 2011

A new *Scutpelecopsis* Marusik & Gnelitsa from Romania (Araneae, Linyphiidae, Erigoninae)

Ioan DUMA[1] & Andrei V. TANASEVITCH[2]

[1] Department of Biology, Faculty of Chemistry-Biology-Geography, West University of Timisoara, Pestalozzi 16, Timisoara 300115, Timis county, Romania. E-mail: ioan.duma@gmail.com

[2] Centre for Forest Ecology and Production, Russian Academy of Sciences, Profsoyuznaya Str. 84/32, Moscow 117997, Russia. E-mail: and-tan@mail.ru

A new *Scutpelecopsis* Marusik & Gnelitsa from Romania (Araneae, Linyphiidae, Erigoninae). - A new species, *S. loricata* sp. n., is described from the southern Carpathians, Romania, differing from the two known congeners by details of the palp and epigyne conformation. All records of *Scutpelecopsis krausi* (Wunderlich, 1980) from the Caucasus actually refer to *S. wunderlichi* Marusik & Gnelitsa, 2009, thus the known distribution of *S. krausi* remains restricted to the type locality in Macedonia.

Keywords: Arachnida - dwarf spiders - new species - Carpathians.

INTRODUCTION

The genus *Scutpelecopsis* Marusik & Gnelitsa, 2009 was recently established for two species: the Caucasian *S. wunderlichi* Marusik & Gnelitsa, 2009, as the type species, and the Macedonian *S. krausi* (Wunderlich, 1980) (Marusik & Gnelitsa, 2009). A third congener, *S. loricata* sp. n., was found in the southern Carpathians, and its description is the subject of this paper.

The genus *Scutpelecopsis* now comprises three similar species, which differ from each other by small differences in palp and epigyne structure, as well as by the arrangement and dimensions of the abdominal scuta. The genus is closely related to *Pelecopsis* Simon, 1864, and its representatives are distinguished by a strongly armored body, as well as by the peculiar shape of the male palpal tibia and the ventral epigynal plate.

MATERIAL AND METHODS

This paper is based on the spider material collected by Ioan and Violeta-Alina Duma from the southern Carpathians, Romania in 2009-2010. Some comparative material from the Zoological Museum of the Moscow State University (Moscow, Russia) and the personal collection of Andrei Tanasevitch (Moscow, Russia) was examined.

Specimens, preserved in 70% ethanol, were studied using a Zeiss stereomicroscope. Close examinations of the palp and epigyne were made in glycerol using an

Manuscript accepted 03.09.2010

Olympus BX51 compound microscope with an Olympus E-330 digital camera. A camera lucida was used for the drawings. All measurements are given in mm. Scale lines in the figures correspond to 0.1 mm unless otherwise indicated.

The terminology of the male palpal tibia details follows that of Marusik & Gnelitsa (2009). A new terminology for the ventral abdominal scuta is proposed by us as more logical and related to their position on the abdomen.

Abbreviations used in the text and figures: AO - anterior tegular outgrowth, CAT - personal collection of Andrei Tanasevitch, DA - dorsal tibial apophysis, E - embolus, IA - intermediate tibial apophysis, ME - membranous edge, MM - median membrane, MS - mesal abdominal scuta, PO - posterior tegular outgrowth, PS - pedicel scuta, PVS - posteroventral scutum, RA - retrolateral tibial apophysis, TmI - position of trichobothrium on tibia I, VP - ventral plate, ZMMU - Zoological Museum of the Moscow State University.

All type material is without registration numbers and deposited in the Muséum d'histoire naturelle, Geneva, Switzerland.

Scutpelecopsis loricata sp. n. Figs 1-11

Holotype: ♂, Romania, Caras-Severin, Băile Herculane, Domogled Mountain, Cheile Feregari (44°51'59"N, 22°24'53"E). 350 m a.s.l., dry valley, under limestone rocks, hand collecting, 3.IV.2010, leg. I. Duma.

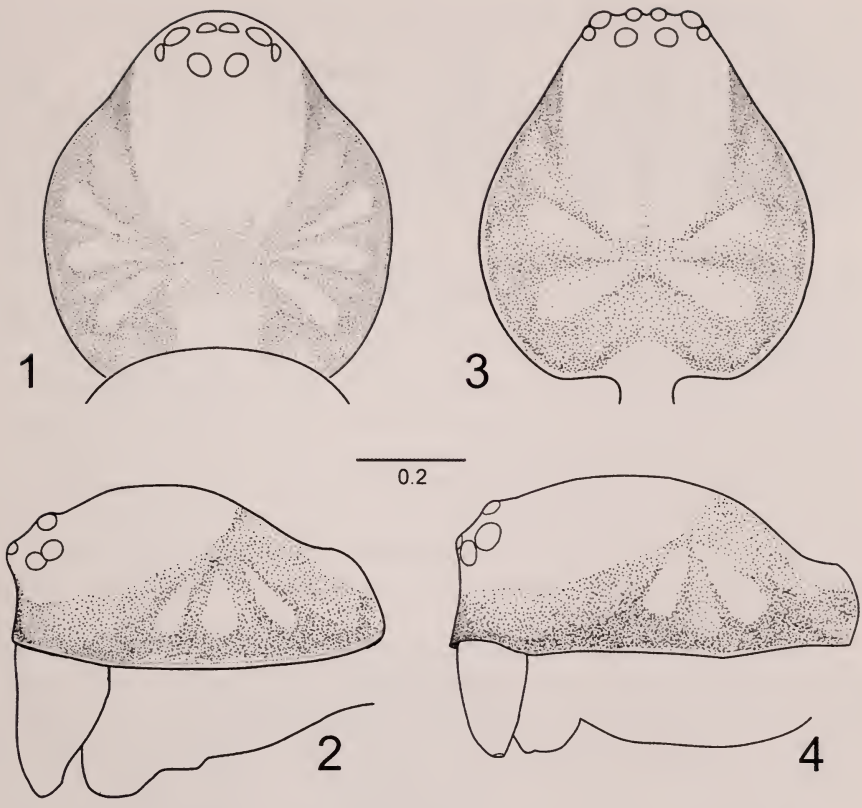
Paratypes: 6 ♂. 4 ♀, same locality and date as for holotype. – 1 ♂. Caras-Severin, Dubova, Mraconia valley (44°37'55"N 22°16'55"E), 200 m a.s.l., 4.VII.2010, leg. I. Duma. – 1 ♀, Băile Herculane, Domogled Mountain, Cheile Feregari (44°51'59"N, 22°24'53"E), 359 m a.s.l., dry valley, under rocks, hand collecting, 14.V.2009, leg. V.-A. Duma.

Etymology: The specific name, an adjective, translated from Latin as "iron-clad", refers to the strong body armor.

Diagnosis: The new species is characterized by the strongly armored body in both sexes, as well as by the peculiar shape of the palpal tibia in male and the ventral plate of the epigyne in female.

Description: Male holotype. Total length 1.61. Carapace unmodified, as shown in Figs 1-2, with fine granulation, 0.67 long, 0.63 wide posteriorly. Sternum extended between coxae IV, 0.43 long, 0.42 wide posteriorly, with fine granulation. Chelicerae 0.26 long, anterior margin with five teeth, posterior one with two teeth. Stridulatory files fine. Labium wider than long. Legs brownish yellow, with darker femora. Length of leg segments, see Table 1.

Chaetotaxy: 1.1.1.1, length of spines about diameter of segment. Metatarsus IV without trichobothrium. TmI 0.31. Palp (Figs 5-8): Tibia with tree apophyses: dorsal one hook-shaped; retrolateral one flattened, slightly widened and concave terminally; intermediate apophysis small, triangular, flattened. Paracymbium simple, narrow, hook-shaped. Tegulum with an anterior conical outgrowth directed forward, as well as with a small outgrowth in posterior part directed backward. Median membrane large, funnel-shaped. Embolus thin, long and coiled, membranous edge narrow. Tuberculated outgrowth present, hidden by median membrane. Abdomen 1.10 long, 0.80 wide, dorsal scutum with fine granulation covering entire dorsal surface. Sigilla well visible. Abdomen ventrally covered with a large scutum extending from pedicel to spinnerets.



FIGS 1-4

Carapace of *Scutpelecopsis loricata* sp. n., ♂ holotype (1-2), ♀ (3-4). (1, 3) Dorsal view. (2, 4) Lateral view.

Female (from the type locality). Total length 1.94. Carapace unmodified, as shown in Figs 3-4, 0.76 long, 0.73 wide, dark brown to almost black, with fine granulation except on cephalic region. Sternum 0.41 long, 0.43 wide, dark brown, with sparse hairs. Chelicerae 0.23 long, anterior margin with five teeth, posterior one with two teeth. Stridulatory files fine. Chaetotaxy as in male, length of spines about diameter of segment. Metatarsus IV without trichobothrium. TmI 0.30. Length of leg segments, see Table 1.

Abdomen 1.37 long, 1.15 wide, dorsal scutum with fine granulation, covering almost entire dorsal surface. Anterior pair of sigilla well visible, posterior pair indistinct. Venter (Fig. 9) with a pair of pedicel scuta, a pair of large mesal scuta, as well as with an unpaired posteroventral scutum. Epigyne somewhat anchoriform, with long, weakly sclerotized lateral parts. Two round and weakly sclerotized depressions present on each side of base of ventral plate as shown in Fig. 10. Vulva as shown in Fig. 11.

VARIABILITY: All examined specimens do not differ in size and position of the intermediate tibial apophysis, number of teeth on the chelicerae, size and shape of scuta. Some differences exist in the body size: males vary from 1.61 to 1.7, females from 1.8 to 1.94.

TABLE 1. Length of leg segments in male and female (in parentheses) of *Scutpelecopsis loricata* sp. n.

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	0.56 (0.56)	0.16 (0.15)	0.46 (0.44)	0.35 (0.36)	0.34 (0.34)	1.87 (1.85)
II	0.52 (0.55)	0.14 (0.14)	0.39 (0.39)	0.32 (0.32)	0.30 (0.31)	1.67 (1.71)
III	0.43 (0.46)	0.13 (0.13)	0.29 (0.33)	0.28 (0.30)	0.26 (0.27)	1.39 (1.49)
IV	0.61 (0.72)	0.16 (0.16)	0.52 (0.52)	0.38 (0.40)	0.32 (0.32)	1.99 (2.12)

TAXONOMIC REMARKS: The new species differs from the two known congeners by the longer embolus with a narrowing membranous edge, by the presence of a distinct anterior conical outgrowth, by small details of the male palpal tibia, as well as by the number of cheliceral teeth (5/2 versus 6/5 in others). *S. loricata* sp. n. is most similar to *S. wunderlichi*, but differs clearly by the smaller size and the position of the intermediate apophysis on the male palp: in the new species it is situated higher and closer to the dorsal tibial apophysis. The female of *S. loricata* sp. n., differs by the wider ventral plate of the epigyne, as well as by the length of the posteroventral scutum (b in Fig. 9): ca. 1/4 of the abdomen length instead of 1/3 as in *S. wunderlichi*, and by the distance between mesal scuta and posteroventral scutum: in *S. loricata* sp. n. this distance is about 1/2 of the length of the posteroventral scutum (a/b in Fig. 9), in *S. wunderlichi* it is much less, about 1/5-1/6).

The female of the new species clearly differs from that of *S. krausi* by having a scutum which covers the entire dorsal abdominal surface, whereas in *S. krausi* the dorsal scutum is developed as a large spot around the sigilla. The male of *S. loricata* sp. n. can be distinguished from that of *S. krausi* by the longer embolus and by the triangular shape of the intermediate tibial apophysis, which is truncate in *S. krausi*.

DISTRIBUTION: The new species is known from only two localities (close to each other) in Romania.

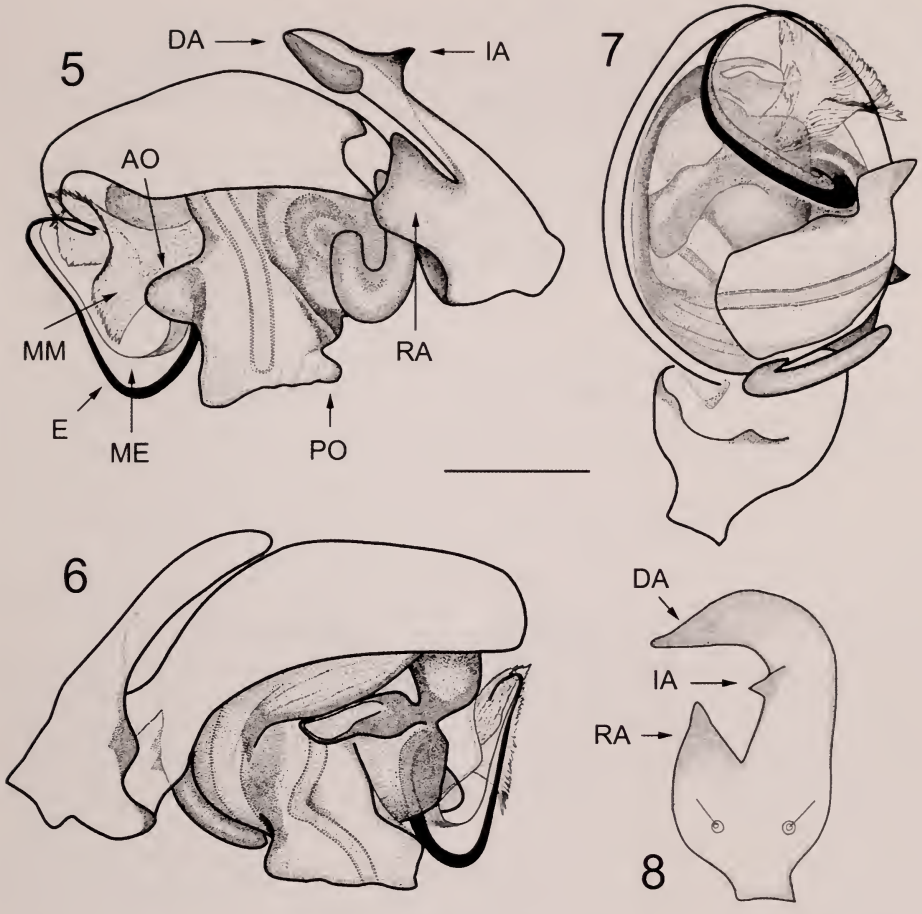
Scutpelecopsis wunderlichi Marusik & Gnelitsa, 2009

Pelecopsis krausi Wunderlich, 1980. – Tanasevitch, 1987: 360, misidentification, examined.– Tanasevitch, 1990: 58, 106, figs 23.8, 24.5, misidentification, examined.

Scutpelecopsis wunderlichi Marusik & Gnelitsa, 2009: 60, figs 1-11, 15-17, 20-26, 29-30, 35-43, 48-54, description ♂ & ♀, types not examined.

MATERIAL EXAMINED: Specimens previously determined as *S. krausi*, re-examined by A. Tanasevitch in 2010; 10 ♂, 4 ♀ (CAT), Russia, Caucasus, Republic of Severnaya Osetiya-Alaniya, S slope of Tsey Mt Ridge, 3-4 km E of Tsey Village, 2300 m a.s.l., burned-out *Pinus* forest, young *Pinus*, *Salix caprea*, tallgrass, 18.IV.-8.VI.1985, leg. S. Alekseev. – 1 ♂ (ZMMU), same locality, 2000 m a.s.l., *Pinus* with *Azalea*, 28.IX.1985, leg. S. Alekseev. – 1 ♂ (ZMMU), same locality, 3000 m a.s.l., alpine meadow, 28.IX.1985, leg. S. Alekseev. – 10 ♂, 4 ♀ (CAT), Caucasus, Georgia, Borzhomi District, Akhaldaba, 1000 m a.s.l., Nedzura River Valley, *Picea*, *Carpinus* & *Fagus* forest, litter, logs, 12.V.1983, leg. S. Golovatch. – 1 ♂ (ZMMU), Caucasus, Armenia, Shnokh Village (between Alaverdi & Bagratashen), 750 m a.s.l., *Carpinus* forest, 24.V.1987, leg. S. Golovatch & K. Eskov.

REMARKS: When describing *S. wunderlichi* from Abkhazia, Caucasus, Marusik & Gnelitsa (2009) noted that they have not seen the material of *Pelecopsis krausi* (now in *Scutpelecopsis*) reported by A. Tanasevitch from the Caucasus (Tanasevitch, 1987, 1990). This material is available in the Zoological Museum of the Moscow State



FIGS 5-8

Scutpelecopsis loricata sp. n., ♂ holotype. (5) Left palp, retrolateral view. (6) Same, prolateral view. (7) Same, ventral view. (8) Palpal tibia, dorsal view.

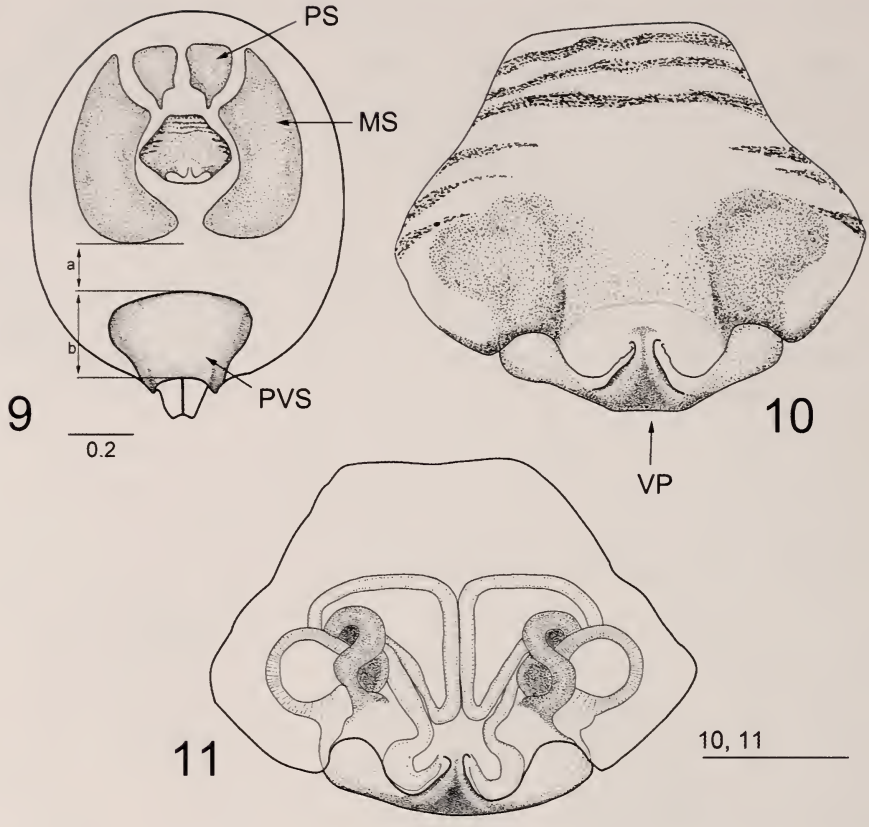
University and in the personal collection of Andrei Tanasevitch. Our examination of the material listed above has shown that all records of *S. krausi* from the Caucasus actually refer to *S. wunderlichi*, thus the known distribution of *S. krausi* is restricted to the type locality in Macedonia.

DISTRIBUTION: Caucasus: Armenia, Georgia, Republic of Severnaya Osetiya-Alaniya, Russia (Tanasevitch, 1987, 1990, under *Pelecopsis krausi*) and Abkhazia (Marusik & Gnelitsa, 2009).

RANGE: Caucasian.

ACKNOWLEDGEMENTS

We are indebted to Peter Schwendinger (Geneva, Switzerland) for valuable comments, corrections and help in preparing the final manuscript. We would also like



FIGS 9-11

Scutpelecopsis loricata sp. n., ♀. (9) Abdomen, ventral view. (10) Epigyne, ventral view. (11) Vulva, ventral view.

to thank Jörg Wunderlich (Hirschberg, Germany), Yuri Marusik (Magadan, Russia) and Christo Deltshev (Sofia, Bulgaria) for their comments on earlier drafts of the manuscript. For collecting some of the material used here we thank Violeta-Alina Duma.

REFERENCES

MARUSIK, Y. M. & GNELITSA, V. A. 2009. Description of a new genus of spiders from eastern Mediterranean and the most armored erigonid species from the western Caucasus (Aranei: Linyphiidae: Erigoninae). *Arthropoda Selecta* 18 (1-2): 57-68.

TANASEVITCH, A. V. 1987. The linyphiid spiders of the Caucasus, USSR (Arachnida: Araneae: Linyphiidae). *Senckenbergiana biologica* 67 (4/6): 297-383.

TANASEVITCH, A. V. 1990. The spider family Linyphiidae in the fauna of the Caucasus (Arachnida, Aranei) (pp. 5-114). *In*: STRIGANOVA, B. R. (ed.). Fauna of the terrestrial invertebrates of the Caucasus. *Nauka Publisher, Moscow*, 237 pp.

WUNDERLICH, J. 1980. Linyphiidae aus Süd-Europa und Nord-Afrika (Arachnida: Araneae). *Abhandlungen und Verhandlungen des Naturwissenschaftlichen Vereins zu Hamburg (N.F.)* 23: 319-337.

Revue suisse de Zoologie 118 (2): 257-264; juin 2011

Ceratophysella lobata sp. n. from Siberia with notes on *C. brevisensillata* Yosii, 1961 (Collembola: Hypogastruridae)

Anatoly BABENKO[1] & Dariusz SKARŻYŃSKI[2]

[1] The Severtsov Institute of Ecology & Evolution, Russian Academy of Sciences, Moscow 119071, Leninski pr., 33, Russia. E-mail: lsdc@mail.ru

[2] Zoological Institute, Wrocław University, Przybyszewskiego 63/77, 51-148 Wrocław, Poland; E-mail: hypogast@biol.uni.wroc.pl

***Ceratophysella lobata* sp. n. from Siberia with notes on *C. brevisensillata* Yosii, 1961 (Collembola: Hypogastruridae).** - *Ceratophysella lobata* sp. n. from Siberia (Russia) and Alaska (USA) is described. Notes on morphology and taxonomic status of the similar species *Ceratophysella brevisensillata* Yosii, 1961 are given.

Keywords: Collembola - Siberia - Alaska - taxonomy.

INTRODUCTION

Ceratophysella Börner, 1932 is a large collembolan genus comprising 125 hemiedaphic species (Bellinger *et al.*, 2010). The genus is generally cosmopolitic, but the majority of species live in temperate climatic zone of Palaearctic (Babenko *et al.*, 1994, Thibaud *et al.*, 2004) and Nearctic (Christiansen & Bellinger, 1980). For long time *Ceratophysella brevisensillata* Yosii, 1961, described on material from the north-eastern part of the USA (Yosii, 1960, 1961), was one of the most easily distinguishable species of the genus mainly because of a notable difference in sensilla length on thoracic and abdominal terga. Based on specimens from Alaska, Fjellberg (1985) added new diagnostic features, namely a specific shape of one of the maxillary lamellae. However, in the eastern Palaearctic two distinct forms with short thoracic sensilla but different maxillae were detected (Babenko *et al.*, 1994) and it was not clear which one belongs to the true *C. brevisensillata*. Two different types of maxillae in the "species" were also found in Alaska (Arne Fjellberg, pers. comm.). Due to the kindness of Dr. Peter Schwendinger (Museum of Natural History Geneva) we were able to study several types of *C. brevisensillata* from Massachusetts, USA and to solve a problem of two east Palaearctic-Alaskan forms of this "species". Below we redescribe types of *C. brevisensillata* and describe a new species having a different type of maxillae.

MATERIAL AND METHODS

Terminology for the descriptions follows that given in Fjellberg (1984, 1999), Babenko et al. (1994) and Thibaud *et al.* (2004). Abbreviations used: ant. I-IV – antennal segments I-IV, th. I-III – thoracic terga I-III, abd. I-VI – abdominal terga I-VI. Depositories: MNHG – Museum of Natural History, Geneva, Switzerland; MPGU –

Manuscript accepted 31.10.2010

Chair of Zoology and Ecology of the Moscow State Pedagogical University, Russia; DBET – Department of Biodiversity and Evolutionary Taxonomy, Wrocław University, Poland; AF – collection of A. Fjellberg, Tjöme, Norway.

RESULTS AND DISCUSSION

Ceratophysella brevisensillata Yosii, 1961 Figs 1-9

MATERIAL EXAMINED: 10 paratypes (?) on slides, formerly in alcoholic vial labeled: „*Hypogastrura* (*Ceratophysella*) *pseudarmata* (Folsom) det. Yoshii, USA (Massachusetts), Arlington 15.XI.1950, leg. Bonet, on rain pools" (MNHG).

REDESCRIPTION: Body length 1-1.3 mm. Color in alcohol grey to dark grey. Eye patches black, anal spines light. Granulation fine and uniform, with 14-22 granules between setae p_1 on abd. V. Dorsal chaetotaxy of B type, macrosetae p_2 on th. II-III set nearly in line with setae p_1, setae m_3 and m_4 on th. II usually present, setae a_2 longer than a_3, setae m_6 absent, setae p_1 and p_2 on abd. IV macro- and microsetae respectively, setae p_3 present (Figs 1-2). Arrangement of setae on head typical for the genus. Differentiation of dorsal setae into micro- and macrosetae distinct. Setae long, pointed, slightly curved and serrated (Fig. 3). Body sensilla (s) p_4 on th. II-III and p_5 on abd. I short, about 1/3-1/2 of microsetae. Body sensilla on abd. II-V and lateral parts of th. II-III long, but shorter than macrosetae (Fig. 3). Microsensilla (ms) on th. II present. Subcoxae I-III with 1, 2, 3 setae respectively.

Ant. IV with simple apical vesicle, subapical organite (or), microsensillum (ms), 7 cylindrical sensilla (2 lateral and 5 dorsal), about 15-20 short curved flattened at tips sensilla in ventral file (Fig. 4). Ant. III-organ with two long (lateral) and two short (internal) curved sensilla. Microsensillum on ant. III present. Eversible sac between ant. III-IV present. Ant. I with 7 setae.

Ocelli 8 + 8. Postantennal organ about twice as large as single ocellus, with four lobes of which the anterior pair larger than the posterior. Accessory boss present (Fig. 5).

Labrum with 5, 5, 4 setae and without apical papillae. 4 prelabrals present. Labium and head of maxilla (Fig. 6) of the *C. armata* type. Outer lobe with 2 sublobal hairs.

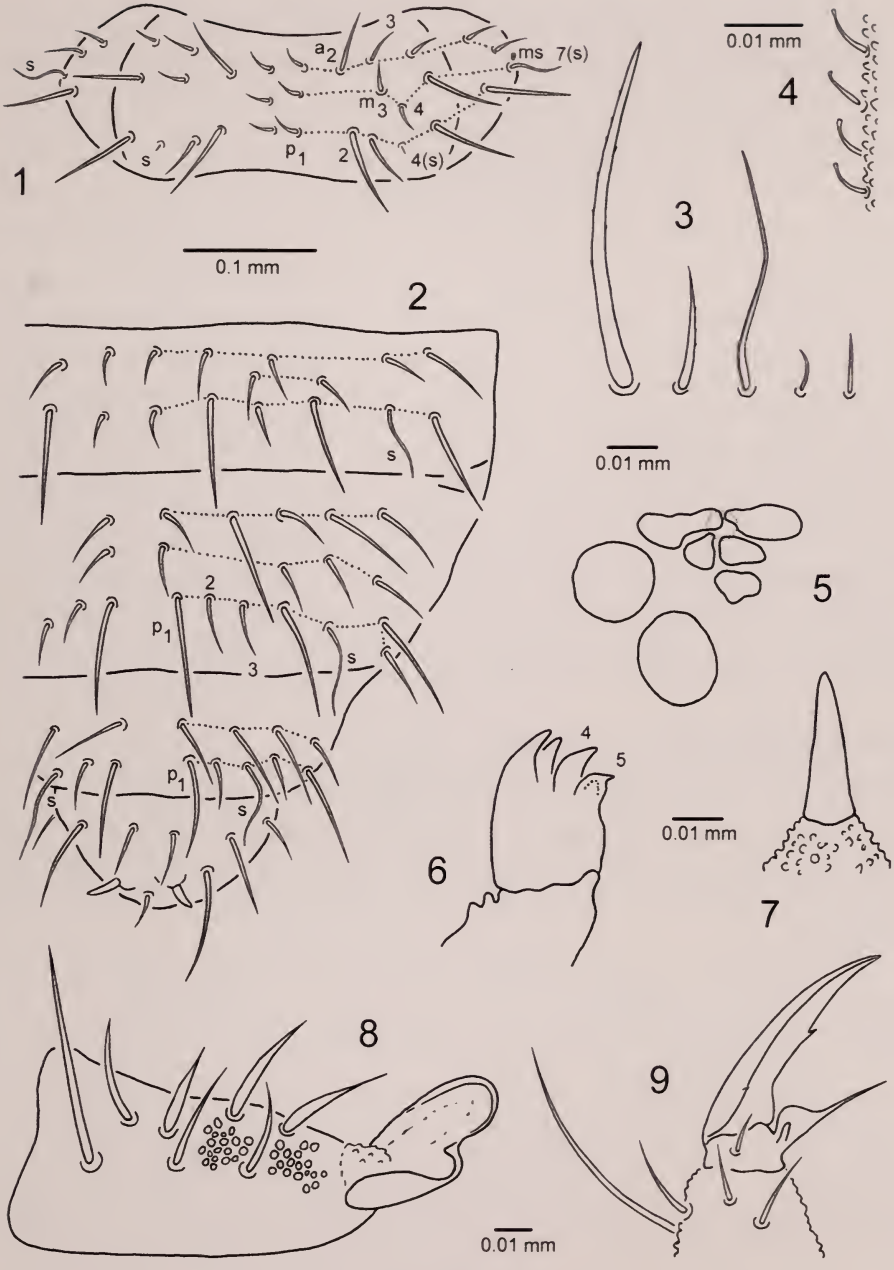
Tibiotarsi I, II, III with 19, 19, 18 setae respectively, tibiotarsal tenent hairs slightly longer than inner edge of claws and pointed. Claws with inner tooth and pair of indistinct lateral teeth. Empodial appendage with broad basal lamella and apical filament reaching inner tooth or slightly beyond (Fig. 9).

Ventral tube with 4 + 4 setae.

Furca well developed (Fig. 8). Dens/mucro ratio = ca. 2. Dens with 7 setae (2-4 inner modified). Mucro boat-like. Retinaculum with 4 + 4 teeth.

Anal spines short, half as long as inner edge of claws III, situated on basal papillae (Figs 2, 7).

REMARKS: The species was originally described from the north-eastern part of the USA. Later it was recorded from several localities within the same region (Christiansen & Bellinger, 1980), from Alaska and Chukotka (Fjellberg, 1985) and Siberia (Babenko *et al.*, 1994). Alaskan and East Palaearctic specimens treated as



FIGS 1-9

Ceratophysella brevisensillata Yosii, 1961. (1) Chaetotaxy of th. II. (2) Chaetotaxy of abd. III-VI. (3) From left to right: macroseta p_2, microseta p_1, sensilla m_7, sensilla p_4 on th. II and sensilla p_5 on abd. I. (4) Sensilla in ventral file on ant. IV. (5) Postantennal organ, accessory boss and neighbour ocelli. (6) Head of maxilla, lateral view. (7) Anal spine. (8) Dens and mucro. (9) Claw I with empodial appendage.

C. brevisensillata clearly differ from the above redescription of Yosii's types by having longer anal spines and coarser integument granulation. They could be considered as a separate species if their morphology was homogeneous within the area. Unfortunately it is not so and many important diagnostic characters vary in different parts of the distributional range without forming clear geographical pattern. Thus, inner margin of claw III/anal spine ratio varies in Palaearctic specimens from 1.8: 1 to 0.9: 1, being usually about 1: 1. Yosii's "a" measure is usually 10-12, but the whole range is 9-16. Chaetom differentiation into macro and microsetae is strong in most Palaearctic regions but specimens from Kemerovo Province and eastern Tuva are characterized by weak differences in seta length with a_2 on th. II almost as long as a_1 and a_3. Intermediary conditions have been also seen. The single available specimen from the Kyrgyz mountains has rather short but strong (almost spine-like) macrosetae. Alaskan and Chukotka specimens have 2 sublobals on maxillary outer lobe and p_3 setae on abd. IV are usually absent. Populations from more western parts of Palaearctic differ by having only 1 sublobal hair and both p_2 and p_3 microsetae present on abd. IV. Nevertheless, two sublobals have been also seen in populations from Buryatia, eastern Tuva, north-eastern Altai and Kyrgyzstan and specimens without p_3 on one or both sides on abd. IV can be found within many studied populations. Just now we prefer to treat all these forms as a single polymorphic species with a wide Siberian-American distributional range being sure that more work and material are needed to clear up their status. However the existing distributional gap (see Fig. 21) between east and west American populations raises some doubts that they are conspecific.

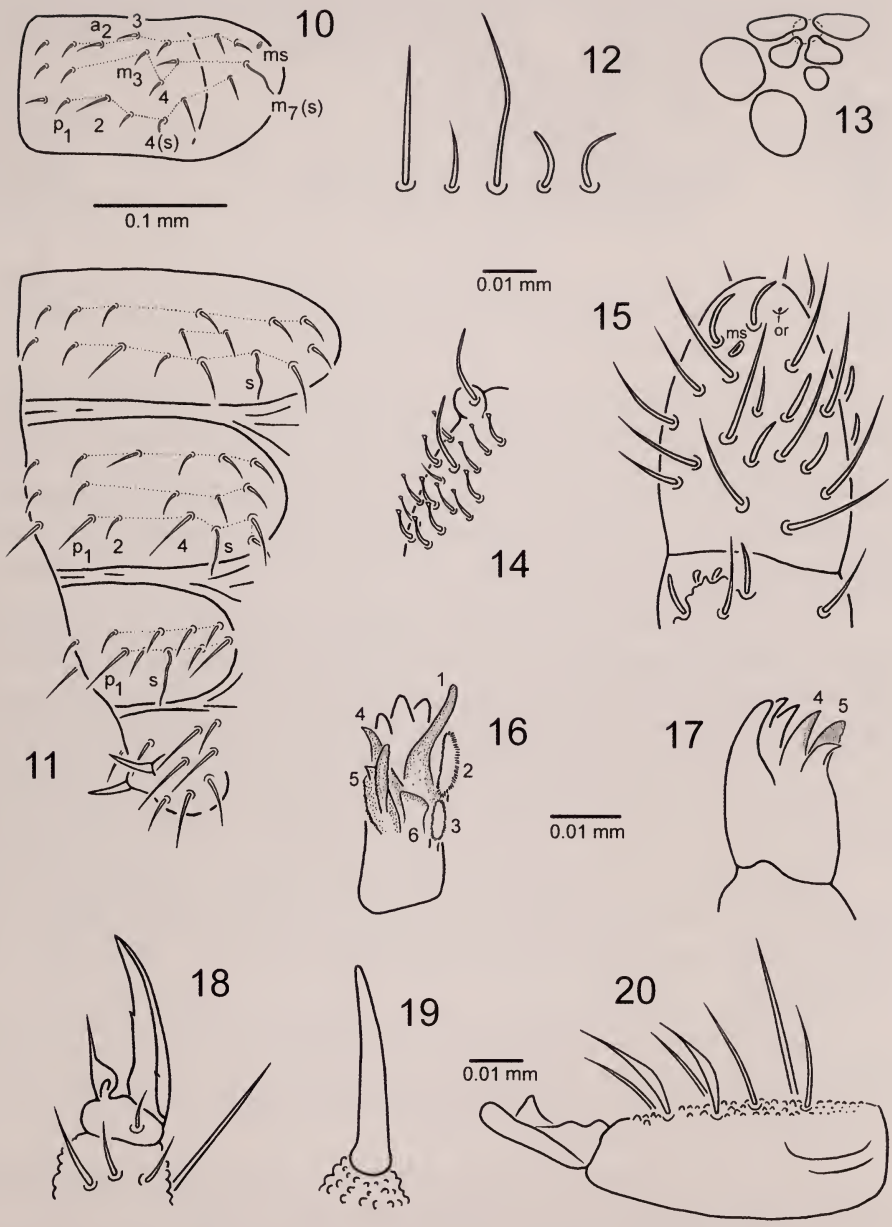
Ceratophysella lobata sp. n. Figs 10-20

Hypogastrura (*Ceratophysella*) *brevisensillata*: Fjellberg (1985): 37
Hypogastrura (*Ceratophysella*) cf. *brevisensillata*: Babenko *et al.* (1994): 127

MATERIAL EXAMINED: Holotype, female, Russia, Jakutia (Sakha Republic), Suntar-Khayata Mt. Range, upper current of Kyumyume River (63° 13'N 139° 32'E), 1,800 m a.s.l, willow bushes with lichen cover, 9.VII.2002, leg. O. Makarova (MPGU). – Paratypes, 12 females, 11 males on slides and many specimens in alcohol, same data as holotype (MPGU, DBET and MNHG).

OTHER MATERIAL: Russia: 3 females, Ural Mts., Perm' Province, State nature reserve "Basegi", Srednii Baseg Mt. (58° 50'N 58° 40'E), alpine tundra, 23.VII.1990, leg. S. Esyunin (MPGU). – 2 females, same region but mixed forest with fern cover, 4.IX.1990, leg. S. Esyunin (MPGU). – 13 females and 3 males, Siberia, Putorana plateau, vicinity of Yt-Kyuel' lake (68° 08'N 91° 50'E), 700-900 m a.s.l., nival desert, 28.VII-13.VIII.1996, leg. A. Babenko (MPGU). – 7 females and 1 male, Siberia, Taimyr peninsula, upper current of Nizhnaya Agapa River (70° 06N 87° 25'E), tundra, 6.VII-5.VIII.1999, leg. A. Babenko (MPGU). – 2 females and 1 male, Chukotka, vicinity of El'gygytgyn Lake (67° 26' 172° 10'E), tundra, 20.VIII.1974, leg. E. Bondarenko (MPGU). – 10 specimens, Chukotka, Aborigen, in fungi on dry ridge, 29.VII.1979, leg. A. Fjellberg (AF). – 9 specimens, USA, Alaska, Brook Range, W of Atigun Camp, dry alpine meadow, c. 1600 m a.s.l., 19.VIII.1976, leg. A. Fjellberg (AF). – 7 specimens, USA, Alaska,vicinity of Fairbanks, litter in aspen forest, 21.VII.1980, leg. A. Fjellberg (AF).

DESCRIPTION: Body length 1-1.2 mm. Color in alcohol light to dark grey-brown. Eye patches black, anal spines light. Granulation fine and uniform, usually 12-15 granules between setae p_1 on abd. V. Dorsal chaetotaxy of B type, macrosetae p_2 on th. II-III set nearly in line with setae p_1, setae m_3 and m_4 on th. II usually present, setae a_2 slightly longer than a_3, setae m_6 absent, setae p_1 and p_2 on abd. IV macro- and micro-



FIGS 10-20

Ceratophysella lobata sp. n. (10) Chaetotaxy of th. II. (11) Chaetotaxy of abd. III-VI. (12) From left to right: macroseta p_2, microseta p_1, sensilla m_7, sensilla p_4 on th. II and sensilla p_5 on abd. I. (13) Postantennal organ, accessory boss and neighbour ocelli. (14) Sensilla in ventral file on ant. IV. (15), Chaetotaxy of ant. III-IV. (16) Head of maxilla. (17) Head of maxilla, lateral view. (18) Claw III with empodial appendage. (19) Anal spine. (20) Dens and mucro.

FIG. 21

Known distribution of *C. lobata* sp.n. (white dots) and *C. brevisensillata* Yosii, 1961 (black dots, American data according to Christiansen & Bellinger (1980)). Black & white dots in Alaska and Chukotka indicate uncertain records (data from Fjellberg (1985).

setae respectively, setae p_3 absent (Figs 10-11). Arrangement of setae on head typical for the genus. Differentiation of dorsal setae into micro- and macrosetae not strong and more pronounced on last abdominal terga. Setae short, fine, pointed, slightly curved and serrated. Body sensilla p_4 on th. II-III and p_5 on abd. I usually equal to microsetae, thick and sometimes curved. Body sensilla (s) on abd. II-V and lateral parts of th. II-III about as long as macrosetae (Fig 12). Microsensilla (ms) on th. II present. Subcoxae I-III with 1, 2, 3 setae respectively.

Ant. IV with simple apical vesicle, subapical organite (or), microsensillum (ms), 5-7 (usually 7) cylindrical sensilla (2 lateral and 3-5 dorsal) (Fig. 15) and about 15 short curved flattened at tips sensilla in ventral file (Fig. 14). Ant. III-organ with two long (lateral) and two short (internal) curved sensilla (Fig. 15). Microsensillum on ant. III present. Eversible sac between ant. III-IV present. Ant. I with 7 setae.

Ocelli 8 + 8. Postantennal organ about twice as large as single ocellus, with four lobes of which the anterior pair larger than the posterior. Accessory boss present (Fig. 13).

Labrum with 5, 5, 4 setae and without apical papillae. 4 prelabrals present. Labium of the *C. armata* type. Maxillary head with prolonged denticulate lobe on lamella 5 which only slightly shorter than lamella 4 (Figs 16-17). Outer lobe with 2 sublobal hairs.

Tibiotarsi I, II, III with 19, 19, 18 setae respectively, tibiotarsal tenent hairs nearly as long as inner edge of claws and usually pointed, sometimes truncate. Claws with inner tooth and pair of indistinct lateral teeth. Empodial appendage with broad basal lamella and apical filament reaching inner tooth or slightly beyond (Fig. 18).

Ventral tube with 4 + 4 setae.

Furca well developed. Dens/mucro ratio = ca. 2. Dens with 7 setae (2 inner modified). Mucro boat-like (Fig. 20). Retinaculum with 4 + 4 teeth.

Anal spines equal to or slightly longer than inner edge of claws III, situated on basal papillae (Figs 11, 19).

VARIABILITY: Siberian and available Alaskan material appears to be morphologically homogeneous throughout the distributional range. However Fjellberg (1985) mentioned that in Alaska "exact chaetotaxy and differentiation in macro/microchaetae is rather variable" and alpine specimens from Brook Range "frequently have long,

hair-like p_5 sensilla on Abd.I". It may indicate the presence of the third separate form there apart from *C. lobata* sp. n. and *C. brevisensillata* s. l.

ETYMOLOGY: The name reflects the most characteristic feature of the new species - the presence of an additional lobe on one of the maxillary lamellae.

DISTRIBUTION: The new species which seems to be a usual inhabitant of Subarctic Mountains was found in few remote Palaearctic regions from Ural to Chukotka and in Alaska (see map on Fig. 21 and material above).

AFFINITIES: A combination of four features, viz. a full number of ocelli, a chaetotaxy of B type, shortened dorsal sensilla on three first terga and maxillae with prolonged lobe on lamella 5, distinguishes *C. lobata* sp. n. from all other known species of the ceratophysellan lineage. Thus, only *C. brevisensillata* and *Boneto-gastrura nivalis* (Martynova) are characterized by the same type of sensillar differentiation, but both have the usual armata-type of maxillae and longer dorsal setae which are more clearly differentiated into macro/microsetae. Apart from this, *B. nivalis* has only 4 + 4 ocelli and partly reduced chaetotaxy (m_3 always and m_4 usually absent on th. II-III, abd. I-III without m-setae as a rule and p_3 often absent on abd. I-IV).

Shortened dorsal sensilla on thorax similar to those in *C. lobata* sp. n. are also characteristic of *C. bengtssoni* (Ågren), *C. microchaeta* (Babenko) and *B. variabilis* (Christiansen) but maxillae of all these species are modified differently with broadened lamella 1 and without prolonged lobe on lamella 5.

The same type of maxillae as in *C. lobata* sp. n. is known only for *C. sigillata* (Uzel), *C. sibirica* Martynova and *C. pseudarmata* (Folsom)[1]. They can be easily distinguished from *C. lobata* sp. n. due to long dorsal sensilla on all terga and clearly clavate tibiotarsal tenent hairs (pointed or truncate in *C. lobata* sp. n.).

The new species runs in the most recent key to the Palaearctic *Ceratophysella* species (Thibaud *et al.*, 2004) to couplet 11 which needs to be modified as follows:

11	Sensillum p_5 on abd. I small, spine-like; micro- and macrosetae clearly differentiated	11*
–	Sensillum p_5 on abd. I long, hair like; micro- and macrosetae weakly differentiated	*microchaeta* (Babenko, 1994)
11*	Maxillary head of the armata type without prolonged lobe on lamella 5	*brevisensillata* Yosii, 1961
–	Maxillary head with prolonged denticulate lobe on lamella 5 (Figs 16-17)	*lobata* sp. n.

ACKNOWLEDGEMENTS

We would like to express our sincere thanks to Peter Schwendinger (Museum of Natural History Geneva) and Arne Fjellberg (Tjöme, Norway) for the loan of the material.

[1] According to Babenko *et al.* (1994) a specific status of these three species needs further confirmation.

REFERENCES

Babenko, A. B., Chernova, N. M., Potapov, M. B. & Stebaeva, S. K. 1994. Collembola of Russia and adjacent countries: Family Hypogastruridae. *Nauka*, *Moscow*, 336 pp.

Bellinger, P., Christiansen, K. A. & Janssens, F. 2010. Checklist of the Collembola of the World. Available from: http://www.collembola.org (date of access: 29.IX.2010).

Christiansen, K. & Bellinger, P. 1980. The Collembola of North America north of the Rio Grande. *Grinnell College, Grinnell, Iowa*, 1312 pp.

Fjellberg, A. 1984. Maxillary structures in Hypogastruridae (Collembola). *Annales de la Société Royale Zoologique de Belgique* 114: 89-99.

Fjellberg, A. 1985. Arctic Collembola. 1. The collembolan fauna of Alaska: Families Poduridae, Hypogastruridae, Odontellidae, Brachystomellidae and Neanuridae. *Entomologica Scandinavica* Supplement 21: 1-126.

Fjellberg, A. 1999. The Labial Palp in Collembola. *Zoologischer Anzeiger* 237: 309-330.

Thibaud, J. -M., Schulz H.-J., Gama, M. M. da 2004. Synopses on Palaearctic Collembola. Hypogastruridae. Vol. 4. *Abhandlungen und Berichte des Naturkundemuseums Görlitz* 75(2): 1-287.

Yosii, R. 1960. Studies on the Collembolan Genus *Hypogastrura*. *The American Midland Naturalist* 64(2): 257-281.

Yosii, R. 1961. Further Remarks on the Collembolan Genus *Hypogastrura* with Description of a New Genus. *The American Midland Naturalist* 66(1): 250-251.

Revue suisse de Zoologie 118 (2): 265-292; juin 2011

Taxonomie et répartition des chiroptères de Tunisie

Ridha DALHOUMI[1], Patricia AISSA[1] & Stéphane AULAGNIER[2]
[1] Laboratoire de Biosurveillance de l'Environnement, Faculté des sciences de Bizerte, 7021 Zarzouna (Tunisie)
[2] Comportement et Ecologie de la Faune Sauvage, I.N.R.A., B.P. 52627, 31326 Castanet Tolosan cedex (France)
Courriels : dalhoumi_ridha@yahoo.com; Stephane.Aulagnier@toulouse.inra.fr

Taxonomie et répartition des chiroptères de Tunisie. - A partir d'une compilation des données publiées, y compris dans la littérature grise, le présent travail fournit une liste actualisée des 19 espèces de Chiroptères inventoriées en Tunisie ainsi que des cartes précises de leur répartition géographique. Avec six genres et dix espèces la famille des Vespertilionidae est la plus diversifiée devant les Rhinolophidae (un genre, cinq espèces). Hipposideridae, Rhinopomatidae, Molossidae et Miniopteridae sont représentés chacune par une seule espèce. Certaines espèces sont très largement distribuées (espèces méditerranéennes), d'autres sont seulement présentes dans le nord du pays (espèces paléarctiques), d'autres enfin sont inféodées aux zones désertiques du sud (espèces saharo-sindiennes). Trois espèces classées vulnérables et cinq espèces classées quasi-menacées sur la liste rouge de l'U.I.C.N. devraient bénéficier de mesures de conservation.

Mots clés: Chauves-souris - inventaire - répartition - biogéographie - conservation - Tunisie

Taxonomic status and distribution of Tunisian bats. - An extensive review of the published and unpublished literature resulted in an updated list of 19 bat species for Tunisia. Provisional distribution was mapped for all of them. The family Vespertilionidae (six genera, ten species) is the most diversified, beyond Rhinolophidae (one genus, five species). Only one species each of Hipposideridae, Rhinopomatidae, Molossidae and Miniopteridae have been recorded so far. Some species are widely distri - buted over the country (mediterranean species), when others are restricted to the northern part (palaearctic species) and some are only distributed in the southern desert areas (saharo-sindian species). Three species are classified as vulnerable and five species are classified as near threatened according to the I.U.C.N. redlist; they should benefit conservation measures.

Keywords: Chiroptera - taxonomy - distribution - biogeography - conservation - Tunisia

Manuscrit accepté le 02.12.2010

INTRODUCTION

En Tunisie, les Chiroptères constituent sans aucun doute l'un des ordres de Mammifères terrestres les plus méconnus du grand public. Ceci semble lié en partie à l'absence de prospections récentes mais également au mode de vie nocturne des chauves-souris et à la crainte superstitieuse qu'elles inspirent encore. Pourtant, les premières notes sur les Chiroptères tunisiens remontent au XIXème siècle. Le premier, Hartmann (1868) signale la présence de deux espèces, *Rhinolophus Ferrum-equinum* et *Miniopterus Schreibersii* (sic), puis Fitzinger (1870) en rapporte une troisième, *Vesperugo marginatus* (= *Pipistrellus kuhlii*), sans préciser de localisations. Huit ans plus tard, Dobson (1878) recense une nouvelle espèce en provenance de "Tunis" : *Vespertilio murinus* (= *Myotis punicus*). En 1885, Lataste rajoute *Phyllorhina Tridens* (= *Asellia tridens*) et *Vesperugo isabellinus* (= *Eptesicus isabellinus*). Il précise la répartition des cinq espèces inventoriées dans son catalogue critique des mammifères apélagiques sauvages de la Tunisie publié en 1887. Par la suite, Anderson (1892) complète la liste avec *Plecotus auritus* (= *Plecotus gaisleri*).

Au début du XXème siècle, Andersen & Matschie (1904), Gadeau de Kerville (1908) et Olivier (1909) rapportent, entre autres, la présence de trois espèces supplémentaires: *Euryale barbarus* (= *Rhinolophus euryale*), *Rhinolophus hipposideros* et *Rhinopoma microphyllum* (= *Rhinopoma cystops*). Dans les années trente, la synthèse de Blanc (1935) sur les Mammifères de Tunisie, l'analyse biogéographique d'Heim de Balsac (1936) et la clef dichotomique des Chéiroptères de la Barbarie (Laurent, 1937) ne mentionnent aucune nouvelle espèce de Chiroptères.

Les prospections de Deleuil & Labbe (1955a) dans plusieurs sites du nord tunisien donnent lieu à une synthèse rapidement dépassée par la découverte d'*Otonycteris Hemprichi* (sic) près de Redeyef (Deleuil, 1957). Un an plus tard, Kahmann (1958) signale pour la première fois en Tunisie *Rhinolophus mehelyi*. Lors de leur parcours spéléologique réalisé en octobre 1967 dans les grottes des chauves-souris, du Cheval et de Kef El Agab, Aellen & Strinati (1969) fournissent la première liste des Chiroptères cavernicoles de Tunisie; leur inventaire décrit la répartition des 13 espèces précédemment identifiées (dont *Vespertilio pipistrellus* (= *Pipistrellus pipistrellus*) rapportée de Djerba par Galli-Valerio en 1911 à la suite d'une probable erreur d'identification) et d'une espèce nouvelle pour le pays: *Rhinolophus blasii*.

Avec l'expédition de la Smithsonian Institution (1972-1975), Cockrum (1976a) complète l'inventaire des chauves-souris tunisiennes avec quatre espèces: *Myotis capaccinii*, *M. emarginatus*, *Pipistrellus pipistrellus* et *Pipistrellus savii* (= *Hypsugo savii*) et fournit quelques nouvelles localisations pour les espèces déjà connues. Enfin, en 1981 Beaucournu *et al.* rapportent la première observation de *Tadarida teniotis*, dont la première capture en 1963 n'a été rapportée que plus tard par Kock & Nader (1984).

Depuis lors, contrairement aux autres pays du Maghreb, la Tunisie n'a pas été prospectée extensivement, toutefois plusieurs travaux récents rapportent des données locales (e.g. Zava & Masseti, 2007; Hizem & Allegrini, 2009). Toutefois le travail le plus complet est la thèse de Gharaibeh (1997) qui fournit une liste de 18 espèces accompagnée de cartes de répartition, mais sans analyse critique de la systématique et des données publiées. Une dix-neuvième espèce, *Pipistrellus rueppellii*, est connue par

un spécimen des collections du Zoologisches Forschungsinstitut und Museum Alexander Koenig de Bonn (ZFMK) (Van Cakenberghe & Seamark, 2006).

Le présent travail de compilation bibliographique propose une actualisation critique de l'inventaire des six familles de chauves-souris recensées en Tunisie et la cartographie de leur distribution à partir d'une analyse bibliographique plus approfondie.

RESULTATS

Rhinolophidae

Rhinolophus blasii Peters, 1866

Rhinolophus blasii blasii. – Aellen & Strinati, 1969
Rhinolophus blasii. – Wiersema & Vreugdenhil, 1975

Le Rhinolophe de Blasius a été recensé uniquement dans trois sites cavernicoles de la Tunisie. Ainsi, un mâle a été trouvé par Aellen & Strinati (1970) dans la grotte des Chauves-souris d'El Haouaria le 3 octobre 1967 (Fig. 1). Cockrum (1976a) a signalé cette espèce dans la mine du Djebel Ressas et dans la mine du Djebel Zaghouan. Enfin, Deleuil & Labbe (1955a) ont publié les mensurations de deux spécimens de rhinolophes appartenant très probablement à cette espèce (cf. *R. euryale*) provenant de la grotte des chauves-souris d'El Haouaria (Cap Bon) et d'une grotte profonde entre Testour et El Aroussa.

Rhinolophus euryale Blasius, 1853

Euryale barbarus. – Andersen & Matschie, 1904
Rhinolophus euryale barbarus. – Andersen, 1905
Rhinolophus euryali. – Trouessart, 1906
Rhinolophus euryale. – Gadeau de Kerville, 1908
Rhinolophus euriale. – Karaman, 1939
Rhinolophus (?) euryale. – Aellen & Strinati, 1970

Le Rhinolophe euryale est assez difficilement identifiable des deux autres espèces de taille moyenne, au point que Deleuil & Labbe (1955a) ont décrit la sous-espèce *tuneti* d'après un *Rhinolophus mehelyi* (photographie et mesures du type) et deux *R. blasii* (mesures des paratypes). Dans la grotte des chauves-souris d'El Haouaria successivement Kahmann (1958), Aellen & Strinati (1969, 1970) et Cockrum (1976a, b) n'ont observé que des rhinolophes de Méhely. Aussi les données rapportées pour *R. euryale* doivent être reprises avec prudence.

Le Rhinolophe euryale a été rapporté pour la première fois par Andersen & Matschie (1904) dans une grotte près de Tebourba (Fig. 1) le 12 mars 1898 (le second auteur étant le descripteur de *R. mehelyi*). Aellen & Strinati (1970) attribuent à cette espèce deux radius collectés dans la grotte du Cheval du Djebel Zaghouan le 5 octobre 1967. Cockrum (1976a) a collecté huit spécimens dans la mine de kohl, à 5km au nord-est d'Aïn Draham.

Parmi les données à confirmer, Gadeau de Kerville (1908) a trouvé un essaim de 96 mâles et de 26 femelles dans la grotte de Djebel Gloub le 18 mai 1906 (donnée publiée aussi par Trouessart, 1906). Blanc (1935), qui n'a pas observé *R. mehelyi*, rapporte *R. euryale* d'une grotte du Djebel Ichkeul, près de Mateur et d'une carrière de pierres située à l'est de Gafsa. Deux spécimens de cette dernière provenance sont

déposés dans les collections du Museum für Naturkunde Berlin (ZMB), ainsi qu'un individu provenant d'El Hamma de Gabès. Enfin, une femelle a été capturée dans le grenier d'une maison du Parc National d'El Feidja (Zava & Masseti, 2007).

Rhinolophus ferrumequinum (Schreber, 1774)

Rhinolophus Ferrum-equinum. – Hartmann, 1868
Rhinolophus ferrum-equinum. – Trouessart, 1905
Rhinolophus ferrum equinum. – Blanc, 1935
Rhinolophus ferrum equinum obscurus. – Laurent, 1937
Rhinolophus ferrumequinum ferrumequinum. – Aellen & Strinati, 1969
Rhinolophus ferrumequinum. – Baker *et al*., 1974

Le Grand rhinolophe a été signalé dans une quinzaine de sites de Tunisie (Fig. 2), mines, caves et grottes, mais aussi bâtiments. Du nord au sud cette espèce a été observée à El Haouaria (Naturhistorisches Museum Wien - NMW), dans une pelote de Chouette effraie (*Tyto alba*) collectée entre El Haouaria et Sidi Daoud (Heim de Balsac *et al*., 1954), dans une mine abandonnée du Djebel Bou Kornine (Deleuil & Labbe, 1955a), dans une mine du Djebel Ressas (Deleuil & Labbe, 1955a; Cockrum, 1976a; Noblet & Nefzi, 1991), dans une grotte du Djebel Oust (Cockrum, 1976a) où Gharaibeh (1997) a observé le 29 juillet 1996 des femelles allaitantes et des juvéniles, dans la grotte du Cheval du Djebel Zaghouan (Deleuil & Labbe, 1955a; Aellen & Strinati, 1969), mais aussi la grotte du poste d'observation (Cockrum, 1976a) et dans la mine abandonnée de kohl au nord-est d'Aïn Draham(Cockrum, 1976a).

Une colonie de 80 individus a été trouvée dans une bâtisse du Parc National d'El Feidja, ainsi qu'une femelle isolée dans un entrepôt (Zava & Masseti, 2007). Une galerie de mine à El Akhouat hébergeait deux femelles le 23 décembre 1954 (Deleuil & Labbe, 1955a), la mine abandonnée de Scarna (Djebel Barbrou) abritait plusieurs individus dont un juvénile mâle le 26 juillet 1996 (Gharaibeh, 1997) là où dix spécimens avaient auparavant été collectés par Cockrum (1976a).

Plus au sud, *R. ferrumequinum* a été également signalé à Feriana (Lataste, 1885), au sud de Redeyef sur la route en direction d'Aïn Ameur (Cockrum, 1976a) et dans une grotte au nord-ouest de Toujane (Baker *et al*., 1974). Enfin, *R. ferrumequinum* a été collecté à Foum Tataouine, dans le tunnel sous la montagne située au sud de Tataouine (Baker *et al*., 1974), ainsi que dans les fortifications de la ville (Cockrum, 1976a).

Rhinolophus hipposideros (Bechstein, 1800)

Rhinolophus hipposideros. – Gadeau de Kerville, 1908
Rhinolophus hipposideros minimus. – Laurent, 1937
Rhinolophus hipposideros escalerae. – Cockrum, 1976a

Apparemment plus rare, le Petit rhinolophe a été surtout rapporté dans l'extrême nord tunisien (Fig. 3). Ainsi, l'espèce a été recensée dans le Parc National d'Ichkeul les 30-31 décembre 1991 (Noblet & Nefzi, 1991), dans une forêt claire de pins à Nefza le 10 septembre 2004 (Rebelo & Brito, 2006), près d'Aïn Draham dans un tombeau antique appelé grotte de Kaloi (Gadeau de Kerville, 1908) et dans la grotte des chauves-souris d'El Haouaria (Heim de Balsac *et al*., 1954). Au Djebel Zaghouan, ce rhinolophe été observé dans une grotte au niveau du poste d'observation: quatre

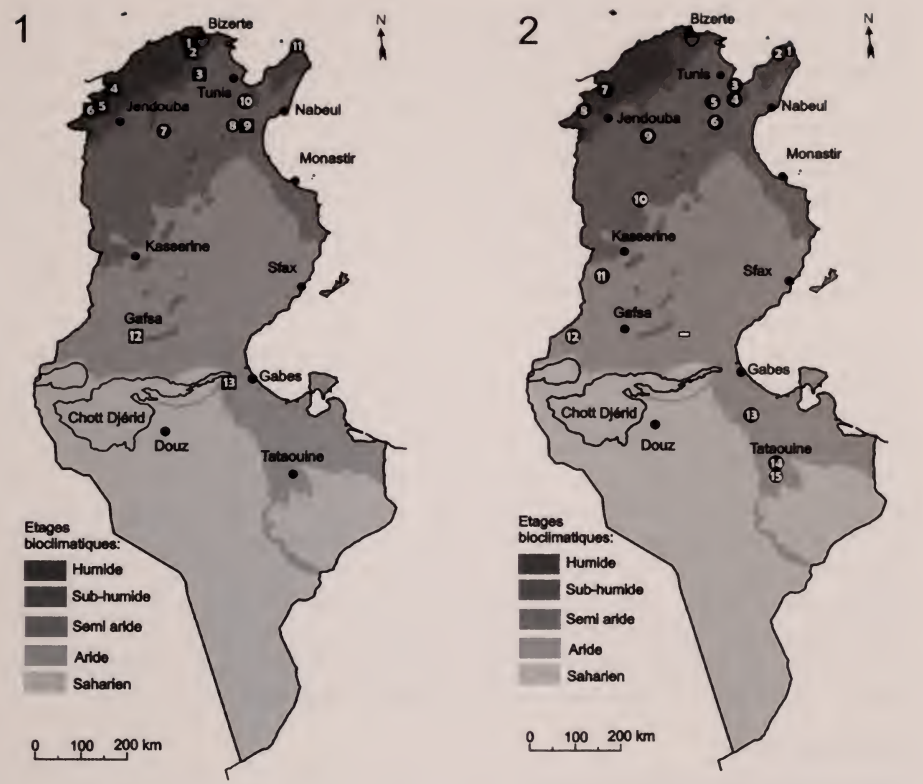


FIG. 1: Carte des observations de *Rhinolophus blasii* (●) et de *Rhinolophus euryale* (■) en Tunisie.
1: Djebel Ichkeul, 2: Mateur, 3: Tebourba, 4: Aïn Draham, 5: Djebel Gloub, 6: El Feidja, 7: Testour, 8: Djebel Zaghouan (mine), 9: Djebel Zaghouan (grotte du Cheval), 10: Djebel Ressas (mine), 11: El Haouaria (grotte des chauves-souris), 12: Gafsa (carrière), 13: El Hamma de Gabès.

FIG. 2: Carte des observations de *Rhinolophus ferrumequinum* en Tunisie
1: El Haouaria, 2: Sidi Daoud, 3: Djebel Bou Kornine, 4: Djebel Ressas (mine), 5: Djebel Oust, 6: Djebel Zaghouan (grotte du Cheval, grotte du poste d'observation), 7: Aïn Draham, 8: El Feidja, 9: El Akhouat, 10: Djebel Barbrou, 11: Feriana, 12: Redeyef (mine), 13: Toujane, 14: Tataouine, 15: Foum Tataouine.

mâles le 13 février 1955 (Deleuil & Labbe, 1955a) et 13 le 30 avril 1975 (Cockrum, 1976a). Dans le centre tunisien, trois femelles ont été collectées dans des catacombes à Sousse (Muséum National d'Histoire Naturelle, Paris - MNHN) et Blanc (1935) rapporte l'espèce des anfractuosités de rocher dans les montagnes près de Kasserine.

Rhinolophus mehelyi Matschie, 1901

Rhinolophus euryale tuneti. – Deleuil & Labbe, 1955a
Rhinolophus mehelyi. – Kahmann, 1958
Rhinolophus mehelyi tuneti. – Cockrum, 1976b

La présence en Tunisie du Rhinolophe de Méhely est rapportée pour la première fois par Kahmann (1958) qui l'a trouvé avec *Miniopterus schreibersii* et *Myotis*

punicus dans la grotte des chauves-souris à El Haouaria (Fig. 4) le 23 octobre 1957. Dans cette même grotte, Deleuil & Labbe (1955a) ont décrit *R. mehelyi tuneti*, Aellen & Strinati (1970) y ont observé un essaim contenant plusieurs centaines de *R. mehelyi* le 3 octobre 1967, 500 à 600 en 1971 selon Vesmanis (1976), et Cockrum (1976a) y a prélevé 17 spécimens. Ce rhinolophe a été observé à proximité dans les grottes romaines (Baker *et al.*, 1974), à 2 km au nord d'El Haouaria (Cockrum, 1976a), à Djebel Sidi Abiod (NMW) et dans au moins deux sites du Cap Bon près d'El Ouidane (11 km à l'ouest sur MC 27) et dans la mine de charbon abandonnée (Cockrum, 1976a), dont très certainement la station mentionnée par Felten *et al.* (1977). Gharaibeh (1997) l'a aussi trouvé dans la carrière de sable de Menzel Témime.

Un autre groupe de données provient du sud de Tunis: mines Entouna, du Djebel Ressas et du Djebel Zaghouan, avec l'observation insolite d'un individu sur la calandre d'une voiture entre Zaghouan et Khereddine (Cockrum, 1976a). En 1958, C.J. Marinkelle a collecté un spécimen de Tunis et trois autres de Nabeul (The Field Museum Chicago - FMNH). Plus au nord, le Rhinolophe de Méhely a aussi été observé dans une grotte et une mine du Djebel Ichkeul (Kahmann, 1958; Cockrum, 1976a), dans la mine près du cimetière de Ras Rajel (Cockrum, 1976a) et dans la grotte de Djebel Gloub (MNHN). Zava & Masseti (2005) ont trouvé une colonie de 30 individus dans le Parc National d'El Feidja (Kef en Negcha) le 31 mai 2000, avec capture d'un mâle et d'une femelle. Outre une première mention dans ce parc national, Gharaibeh (1997) rajoute deux localités: Ghar Kraiz et Damous Saïd (Djebel Serdj).

Enfin, le Rhinolophe de Méhely a été noté dans le Parc National de Bou Hedma (GOPA - DGF, 2005) et dans une grotte du Djebel Orbata (Kahmann, 1958).

Hipposideridae

Asellia tridens (É. Geoffroy, 1813)
Phyllorhina Tridens. – Lataste, 1885
Hipposiderus tridens. – Trouessart, 1905
Asellia tridens diluta. – Laurent, 1937
Asellia tridens. – Kock, 1969

Faute de prospections dans les régions les plus sahariennes, le Trident du désert a été recensé essentiellement au voisinage du Chott Djerid (Fig. 3). Au nord de ce chott, l'espèce a été rencontrée à Redeyef (Lataste, 1885), dans une mine abandonnée à 4 km au sud de Redeyef et dans la mine de phosphate abandonnée de M'dhila (Cockrum, 1976a). Cette espèce a été aussi inventoriée à El Hamma de Tozeur (= El Hamma de Djerid) par Kock (1969), Baker *et al.* (1974), Vesmanis (1976) et Benda *et al.* (2006) et à Tozeur même, dans un aqueduc abandonné, par Kock (1969) et Cockrum (1976a).

À l'est du Chott Djerid, *Asellia tridens* a été observée dans les constructions romaines (sources chaudes) d'El Hamma de Gabès (Lataste, 1885), inopportunément rapporté à Gabès par Heim de Balsac (1936) et Laurent (1937). Au sud-est enfin, deux spécimens ont été collectés à Djerba (MNHN) et un autre à Zarsis (Cockrum, 1976a).

Rhinopomatidae

Rhinopoma cystops Thomas, 1903
Rhinopoma microphyllum. – Olivier, 1909
Rhinopoma cystops arabium. – Laurent, 1941a

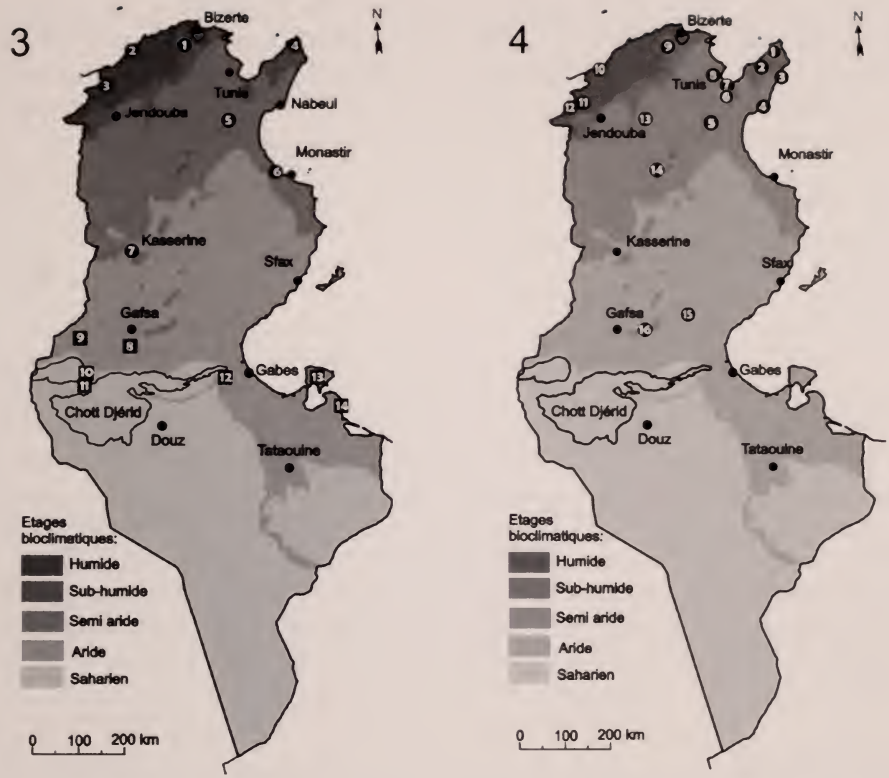


FIG. 3: Carte des observations de *Rhinolophus hipposideros* (●) et d'*Asellia tridens* (■) en Tunisie.
1: Ichkeul, 2: Nefza, 3: Aïn Draham (grotte de Kaloi), 4: El Haouaria (grotte des chauves-souris), 5: Djebel Zaghouan (grotte du poste d'observation), 6: Sousse, 7; Kasserine. 8: M'dhila, 9: Redeyef, 10: El Hamma de Tozeur (palmeraie STIL, aqueduc), 11: Tozeur, 12: El Hamma de Gabès, 13: Djerba, 14: Zarzis.

FIG. 4: Carte des observations de *Rhinolophus mehelyi* en Tunisie.
1: El Haouaria (grotte des chauves-souris, grottes romaines, 2 km N, Djebel Sidi Abiod), 2: El Ouidane, 3: Menzel Temime, 4: Nabeul, 5: Djebel Zaghouan (mine), 6: Djebel Ressas (mine), 7: Entouna, 8: Tunis 9: Djebel Ichkeul, 10: Ras Rajel, 11: Djebel Gloub, 12: Kef en Negcha, 13: Ghar Kraiz, 14: Djebel Serdj, 15: Bou Hedma, 16: Djebel Orbata.

Rhinopoma cystops. – Rode, 1947
Rhinopoma hardwickei cystops. – Aellen & Strinati, 1969
Rhinopoma hardwickei. – Hayman & Hill, 1971
Rhinopoma hardwickei arabium. – Hill, 1977
Rhinopoma hardwickii. – Dietz *et al*., 2007
Rhinopoma hardwicki. – Hizem & Allegrini, 2009

Seul représentant à ce jour de la famille des Rhinopomatidae en Tunisie, *Rhinopoma cystops* a récemment été élevé au rang spécifique (Hulva *et al*., 2007) et par conséquent individualisé par rapport à *R. hardwickii*, l'espèce asiatique.

Le Petit rhinopome est un hôte des zones arides de Tunisie, recensé particulièrement au nord du Chott Djerid (Fig. 5), mais aussi dans le Parc National de Bou

Hedma (GOPA - DGF, 2005). Rapporté de Redeyef (Olivier, 1909), entre Redeyef et Metlaoui (Laurent, 1941a; b), Gharaibeh (1997) a capturé deux femelles gravides dans la Réserve de Dghomous le 26 mai 1996. Le 9 juin 2002, De Smet (*in litt.*) a observé entre 100 et 200 individus dans une grotte du Djebel Morra dans le Parc National de Dghoumes.

Molossidae

Tadarida teniotis (Rafinesque, 1814)

Tadarida teniotis. – Beaucournu *et al*,. 1983
Tadarida taeniotis. – Chastel *et al*,. 1983
Tadarida teniotis teniotis. – Kock & Nader, 1983

Seul représentant de la famille des Molossidae observé en Tunisie, le Molosse de Cestoni n'a été signalé que de quatre sites (Fig. 5). Du nord au sud, ses émissions sonores et ultrasonores ont été enregistrées au Cap Serrat le 9 septembre 2004 (Rebelo & Brito, 2006). Dans le Parc National de Bou Hedma, un mâle et une femelle ont été capturés entre le 14 et le 20 septembre 2006 (Hizem, 2007) et trois spécimens ont été identifiés dans les pelotes des rapaces (Hizem & Allegrini, 2009). Dans la région des chotts et notamment dans la gorge de Seldja, cette espèce a été recensée par Kock & Nader (1984). Mais la première observation provient d'une profonde fissure verticale d'une falaise à Ksar Haddada (Beaucournu *et al*., 1981; 1983). Des observations en vol à Tamerza, près de la frontière algérienne, restent à confirmer (Beaucournu *et al*., 1983).

Miniopteridae

Miniopterus schreibersii (Kuhl, 1817)

Miniopterus Schreibersii. – Hartmann, 1868
Miniopterus Schreibersi. – Blanc, 1935
Miniopterus schreibersii. – Deleuil & Labbe, 1955a
Miniopterus schreibersi schreibersi. – Aellen & Strinati, 1969
Miniopterus schreibersi. – Baker *et al*., 1974

Le Minioptère de Schreibers, récemment attribué à la famille des Miniopteridae, est très largement répandu en Tunisie, de l'extrême nord jusqu'à la région des chotts (Fig. 6). Rapporté dès 1868 par Hartmann, il a fait l'objet de nombreuses collectes par l'expédition de la Smithsonian Institution (Cockrum, 1976a) alors qu'il n'était connu que de huit localités. Blanc (1935) a listé la grotte de Tebourba (12 spécimens au ZMB), le Djebel Ichkeul (où il a été retrouvé par Noblet & Nefzi, 1991) et une grotte à Gafsa. Puis Deleuil & Labbe (1955a) l'ont observé dans la grotte des chauves-souris d'El Haouaria (où la colonie a été revue par Aellen & Strinati (1970) le 3 octobre 1967, puis par Cockrum (1976a) avec 9 spécimens collectés) et les ruines d'Utique, et l'ont reçu de la région de Ghardimaou, de Bulla Regia, de Souk el Arba (ville de Jendouba).

Cockrum (1976a) l'a aussi collecté dans la mine près du cimetière de Ras Rajel, dans la mine de kohl abandonnée près d'Aïn Draham, dans la carrière de Chemtou (à l'ouest de Jendouba), au Djebel Zaghouan (grotte du poste d'observation, bassins d'irrigation à 4 km et à 6 km à l'ouest de ce poste, mines à 3 km au sud-est), au Djebel Ressas, dans la mine Entouna, au Djebel Barbrou (mine Scarna), au voisinage du

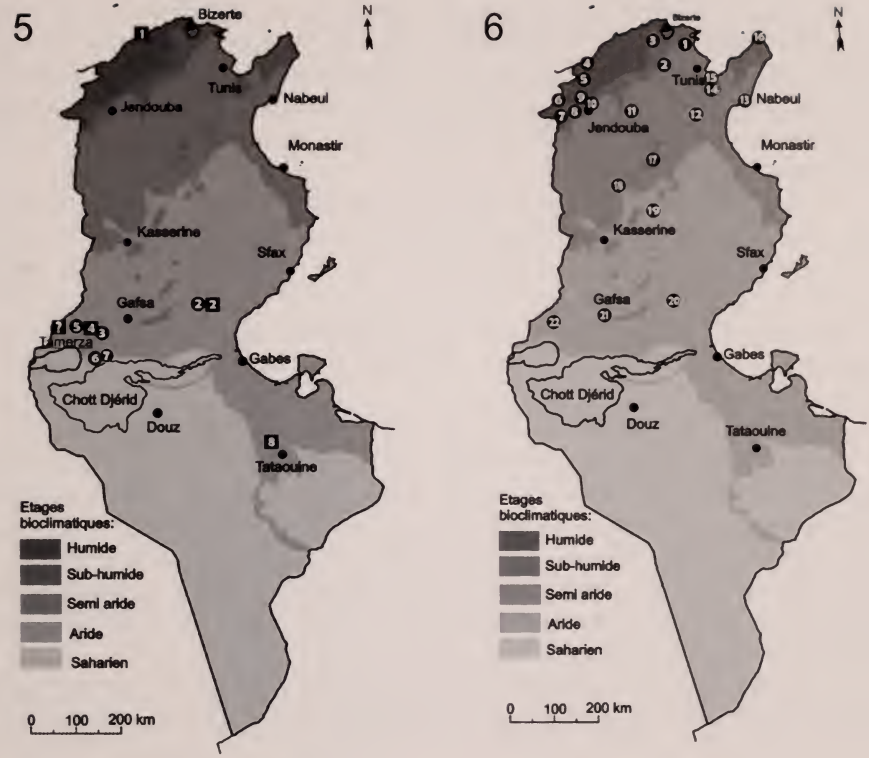


FIG. 5: Carte des observations de *Rhinopoma cystops* (●) et de *Tadarida teniotis* (■) en Tunisie. 1: Cap Serrat, 2: Bou Hedma, 3: Redeyef, 4: Gorge de Seldja, 5: Metlaoui - Redeyef, 6: Dghoumes, 7: Djebel Morra, 8: Ksar Haddada

FIG. 6 : Carte des observations de *Miniopterus schreibersii* en Tunisie.
1: Utique (ruines), 2: Tebourba, 3: Ichkeul, 4: Ras Rajel, 5: Aïn Draham, 6: El Feidja, 7: Ghardimaou, 8: Chemtou (carrière), 9: Bulla Regia, 10: Souk el Arba, 11: Ghar Kraiz, 12: Djebel Zaghouan (grotte du poste d'observation, bassin d'irrigation, mine, 6 km O), 13: Nabeul, 14: Djebel Ressas (mine), 15: Entouna, 16: El Haouaria (grotte des chauves-souris), 17: Aïn Dhab, 18: Djebel Barbrou, 19: El Hamrouni, 20: Bou Hedma (parc, bordj), 21: Gafsa, 22: Redeyef (mine).

Ressas, dans la mine Entouna, au Djebel Barbrou (mine Scarna), au voisinage du bassin d'El Hamrouni et dans une mine située à l'ouest de Redeyef sur la route d'Aioun Ameur. En 1958, C.J. Marinkelle a prélevé un spécimen à Nabeul (FMNH).

Gharaibeh (1997) a rajouté Ghar Kraiz et Aïn Dhab, avant les observations plus récentes dans le Parc National d'El Feidja (Dhouib, 1998) et le Parc National de Bou Hedma (Moldrzyk, 2003) où il a été capturé entre le 10 et le 13 mai 2008 devant le Borj (Hizem & Allegrini, 2009).

VESPERTILIONIDAE

Eptesicus isabellinus (Temminck, 1840)

Vesperugo isabellinus. – Lataste, 1885
Vespertilio serotinus isabellinus. – Trouessart, 1905
Eptesicus isabellinus. – Laurent, 1937

Récemment élevée au rang d'espèce (Ibañez *et al.*, 2006; Mayer *et al.*, 2007; Juste *et al.*, 2009), la Sérotine isabelle, seule sérotine d'Afrique du Nord, est une espèce assez commune pour la Tunisie, mais peu cavernicole elle a échappé aux prospections anciennes (Fig. 7). Par exemple Cockrum (1976a) rapporte la collecte de spécimens dans trois localités (contre 13 pour *Miniopterus schreibersii*) par capture au filet uniquement.

Au nord du pays, elle a été trouvée à Tunis (Lataste, 1885) puis capturée à l'entrée d'une galerie de mine du Djebel Ressas le 23 août 1974 (Vaughan *et al.*, 1977), et au-dessus d'un bassin au Djebel Zaghouan le 26 avril 1975 (Cockrum, 1976a), donnée ensuite attribuée à la mine située au sud-est de Zaghouan, mais confirmée au niveau du bassin par Gharaibeh (1997) après consultation des spécimens conservés au Texas. Ce dernier rajoute une capture au-dessus d'un bassin d'irrigation du Djebel Ressas.

Au centre, l'espèce a été capturée au voisinage du bassin d'El Hamrouni (Cockrum, 1976a), à Sidi Bouzid (MNHN) et dans le Parc National de Bou Hedma. Ainsi, un spécimen a été capturé au filet en mai 1996 dans un bosquet d'Eucalyptus irrigué par la seguia (Gharaibeh, 1997), quatre mâles et six femelles en septembre 2006, puis trente cinq individus entre le 10 et le 13 mai 2008, devant le Bordj de Bou Hedma (Hizem, 2007; Hizem & Allegrini, 2009). *Eptesicus isabellinus* a également été inventorié à 4 km au sud de Redeyef (Cockrum, 1976a), à Tozeur (Djerid, Deleuil & Labbe, 1955a) et à Gabès (ZMB).

Au sud, l'espèce a été signalée à Foum Tataouine par Baker *et al.* (1974) qui ont étudié quatre des six femelles allaitantes capturées le 5 juin 1973 (Cockrum, 1976a).

Pipistrellus kuhlii (Kuhl, 1817)

Vesperugo marginatus. – Fitzinger, 1870
Vesperugo Kuhlii. – Dobson, 1878
Vesperugo Kuhli. – Lataste, 1885
Vespertilio Kuhli. – Trouessart, 1905
Vespertilio pipistrellus. – Galli-Valerio, 1911
Pipistrellus Kühli Kühli. – Laurent, 1937
Pipistrellus Kühli albolimbatus. – Laurent, 1937
Pipistrellus kuhlii kuhlii. – Deleuil & Labbe, 1955a
Pipistrellus kuhlii albolimbatus. – Deleuil & Labbe, 1955a
Pipistrellus Kuhli. – Deleuil & Labbe, 1955b
Pipistrellus kuhli. – Aellen & Strinati, 1969
Pipistrellus kuhlii. – Hayman & Hill, 1971
Pipistrellus kuhli kuhli. – Cockrum, 1976a
Pipistrellus kühli. – Beaucournu *et al,*. 1981
Pipistrellus (Pipistrellus) kuhlii. – Kock, 2001

La Pipistrelle de Kuhl est sans doute la chauve-souris la plus commune en Tunisie où elle est largement répandue dans le nord et le centre (Fig. 8). Elle a le plus souvent été capturée en sortie de gîte, sous les toits ou dans des fentes de bâtiments, ou en vol au-dessus de plans d'eau.

Dans l'extrême nord tunisien, l'espèce a été trouvée dans l'île de la Galite (Vesmanis, 1972), entendue à Nefza (au-dessus de la route dans une forêt dense de pins et dans une forêt claire sur une dune fossile) et au Cap Serrat (Rebelo *in litt.*), dans le

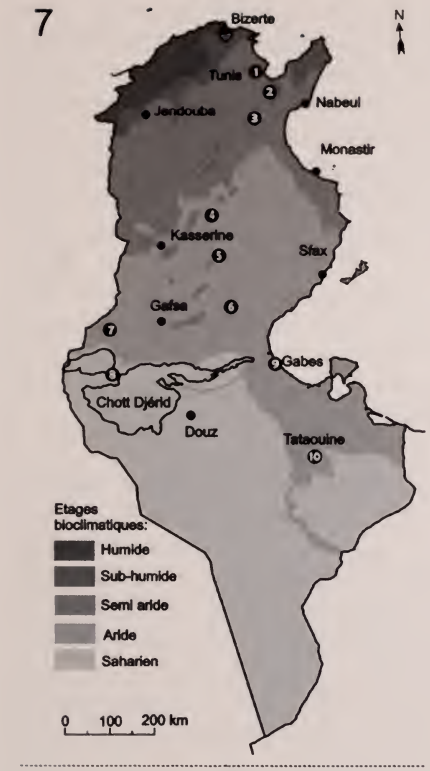


FIG. 7: Carte des observations d'*Eptesicus isabellinus* en Tunisie.
1: Tunis, 2: Djebel Ressas (bassin, mine), 3: Djebel Zaghouan (bassin), 4: El Hamrouni, 5: Sidi Bouzid, 6: Bou Hedma (parc, bordj), 7: Redeyef (mine), 8: Tozeur, 9: Gabès, 10: Foum Tataouine.

FIG. 8: Carte des observations de *Pipistrellus kuhlii* en Tunisie.
1: Galite, 2: Nefza, 3: Cap Serrat, 4: Ichkeul, 5: Oued Medjerda, 6: Carthage (ruines, port punique), 7: Tunis, Sidi Mansour, Khereddine, Dubosville, Megrine, 8: Oudna, 9: Djebel Ressas (bassin), 10: Mornag, 11: Grombalia, 12: Sidi Daoud, 13: El Haouaria, 14: Oued Lebna, 15: Hammamet, 16: Enfidaville, 17: Oued Zriba, 18: Djebel Zaghouan (temple des eaux), 19: Massicault, 20: El Bathan, 21: El Hamaïn, 22: Beja, 23: Ain Jammalah, 24: Bulla Regia, 25: Chemtou (théâtre romain), 26: Hammam-sousse, 27: Sousse, 28: Kairouan, 29: El Hamrouni, 30: Gamouda, 31: Thyna, 32: Bou Hedma (parc, bordj), 33: Gafsa, 34: Bled Douarah, 35: Moularès, 36: Redeyef, 37: Tamerza, 38: Tozeur, 39: Nefta, 40: Kebili, 41: Douz, 42: El Hamma de Gabès, 43: Gabès, 44: Adjim, 45: Djerba, 46: Zarzis, 47: Ksar Haddada, 48: Tataouine, 49: Foum Tataouine, 50: Douirat, 51: Ghomrassen.

Dans l'extrême nord tunisien, l'espèce a été trouvée dans l'île de la Galite (Vesmanis, 1972), entendue à Nefza (au-dessus de la route dans une forêt dense de pins et dans une forêt claire sur une dune fossile) et au Cap Serrat (Rebelo *in litt.*), dans le Parc National de l'Ichkeul (Noblet & Nefzi, 1991) et à l'embouchure de l'Oued Medjerda (Deleuil & Labbe, 1955a).

Dans la région de Tunis, cette espèce a été collectée au port punique de Carthage (Vesmanis, 1972; Cockrum, 1976a), dans la ville de Tunis (Dobson, 1878;

Au sud de Tunis, elle a été citée dans la plaine de Mornag (Deleuil & Labbe, 1955a), à 1 km au sud-est de la station Oudna, près d'un bassin d'irrigation du Djebel Ressas et dans un bâtiment situé à 10 km à l'ouest de Grombalia sur la route C 34 par Cockrum (1976a). Plus au sud, cette espèce a aussi été capturée au Temple des eaux du Djebel Zaghouan (Beaucournu *et al.*, 1981), à Hammamet, à l'oued Zriba et à Enfidaville (Harrison Institute). Au nord-est et à l'est, la Pipistrelle de Kuhl a été notée à Sidi Daoud (Deleuil & Labbe, 1955a), El Haouaria (Vesmanis, 1972) et à l'oued Lebna (Deleuil & Labbe, 1955b). Au sud-ouest, Deleuil & Labbe (1955b) l'ont également signalée à El Baten et à Massicault. À l'école d'El Hamain, ils ont trouvé aussi soixante-cinq femelles et deux mâles le 22 mai 1955 sous les tuiles; le 25 juillet 1955 trois femelles sur dix étaient allaitantes. Gharaibeh (1997) a collecté quatre spécimens entre les briques d'une maison dans la pépinière forestière d'Ain Jammalah. A l'ouest, cette pipistrelle a été trouvée à Béja (Cockrum, 1976a), Bulla Regia (Deleuil & Labbe, 1955a) et dans le théâtre romain de Chemtou (Baker *et al.*, 1974).

Dans le centre tunisien, l'espèce a été trouvée à Hammam Sousse (NMW), à Sousse et Kairouan (Olivier, 1896), à proximité du bassin d'El Hamrouni, à Gamouda (Cockrum, 1976a) et à Thyna (Kayser, 1995). Dans le Parc National de Bou Hedma, trois mâ les et deux femelles ont été capturés au filet et 10 individus ont été identifiés à partir des fragments de crânes retrouvés dans les pelotes de rapaces (Hizem, 2007). En mai 2008, une colonie a été découverte sous l'écorce décollée d'un Acacia radiana et 20 spécimens ont été capturés au filet devant le Bordj (Hizem & Allegrini, 2009).

Dans la région des chotts, la Pipistrelle de Kuhl a été signalée pour la première fois par Lataste (in Roudaire, 1881) mais sans localisation précise. Ultérieurement, cette pipistrelle a été rapportée à Gafsa (NMW), à Bled Douarah (University of Colorado Museum - UCM), à Moularès et Redeyef (Deleuil & Labbe, 1955b), dans les oasis de Tamerza et Tozeur (Cockrum, 1976a), au Mausolée de Sidi Hassen Ayed situé à 4,5 km au sud de Nefta (Baker *et al.*, 1974), à Kebili (Vesmanis, 1972), à Douz (Kock, 2001), à El Hamma de Gabès (Lataste, 1885), à Gabès (Aellen, 1957; Benda *et al.*, 2006) et dans la région de Ghomrassen (= 100 km au sud de Gabès) (Benda *et al.*, 2006).

Dans le sud tunisien, cette pipistrelle a été rapportée de Adjim (après correction de l'identification de Galli-Valerio, 1911), Djerba et Zarzis (Blanc, 1935), capturée dans la gorge près de Ksar Hadada (Beaucournu & Hellal, 1977; Beaucournu *et al.*, 1983), à Tataouine (Blanc, 1935), à Foum Tataouine (Baker *et al.*, 1974; Cockrum, 1976a) et à Douirat (Anderson, 1892). Malgré ces données anciennes, Heim de Balsac (1936) considè re que cette espè ce a été rarement signalée dans l'extrême sud tunisien. De toute évidence cette région manque de prospections récentes, d'autant que ses pipistrelles ont souvent été rapportées à la sous-espèce *albolimbatus*, voire *pallidus*, variété plus claire dans laquelle certains auteurs distinguent une autre espèce: *Pipistrellus deserti*.

Pipistrellus pipistrellus Schreber, 1774

Pipistrellus pipistrellus. – Cockrum, 1976a

Une récente étude morphométrique et génétique (Benda *et al.*, 2004a) a montré que les *Pipistrellus pipistrellus* du Maghreb divergent des populations européennes, sans pour autant supporter un statut spécifique.

La Pipistrelle commune n'a été recensée avec certitude que dans deux sites en Tunisie (Fig. 9). Au Djebel Ressas, deux mâ les ont été capturés au filet le 24 octobre 1974 à l'entrée de la mine (Cockrum, 1976a; Vaughan *et al.*, 1977) et une femelle au-dessus d'un bassin d'irrigation le 8 mai 1975 (Cockrum, 1976a). Cette pipistrelle a été également signalée dans le Parc National d'El Feidja (DGF, 1988).

Le spécimen identifié à Adjim par Galli-Valerio (1911), un parasitologue, est sujet à caution. En effet, l'observation de cet auteur semble erronée et correspondre à celle de *Pipistrellus kuhlii*, espèce commune sur l'île de Djerba (Aellen & Strinati, 1969).

Pipistrellus rueppellii (Fischer, 1829)

Pipistrellus rueppellii. – Van Cakenberghe & Seamark, 2006

L'unique Pipistrelle de Rüppell recensée en Tunisie a été collectée près de Matmata (Fig. 9) par G. Nobis (ZFMK).

Otonycteris hemprichii Peters, 1859

Otonycteris Hemprichi. – Deleuil, 1957
Otonycteris hemprichi. – Fain, 1959
Otonycteris hemprichi hemprichi. – Aellen & Strinati, 1969
Otonycteris hemprichii. – Gharaibeh, 1997

La distribution de l'Oreillard d'Hemprich est limitée aux zones arides et sahariennes de la Tunisie (Fig. 9). Rapporté par Deleuil (1957) de Redeyef sur la base d'un spécimen trouvé noyé le 4 janvier 1956 dans un oued, cette chauve-souris a été collectée à Sfax (Fain, 1959) et dans la gorge de Seldja le 1er septembre 1972 (Nader & Kock, 1983). Au sud, elle a été capturée de jour dans une fente de la falaise fissurée de la gorge au voisinage du Ksar Hadada (Beaucournu *et al.*, 1983).

Plecotus gaisleri Benda, Kiefer, Hanák & Veith, 2004

Plecotus auritus. – Anderson, 1892
Plecotus auritus auritus. – Laurent, 1939
Plecotus austriacus christiei. – Ellerman & Morrison-Scott, 1951
Plecotus austriacus aegyptius. – Aellen & Strinati, 1969
Plecotus austriacus. – Hayman & Hill, 1971
Plecotus teneriffae cf. *gaisleri*. – Benda *et al.*, 2004b
Plecotus kolombatovici. – Spitzenberger *et al.*, 2006
Plecotus gaisleri. – Dietz *et al.*, 2007

La systématique du genre *Plecotus* a été abondamment discutée ces dernières années, à la faveur d'analyses génétiques notamment. Pour le nord-ouest de l'Afrique tous les auteurs s'accordent cependant à reconnaître un seul taxon, tantôt sous-espèce de *P. teneriffae* (Benda *et al.*, 2004b) ou de *P. kolombatovici* (Spitzenberger *et al.*, 2006), tantôt espèce (Mayer *et al.*, 2007; Dietz *et al.*, 2007).

L'Oreillard du Maghreb a été rapporté pour la première fois en Tunisie par Anderson (1892) comme *Plecotus auritus*, alors seul taxon identifié pour le Paléarctique occidental. Les spécimens, 2 mâles et 14 femelles, en provenance de Douirat, étaient caractérisés par un pelage cendré clair sur le dos. C'est actuellement la localisation la plus méridionale d'une espèce qui, curieusement, a peu été contactée dans le nord du pays (Fig. 10).

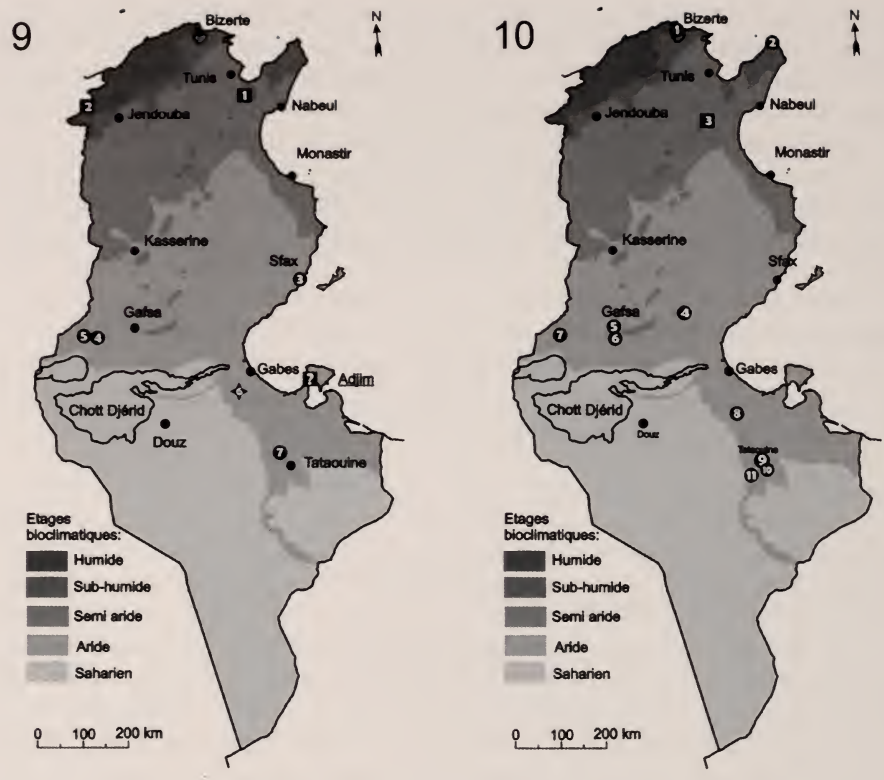


FIG. 9: Carte des observations de *Pipistrellus pipistrellus* (■), de *Pipistrellus rueppellii* (✧) et d'*Otonycteris hemprichii* (●) en Tunisie.
1: Djebel Ressas (bassin, mine), 2: El Feidja, 3: Sfax, 4: Gorge de Seldja, 5: Redeyef, 6: Matmata, 7: Ksar Haddada.

FIG. 10: Carte des observations de *Plecotus gaisleri* (●) et de *Hypsugo savii* (■) en Tunisie.
1: Bizerte, 2: El Haouaria, 3: Djebel Zaghouan (bassin), 4: Bou Hedma (parc, bordj), 5: Gafsa, 6: Djebel Ank, 7: Redeyef (mine), 8: Toujane, 9: Tataouine, 10: Foum Tataouine, 11: Douirat.

Douirat, étaient caractérisés par un pelage cendré clair sur le dos. C'est actuellement la localisation la plus méridionale d'une espèce qui, curieusement, a peu été contactée dans le nord du pays (Fig. 10).

En effet les seules mentions septentrionales sont un spécimen collecté en 1930 à Bizerte (Národní Muzeum Praha - NMP) et une femelle capturée le 12 mars 1963 à El Haouaria (Kock, 1969). Dans le centre, l'oreillard a été recensé dans le Parc National de Bou Hedma (GOPA - DGF, 2005; Hizem & Allegrini, 2009), dans une mine du Djebel Ank (Cockrum, 1976a), dans une grotte près de Gafsa (NMP) et une mine au sud de Redeyef (Cockrum, 1976a), localité d'où Deleuil & Labbe (1955a) ont reçu un spécimen "couleur de poussière".

Plus au sud, il a été capturé près de Toujane dans une fissure de grotte (19 spécimens dont treize mâles) et au sud de Foum Tataouine dans un tunnel fortifié abandonné (9 spécimens sont 5 mâles et 1 femelle) (Baker *et al.*, 1974; Cockrum, 1976a). A

Hypsugo savii (Bonaparte, 1837)
Pipistrellus savii. – Cockrum, 1976a
Pipistrellus savii ochromixus. – Cockrum, 1976a
Hypsugo savii. – Noblet & Nefzi, 1991

Le Vespère de Savi n'a été signalé en Tunisie qu'au Djebel Zaghouan (Fig. 10) où trois mâles ont été capturés au filet le 30 avril 1975 au-dessus d'un bassin à 4 km à l'ouest du poste d'observation (Cockrum, 1976a; Vaughan *et al*., 1977).

Myotis capaccinii (Bonaparte, 1837)
Myotis capaccinii. – Cockrum, 1976a

Le Murin de Capaccini, souvent oublié de Tunisie dans les ouvrages de synthèse, n'a été signalé que dans trois sites du nord tunisien (Fig. 11). La première mention (Cockrum, 1976a; Vaughan *et al*., 1977) est celle de la capture par quatre fois dans une mine de plomb abandonnée du Djebel Ressas (1 mâle le 7 août 1974, 12 mâles et 6 femelles le 23 août, 10 femelles le 24 octobre, puis 24 mâles le 8 mai 1975). Il a aussi été collecté dans la grotte de Tebourba (ZMB). Enfin, Noblet & Nefzi (1991) ont capturé 10 mâles et une femelle dans le Parc National de l'Ichkeul les 30-31 décembre 2001.

Myotis emarginatus (É. Geoffroy, 1806)
Myotis emarginatus. – Cockrum, 1976a

Le Murin à oreilles échancrées n'est connu en Tunisie que de quatre localités, dont trois dans le nord (Fig. 11). Il a d'abord été capturé au Djebel Oust (1 mâle et 2 femelles post-allaitantes le 29 juillet 1974) et dans la grotte proche du poste d'observation du Djebel Zaghouan (4 femelles le 30 avril 1975, Cockrum, 1976a; Vaughan *et al*., 1977).

Dans le Parc National d'El Feidja, Gharaibeh (1997) a collecté en juin 1996 huit individus dans une colonie mixte avec *Rhinolophus mehelyi* de 200 à 300 individus, puis Zava & Masseti (2007) ont observé en mai 2000 une colonie de 50 individus dans un bâtiment ainsi que 3 mâles et 2 femelles dans un logement du parc.

Par ailleurs, cette espèce a été capturée en novembre 2001 par De Smet (*in litt*.) dans le Parc National de Sidi Toui, à proximité de la frontière libyenne.

Myotis punicus Felten, 1977
Vespertilio murinus. – Dobson, 1878
Myotis murinus. – Trouessart, 1905
Myotis myotis (vel. *murinus*). – Trouessart, 1906
Myotis myotis myotis. – Laurent, 1937
Myotis myotis. – Karaman, 1939
Myotis myotis oxygnathus. – Rode, 1947
Myotis blythi. – Ellerman & Morrison-Scott, 1951
Myotis blythi oxygnathus. – Aellen & Strinati, 1969
Myotis blythii. – Hayman & Hill, 1971
Myotis blythi punicus. – Felten *et al*., 1977
Myotis punicus. – Simmons, 2005

Après de nombreux changements taxonomiques, tantôt *Myotis myotis* de petite taille, tantôt *Myotis blythii* de grande taille et décrit comme une sous-espèce de ce

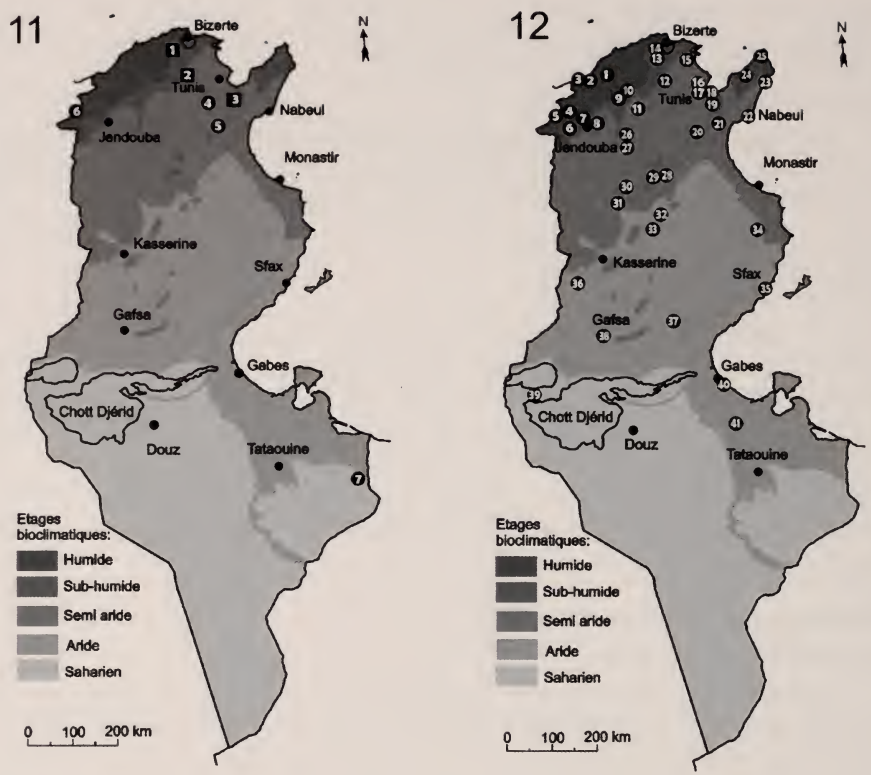


FIG. 11: Carte des observations de *Myotis capaccinii* (■) et de *Myotis emarginatus* (●) en Tunisie.
1: Ichkeul, 2: Tebourba, 3: Djebel Ressas (mine), 4: Djebel Oust, 5: Djebel Zaghouan (grotte du poste d'observation), 6: El Feidja, 7: Sidi Toui.

FIG. 12: Carte des observations de *Myotis punicus* en Tunisie.
1: Djebel Abiod, 2: Ras Rajel, 3: Tabarka, 4: Djebel Gloub, 5: El Feidja, 6: Chemtou (théâtre romain), 7: Bulla Regia, 8: Kef El Agab, 9: Beja, 10: Djebel Kalina, 11: Testour - El Aroussa, 12: Tebourba, 13: Ichkeul, 14: Djebel Ichkeul, 15: Utique (citerne, ruines), 16: Tunis, 17: Entouna, 18: Djebel Gattuna, 19: Djebel Ressas (mine, bassin), 20: Djebel Zaghouan (grotte du poste d'observation, mine, mine Sioitayeaa), 21: Hammam Djedidi, 22: Nabeul, 23: Menzel Temime, 24: El Ouidane, 25: El Haouaria (grotte des chauves-souris, 2 km N, grottes romaines), 26: Ghar Kraiz, 27: El Akhouat, 28: Damous Saïd, 29: Aïn Dhab, 30: Makthar, 31: Djebel Barbrou, 32: Djebel Trozza, 33: El Hamrouni, 34: El Djem, 35: Sfax, 36: Feriana, 37: Bou Hedma (parc, bordj), 38: Gafsa, 39: Nefta, 40: Toujane, 41: Djebel Saikra.

Myotis punicus. – Simmons, 2005

Après de nombreux changements taxonomiques, tantôt *Myotis myotis* de petite taille, tantôt *Myotis blythii* de grande taille et décrit comme une sous-espèce de ce taxon, le statut spécifique de *Myotis punicus* a été établi génétiquement, puis confirmé par la morphométrie (Castella *et al.*, 2000; Evin *et al.*, 2008). Felten *et al.* (1977) ont étudié des spécimens tunisiens de plusieurs provenances pour la description du taxon;

Ensuite, Gadeau de Kerville (1908) l'a collecté dans une grotte du Djebel Gloub (46 mâles le 18 mai 1906) et Blanc (1935) l'a rapporté d'une grotte du Djebel Ichkeul (il a été retrouvé dans le Parc National par Noblet & Nefzi, 1991) et d'une grotte près de Tebourba. Puis, il a été surtout recensé lors des prospections de Deleuil & Labbe (1955a) et de la Smithsonian Institution.

Deleuil & Labbe (1955a) l'ont observé en hiver dans une citerne des ruines d'Utique (site de collecte pour Cockrum, 1976a), dans une caverne du Djebel Abiod, dans une grotte profonde entre El Aroussa et Testour, dans deux galeries de mine d'El Akhouat, dans une grotte du Djebel Zaghouan, dans les galeries sud des mines du Djebel Ressas (observation confirmée par Cockrum, 1976a). Dans la grotte des chauves-souris d'El Haouaria, de nombreux spécimens ont été observés par Aellen & Strinati (1970), puis l'holotype défini par Felten (*in* Felten *et al.*, 1977) a été collecté le 25 mars 1971, avec quatorze mâles et une femelle selon Baker *et al.* (1974). L'espèce a aussi été notée au Djebel Kalina (NMW) et dans un gouffre du Djebel Saikra (95 sujets mesurés en décembre 1954). En 1958, C.J. Marinkelle a collecté des spécimens à Nabeul et Sfax (FMNH).

Dans leur étude sur le caryotype de l'espèce, Baker *et al.* (1974) ont disposé de huit mâles et cinq femelles provenant du palais romain d'Amphitrite à Bulla Regia, quatre mâles et une femelle collectés dans le théâtre romain de Chemtou, trois mâles et deux femelles des grottes romaines d'El Haouaria, quatorze mâles et une femelle de la grotte des chauves-souris, ainsi que cinq mâles prélevés à 3 km au nord-ouest de Toujane.

Ces données sont complétées par Cockrum (1976a) qui rajoute des captures dans le tunnel d'une mine près de Sidi Messaoud (Djebel Ichkeul), dans la mine près du cimetière de Ras Rajel, à Bulla Regia, à Beja et au Djebel Zaghouan (20 spécimens dans une mine située sur la route en direction de Aïn Ayed à 3 km au sud-ouest de Zaghouan , 7 dans la mine Sioutayea située à 1 km à l'est sur la route MC 133 , 3 dans la grotte du poste d'observation). Des murins du Maghreb ont aussi été collectés dans une galerie de mine à Hammam Djedid (20 km à l'est de Zaghouan), près d'un bassin d'irrigation au Djebel Ressas, dans la mine Entouna (22 spécimens prélevés), dans les grottes romaines d'El Haouaria et à 2 km au nord (7 spécimens). Toujours à proximité du Cap Bon, 4 murins ont été capturés dans une mine de charbon abandonnée d'El Ouidane et 2 autres dans la carrière de sable de Menzel Temime. Enfin, des prélèvements ont été opérés dans la mine de Scarna (Djebel Barbrou) (11 individus), une mine du Djebel Trozza (5), près du bassin d'El Hamrouni (15), sous les bains dans les ruines de Maktha (12) et à 3 km au nord-ouest de Toujane (14).

De plus, Aellen & Strinati (1970) ont examiné trois mâles et une femelle à Kef el Agab le 7 octobre 1967, Felten *et al.* (1977) rapportent des collectes à Tunis et Tabarka (Senckenberg Museum Frankfurt - SMF) et Benda & Horáček (1995) des spécimens d'El Djem (10 mâles, 2 femelles). G.B. Gharaibeh a légué au Texas Tech University Museum des spécimens de Ghar Tabouda (El Haouaria), Ghar Kraïz, Damous Saïd (Djebel Serdj) et Aïn Dhab.

Le Murin du Maghreb a également été observé dans le Parc National d'El Feidja (DGF, 1988) et dans le Parc National de Bou Hedma (GOPA - DGF, 2005). Enfin, la seule citation dans l'étage bioclimatique saharien provient de l'oasis de Nefta (Wandeler, 1967).

DISCUSSION

Pour réaliser cette synthèse, plusieurs difficultés ont dû être surmontées, à commencer par identifier les références des documents produits, y compris les travaux non indexés, localiser des publications indisponibles en Tunisie et consulter la littérature "grise" (e.g. Blanc, 1935; Wiersema & Vreugdenhil, 1975; DGF, 1988; Noblet & Nefzi, 1991; Dhouib, 1998; Hizem, 2007). Ensuite, la localisation de certaines données s'est avérée délicate avec des désignations imprécises, comme "Djebel Gattuna" ou "Djebel Saïkra", mais aussi des sites difficilement repérables sur les cartes, comme "Mine Entouna" ou "Grotte de Kaloi (près d'Aïn Draham)". Des sites ont été désignés par plusieurs noms, comme "Tataouine" aussi appelé "Foum Tataouine", situé à 2 kilomètres de la ville, ou "El Hamma de Tozeur" dénommé tantôt "El Hamma de Djerid", tantôt "12 km au nord de Tozeur". L'orthographe a été fluctuante avec le temps (ou plutôt l'origine des auteurs) avec "Ichkeul" nommé "Achkeul" par Kahmann (1958) ou encore "Gafsa" transcrit "Kaphja" par Felten *et al.* (1977) pour "Kaphza" (ZMB). Malgré des recherches approfondies, certaines localités n'ont pu être identifiées (et localisées) comme "Djebel Glong" (Cockrum, 1976a) ou "Therma" (Stockholm Museum).

Par ailleurs, cette synthèse met en évidence que des sites ont été plus particulièrement prospectés; ce sont les régions d'El Haouaria, de Zaghouan, de Jendouba (Chemtou, Bulla Regia, Parc National El Feidja, Souk El Arba), du Djebel Ichkeul, des chotts (Gafsa, Redeyef, Tozeur) et de Tataouine. Dans ces régions le peuplement de chauves-souris apparaît relativement diversifié avec, par exemple, 13 espèces recensées au Djebel Zaghouan, 10 espèces au Djebel Ressas et à Redeyef. D'autres sites comme El Djem, Hammam Djedidi, Tabarka n'ont été visités qu'en une seule occasion et une grande partie du territoire tunisien reste à explorer.

Les Chiroptères de Tunisie se répartissent en 6 familles, 11 genres et 19 espèces. Avec 6 genres (*Eptesicus*, *Pipistrellus*, *Otonycteris*, *Plecotus*, *Hypsugo* et *Myotis*) et 10 espèces, la famille des Vespertilionidae apparaît la plus diversifiée, comme dans toute la région paléarctique (Corbet, 1978; Simmons, 2005). Les Rhinolophidae, monogénériques (*Rhinolophus*) comptent 5 espèces. Les autres familles, Hipposideridae, Rhinopomatidae, Molossidae et Miniopteridae, nettement moins diversifiées, sont représentées chacune par une seule espèce. Cette diversité apparaît nettement inférieure à celle des autres pays du Maghreb, comme le Maroc, qui héberge 29 espèces dont une de la famille des Nycteridae (Aulagnier & Denys, 2000), ou l'Algérie, qui partage avec le Maroc une espèce d'Emballonuridae pour un total de 24 espèces (Kowalski & Rzebik-Kowalska, 1991). Cette dernière espèce, *Taphozous nudiventris*, pourrait fréquenter les zones sahariennes du sud tunisien, tout comme *Rhinopoma microphyllum* et *Tadarida aegyptiaca*, deux autres espèces présentes dans les zones désertiques d'Egypte au Maroc (Aulagnier *et al.*, 2009). Parallèlement, des prospections approfondies en Kroumirie pourraient révéler la présence de *Barbastella barbastellus* ou *Nyctalus leisleri*, voire celle de *Myotis escalerai*. *Nyctalus lasiopterus*, espèce arboricole méconnue, rapportée du Maroc, de Cyrénaïque et de Sicile, devrait aussi faire l'objet de recherches spécifiques.

Certaines espèces sont très largement distribuées en Tunisie depuis le cap Blanc jusqu'aux confins désertiques: *Rhinolophus ferrumequinum*, *Tadarida teniotis*, *Eptesicus isabellinus*, *Pipistrellus kuhlii*, *Plecotus gaisleri* et *Myotis punicus*. D'autres espèces sont seulement présentes dans le nord du pays: *Rhinolophus hipposideros*, *R. mehelyi* et *Miniopterus schreibersii*, voire l'extrême nord: *Myotis capaccinii*. D'autres sont inféodées aux zones désertiques du sud: *Asellia tridens*, *Rhinopoma cystops*, *Otonycteris hemprichii*. D'autres présentent une distribution qui devra être révisée par des identifications confirmées: *Rhinolophus blasii*, *R. euryale*. D'autres enfin, ont été trop rarement observées pour définir leur patron de répartition: *Pipistrellus pipistrellus*, *P. rueppellii*, *Hypsugo savii* et *Myotis emarginatus*.

L'opposition entre peuplements septentrional et méridional est typique des pays du Maghreb, tant pour les Chiroptères que pour les petits vertébrés terrestres (e.g. Blondel & Aronson, 1999). Pour l'Algérie, à la suite de Heim de Balsac (1936), Kowalski & Rzebik-Kowalska (1991) identifient la Berbérie, qui possède un peuplement paléarctique incluant de nombreuses formes méditerranéennes, et le Sahara, caractérisé par des espèces érémiques dont la distribution s'étend souvent aux déserts d'Asie. La limite entre les deux entités est assez floue tant certaines espèces paléarctiques peuvent pénétrer l'espace saharien à la faveur des oasis ou bien, pour les Chiroptères, bénéficier de conditions favorables dans des gîtes souterrains.

En fonction des récentes révisions systématiques et chorologiques, ces 19 espèces peuvent également être réparties entre sept types fauniques: paléarctique (1), paléarctique occidental (4), méditerranéen (7), méditerranéen occidental (2), méditerranéo-turkestanien (1), saharo-sindien (3) et saharien (1). Cette classification enracine nettement le peuplement tunisien dans l'espace méditerranéen, avec une composante érémique caractéristique des pays du Maghreb (Aulagnier, 1991).

Le statut de conservation des Mammifères méditerranéens a récemment été évalué par l'U.I.C.N. (Temple & Cuttelod, 2009). Trois espèces de Chiroptères présentes en Tunisie sont listées "Vulnérable" sur la liste rouge: *Rhinolophus euryale*, *R. mehelyi* et *Myotis capaccinii*. Il convient de noter qu'aucune donnée récente n'est venue confirmer la présence du murin, tandis que les rhinolophes, souvent confondus par le passé, devraient susciter une attention particulière et leurs gîtes bénéficier d'une protection réglementaire, voire physique (Mitchell-Jones *et al.*, 2007). De plus, cinq espèces sont listées "Quasi-menacé" dont trois déjà inscrites sur la liste du Groupe de Spécialistes Chiroptères de l'U.I.C.N. (Hutson *et al.*, 2001), qui ne recensait que douze espèces en Tunisie (!). Aux *Rhinolophus blasii*, *R. ferrumequinum* et *Miniopterus schreibersii*, assez bien distribués en Tunisie, ont été rajoutés *Rhinolophus hipposideros*, qui régresse en Europe, et *Myotis punicus*, élevé récemment au rang spécifique. Toutes ces espèces, vulnérables et quasi-menacées, sont principalement, voire totalement, cavernicoles, ce qui confère à la Tunisie une responsabilité en matière de conservation des gîtes souterrains, naturels (grottes) et artificiels (carrières, mines).

CONCLUSION

Les recherches sur les chauves-souris tunisiennes ont connu deux périodes. Initiées durant la seconde moitié du XIXè me siècle, de Hartmann (1868) à Olivier (1909), elles ont repris dans les années cinquante avec Deleuil & Labbe (1955a; b)

pour culminer dans les années soixante-dix avec Aellen & Strinati (1969; 1970) et Cockrum (1976a). Depuis, contrairement aux autres pays du Maghreb, les prospections ont été limitées dans l'espace et dans le temps. Cette compilation de la littérature nous a permis de réviser la liste fournie par Gharaibeh (1997) et de fournir des cartes de répartition actualisées pour les espèces actuellement reconnues. Elle devrait également contribuer à diffuser une information validée et éviter l'utilisation de listes mal étayées comme celle de Pereswiet-Soltan (2007).

La majorité de ces espèces ayant été observées dans des gîtes de repos (grottes, caves, fissures...), cette liste n'est encore que provisoire. Incontestablement, l'emploi de méthodes modernes et de matériels adéquats (détecteurs d'ultrasons, filets japonais...), mais aussi l'analyse de pelotes de réjection de rapaces nocturnes, devraient permettre de découvrir d'autres espèces et de préciser la répartition d'espèces encore rarement recensées en Tunisie. Enfin, des contrôles s'imposent pour les gîtes anciennement connus, en utilisant des techniques limitant le dérangement (comptages en sortie de gîte par exemple) afin d'entreprendre des démarches de protection pour les plus fragiles. De manière plus générale, les chauves-souris devraient bénéficier de mesures de conservation qui passent par une sensibilisation du public.

REMERCIEMENTS

En complément des collections répertoriées dans le Gobal Biodiversity Information Facility, des inventaires inédits nous ont été communiqués par Milos Andíra (Národní Muzeum, Praha), Barbara Henzig (Naturhistorisches Museum, Wien), Katrin Krohmann (Senckenberg Museum, Frankfurt), Frieder Mayer (Museum für Naturkunde, Berlin), Violaine Nicolas (Muséum National d'Histoire Naturelle, Paris), qu'ils en soient vivement remerciés. Le travail de RD est financé par Bat Conservation International et Eurobats.

REFERENCES

Aellen, V. 1957. Les Chiroptères africains du Musée zoologique de Strasbourg. *Revue suisse de Zoologie* 64: 189-214.

Aellen, V. & Strinati, P. 1969. Liste des Chiroptères de la Tunisie. *Revue suisse de Zoologie* 76: 421-431.

Aellen, V. & Strinati, P. 1970. Chauves-souris cavernicoles de Tunisie. *Mammalia* 34: 228-236.

Andersen, K. 1905. A list of the species and subspecies of the genus *Rhinolophus*, with some notes on their geographical distribution. *The Annals and Magazine of natural History* (7) 16: 648-662.

Andersen, K. & Matschie, P. 1904. Uebersicht einiger geographischen Formen der Untergattung *Euryalus*. *Sitzungs-Berichte der Gesellschaft Naturforschender Freunde zu Berlin* 5: 71-83.

Anderson, J. 1892. On a small collection of mammals, reptiles, and batrachians from Barbary. *Proceedings of the zoological Society, London* 3-24.

Aulagnier, S. 1991. Zoogegraphical notes on Moroccan bat fauna. *Myotis* 29: 83-89.

Aulagnier, S. & Denys, C. 2000. Présence du Taphien à ventre nu, *Taphozous nudiventris*, (Chiroptera, Emballonuridae) au Maroc. *Mammalia* 64: 116-118.

Aulagnier, S., Haffner, P., Mitchell-Jones, T., Moutou, F. & Zima, J. 2009. Mammals of Europe, North Africa and the Middle East. *A&C Black, London*, 272 pp.

Baker, R. J., Davis, B. L., Jordan, R. G. & Binous, A. 1974. Karyotypic and morphometric studies of Tunisian mammals: bats. *Mammalia* 38: 695-705.

Beaucournu, J. C. & Hellal, H. 1977. Liste annotée des Siphonaptères de Tunisie. *Bulletin de la Société de Pathologie exotique* 70: 524-537.

Beaucournu, J. C., Bach-Hamba, D., Launay, H., Hellal, H. & Chastel, C. 1981. Contributions à l'étude des Siphonaptè res de Tunisie (3ème note). *Bulletin de la Société de Sciences naturelles de Tunisie* 16: 3-10.

Beaucournu, J. C., Bach-Hamba, D., Launay, H., Hellal, H. & Chastel, C. 1983. Deux chiroptères peu connus de Tunisie. *Mammalia* 47: 127-128.

Benda, P. & Horáček, I. 1995. Geographic variation on three species of Myotis (Mammalia: Chiroptera) in South of the Western Palaearctics. *Acta Societatis Zoologicae Bohemicae* 59: 17-39.

Benda, P., Andreas, M., Kock, D., Lucan, R. K., Munclinger, P., Nová, P., Obuch, J., Ochman, K., Reiter, A., Uhrin, M. & Weinfurtová, D. 2006. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean. Part 4. Bat fauna of Syria: distribution, systematics, ecology. *Acta Societatis Zoologicae Bohemicae* 70: 1-329.

Benda, P., Hulva, P. & Gaisler, J. 2004a. Systematic status of African populations of *Pipistrellus pipistrellus* complex (Chiroptera: Vespertilionidae), with a description of a new species from Cyrenaica, Libya. *Acta Chiropterologica* 6: 193-217.

Benda, P., Kiefer, A., Hanák, V. & Veith, M. 2004b. Systematic status of African populations of long-eared bats, genus *Plecotus* (Mammalia Chiroptera). *Folia Zoologica* 53 (Monograph 1): 1-47.

Biollaz, F., Bruyndonckx, N., Beuneux, G., Mucedda, M., Goudet, J. & Christe, P. 2010. Genetic isolation of insular populations of the Maghrebian bat, *Myotis punicus*, in the Mediterranean Basin. *Journal of Biogeography* 37: 1557-1569.

Blanc, M. 1935. Faune tunisienne. 1. Mammifères. Document dactylographié, Tunis, 1-43.

Blondel, J. & Aronson, J. 1999. Biology and wildlife of the Mediterranean region. *Oxford University Press, Oxford*, 328 pp.

Castella, V., Ruedi, M., Excoffier, L., Ibañez, C., Arlettaz, R. & Hausser, J. 2000. Is the Gibraltar Strait a barrier to gene flow for the bat *Myotis myotis* (Chiroptera: Vesperti - lionidae)? *Molecular Ecology* 9: 1761-1772.

Chastel, C., Bach-Hamba, D., Delaunay, H., Le Lay, G., Hellal, H. & Beaucournu, J. C. 1977. Enquête séro-épidémiologique mixte arbovirus-arénavirus chez les petits mammi - fères de Tunisie. *Bulletin de la Société de Pathologie exotique* 70: 471-479.

Chastel, C., Rogues, G., Beaucournu-Saguez, F., Hellal, H., Le Goff, F. & Beaucournu, J. C. 1983. Infections à arbovirus en Tunisie: nouvelle enquête sérologique chez les petits mammifères sauvages. *Bulletin de la Société de Pathologie exotique* 76: 21-33.

Cheniti, T.L. 2001. Conservation des zones humides littorales et des écosystèmes côtiers du Cap-Bon. Partie relative aux Mammifères. *MedWetCoast, Tunis*, 33 pp.

Cockrum, E. L. 1976a. Order Chiroptera (pp. 72-126). *In*: Mammals of Tunisia. Unpublished Report.

Cockrum, E. L. 1976b. Status of the name of a rhinolophid bat, *Rhinolophus euryale tuneti* Deleuil and Labbe, 1955. *Mammalia* 40: 685-686.

Corbet, G.B. 1978. The Mammals of the Palaearctic Region: a taxonomic review. *British Museum (Natural History) - Cornell University Press, London - Ithaca*, 314 pp.

Deleuil, R. 1957. Une nouvelle chauve-souris pour la Tunisie, *Otonycteris hemprichi* Peters, 1860. *Mammalia* 21: 190.

Deleuil, R. & Labbe, A. 1955a. Contributions à l'étude des chauves-souris de Tunisie. *Bulletin de la Société de Sciences naturelles de Tunisie* 8: 39-55.

Deleuil, R. & Labbe, A. 1955b. Sur la variabilité de la Pipistrelle de Kuhl (*Pipistrellus kuhli*). *Bulletin de la Société de Sciences naturelles de Tunisie* 8: 237-242.

DGF (Direction Générale des Forêts) 1988. Avant-projet de création et d'aménagement du Parc National d'El Feidja. *Sous-Direction de la Chasse et des Parcs Nationaux, Tunis*, 18 pp.

Dhouib, S. 1998. Contribution à l'étude du Cerf de Berbérie (*Cervus elaphus barbarus* Bennett, 1833), espè ce préservée du Parc National de El Feidja: régime alimentaire et recensement de la population. *D.E.A. Sciences de l'Environnement, Faculté des Sciences de Bizerte*, 120 pp.

DIETZ, C., HELVERSEN, O. VON & NILL, D. 2007. Handbuch der Fledermäuse Europas und Nordwestafrikas. Biologie, Kennzeichen, Gefährdung. *Franckh-Kosmos, Stuttgart*, 399 pp.

DOBSON, G. E. 1878. Catalogue of the Chiroptera in the collection of the British Museum. *Bristish Museum (Natural History), London*, 567 pp.

ELLERMAN, J. R. & MORRISON-SCOTT, T. C. S. 1951. Checklist of Palaearctic and Indian Mammals 1758 to 1946. *Trustees of the British Museum, London*, 810 pp.

EVIN, A., BAYLAC, M., RUEDI, M., MUCCEDA, M. & PONS, J. M. 2008. Taxonomy, skull diversity and evolution in a species complex of *Myotis* (Chiroptera: Vespertilionidae): a geometric morphometric appraisal. *Biological Journal of the Linnean Society* 95: 529-538.

FAIN, A. 1959. La famille Gastronyssidae Fain, 1956. Description de deux nouvelles espèces chez des chauves-souris asiatiques (Acarina : Sarcoptiformes). *Institut Royal de Sciences naturelles de Belgique* 35: 1-22.

FELTEN, H., SPITZENBERGER, F. & STORCH, G. 1977. Zur Kleinsäugerfauna West-Anatoliens. Teil IIIa. *Senckenbergiana Biologica* 58: 1-44.

FITZINGER, L. J. 1870. Kritische Durchsicht der Ordnung der Flatterthiere oder Handflüger (Chiroptera). Familie der Fledermäuse (Vespertiliones). IV Abtheilung. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe* 62: 211-317.

GADEAU DE KERVILLE, H. 1908. Voyage zoologique en Khroumirie (Tunisie) mai-juin 1906. *J.B. Baillière, Paris*, 316 pp + 30 pl.

GALLI-VALERIO, B, 1911. Notes de parasitologie et de technique parasitologique. *Zentralblatt für Bakteriologie* I 60: 358-363.

GHARAIBEH, B. M. 1997. Systematics, distribution and zoogeography of Mammals in Tunisia. *PhD Thesis, Texas Tech University, Lubbock*, 354 pp.

GOPA – DGF, 2005. Plan d'aménagement et de gestion du Parc National de Bou Hedma et de sa périphérie – rapport final. *IGIP - GOPA Consultants, Tunis - Bad Hamburg*, 63 pp + annexes.

GUSTAFSON, Y. & SCHNITZLER, H. U. 1979. Echolocation and obstacle avoidance in the hipposiderid bat *Asellia tridens*. *Journal of comparative Physiology* A 131: 161-167.

HARTMANN, R. 1868. Geographische Verbreitung der im nordöstichen Afrika wild lebenden Säugethiere. *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* 3: 28-69.

HAYMAN, R. W. & HILL, J. E. 1971. Order Chiroptera. Part 2. *In*: Meester, J. & Setzer, H. W. (eds). The Mammals of Africa: an identification manual". *Smithsonian Institution Press, Washington*, 73 pp.

HEIM DE BALSAC, H. 1936. Biogéographie des Mammifères et des Oiseaux de l'Afrique du Nord. *Bulletin biologique de France et de Belgique* 21(Supplément): 1-446.

HEIM DE BALSAC, H., ARNOUD, M., CANTONI, J. & DELEUIL, R. 1954. Notes sur les régurgitations de la chouette effraie (*Tyto alba* Scop.). *Bulletin de la Société de Sciences naturelles de Tunisie* 7: 139-140.

HILL, J. E. 1977. A review of the Rhinopomatidae (Mammalia: Chiroptera). *Bulletin of the British Museum natural History (Zoology)* 32: 29-43.

HIZEM, M. W. 2007. Contribution à la connaissance de l'écologie du peuplement des Mammifères dans le Parc National de Bou Hedma. *Mastère Ecologie Biologie des Populations, Université Tunis El Manar*, 110 pp.

HIZEM, M. W. & ALLEGRINI, B. 2009. Contribution à la connaissance des Chiroptères du Parc National de Bou Hedma (Tunisie). *Poiretia* 1: 5-9.

HULVA, P., HORÁCEK, I. & BENDA, P. 2007. Molecules, morphometrics and new fossils provide an integrated view of the evolutionary history of Rhinopomatidae (Mammalia: Chiroptera). *BMC evolutionary Biology* 7: 165.

HUTSON, A. M., MICKLEBURGH, S. P. & RACEY, P. A. 2001. Microchiropteran bats. Global status survey and conservation action plan. *I.U.C.N., Gland - Cambridge*, 256 pp.

IBAÑEZ, C., GARCÍA-MUDARRA, J. L., RUEDI, M., STADELMANN, B. & JUSTE, J. 2006. The Iberian contribution to cryptic diversity in European bats. *Acta Chiropterologica* 8: 277-297.

JUSTE, J., BILGIN, R., MUÑOZ, J. & IBAÑEZ, C. 2009. Mitochondrial DNA signatures at different spatial scales: from the effects of the Straits of Gibraltar to population structure in the Meridional serotine bat (*Eptesicus isabellinus*). *Heredity* 103: 178-187.

KAHMANN, H. 1958. Die Fledermaus *Rhinolophus mehelyi* Matschie, 1901 als Glied der Säugetierfauna in Tunesien. *Zoologischer Anzeiger* 161: 227-237.

KARAMAN, Z. V. 1939. II. Beitrag zur Kenntnis der Nycteribien. *Annales Musei Serbiae Meridionalis* 1: 31-44.

KAYSER, Y. 1995. Régime alimentaire inhabituel de la Chouette chevêche (*Athene noctua*) dans les salins de Thyna, Tunisie. *Alauda* 63: 152-153.

KOCK, D. 1969. Die Fledermaus-Fauna der Sudan. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* 521: 1-238.

KOCK, D. 2001. Identity of the African *Vespertilio hesperida* Temminck, 1840 (Mammalia, Chiroptera, Vespertilionidae). *Senckenbergiana Biologica* 81: 277-283.

KOCK, D. & NADER, I. A. 1984. *Tadarida teniotis* (Rafinesque, 1814) in the W-Palaearctic and a lectotype for *Dysopes rupelii* Temminck, 1826 (Chiroptera: Molossida). *Zeitschrift für Säugetierkunde* 49: 129-135.

KOWALSKI, K. & RZEBIK-KOWALSKA, B. 1991. Mammals of Algeria. *Ossolineum, Wroklaw*, 353 pp.

LATASTE, F. 1885. Etude de la faune des Vertébrés de Barbarie (Algérie, Tunisie et Maroc). Catalogue provisoire des Mammifères apélagiques sauvages. *Actes de la Société Linnéenne de Bordeaux* 39: 129-289.

LATASTE, F. 1887. Catalogue critique des Mammifères apélagiques sauvages de la Tunisie. *In*: Exploration scientifique de la Tunisie. *Imprimerie Nationale, Paris*, XV + 42 pp.

LAURENT, P. 1937. Essai d'une clef dichotomique des Chiroptères de la Barbarie. *Mammalia* 1: 133-159.

LAURENT, P. 1939. Présence de l'Oreillard d'Europe, *Plecotus a. auritus*, dans le sud tunisien. *Bulletin du Muséum national d'Histoire naturelle, Paris*, Série 2 11: 279-281.

LAURENT, P. 1941a. Une addition à la faune mammalogique nord-africaine: *Rhinopoma cystops arabium* Thomas. *Mammalia* 5: 11-17.

LAURENT, P. 1941b. A propos de la rhinopome tunisienne. *Mammalia* 5: 99-100.

LE BERRE, M. 1990. Faune du Sahara. 2. Mammifères. *Lechevalier - Chabaud, Paris*, 360 pp.

LE LAY-ROGUES, G. & CHASTEL, C. 1986. Virus des Chiroptères transmis ou non par arthropodes. *Médecine tropicale* 46: 389-395.

MAYER, F., DIETZ, C. & KIEFER, A. 2007. Molecular species identification boosts bat diversity. *Frontiers in Zoology* 4: 4.

MITCHELL-JONES, A. J., BIHARI, Z., MASING, M. & RODRIGUES, L. 2007. Protection et gestion des gîtes souterrains pour les Chiroptères. *Eurobats Publication Series* 2: 1-38.

MOLDRZYK, U. 2003. Preliminary faunal list of the Bou Hedma National Park, southern Tunisia. *Kaupia* 12: 29-41.

NADER, I. A. & KOCK, D. 1983. Notes on some bats from the Near East (Mammalia: Chiroptera). *Zeitschrift für Säugetierkunde* 48: 1-9.

NOBLET, J. F. & NEFZI, T. 1991. Les chauves-souris de Tunisie. Etude et protection. Document dactylographié, 5p + ann.

OLIVIER, E. 1896. Matériaux pour la faune de la Tunisie. *Revue scientifique du Bourbonnais et du Centre de la France* 12: 118-133.

OLIVIER, E. 1909. *Rhinopoma microphyllum* en Tunisie. *Bulletin de la Société zoologique de France* 34: 148.

OWEN, R. D. & QUMSIYEH, M. B. 1987. The subspecies problem in the Trident leaf-nosed bat, *Asellia tridens*: homomorphism in widely separated populations. *Zeitschrift für Säuge - tierkunde* 52: 329-337.

PERESWIET-SOLTAN, A. 2007. Relation between climate and bat fauna in Europe. *Travaux du Muséum National d'Histoire Naturelle "Grigore Antipa"* 50: 505-515.

REBELO, H. & BRITO, J. C. 2006. Bat guild structure and habitat use in the Sahara desert. *African Journal of Ecology* 54: 228-230.

RODE, P. 1947 Les Mammifères de l'Afrique du Nord. I. *La Terre et la Vie* 94: 120-142.

ROUDAIRE, C., 1881. Liste des Vertébrés recueillis par M. le Dr André pendant l'expédition des chotts et déterminés par M. F. Lataste. *In*: Rapport à M. le Ministre de l'Instruction Publique sur la dernière expédition des chotts. Complément des études relatives au projet de mer intérieure. *Imprimerie Nationale, Paris*, 172-174.

SIMMONS, N. B. 2005. Order Chiroptera. *In*: Wilson, D.E. & Reeder, D.M. (eds). Mammal species of the World. A taxonomic and geographic reference. Third edition. *The Johns Hopkins University Press, Baltimore*, 312-529.

SPITZENBERGER, F., STRELKOV, P. P., WINKLER, H. & HARING, E. 2006. A preliminary revision of the genus Plecotus (Chiroptera, Vespertilionidae) based on genetic and morphological results. *Zoologica Scripta* 35: 187-230.

TEMPLE, H. J. & CUTTELOD, A. (comp.) 2009. The status and distribution of Mediterranean mammals. *I.U.C.N., Gland - Cambridge*, 32 pp.

TROUESSART, E. L. 1905. La faune des Mammifères de l'Algérie, du Maroc et de la Tunisie. *Causeries scientifiques de la Société zoologique de France* 1: 353-410.

TROUESSART, E. L. 1906. Liste des Mammifères rapportés par M. H. Gadeau de Kerville de Khroumirie (Tunisie occidentale). *Bulletin du Muséum national d'Histoire naturelle, Paris* 12: 447-448.

VAN CAKENBERGHE, V. & SEAMARK, E. C. J. (eds) 2006. African Chiroptera Report 2006. *African Chiroptera Project, Pretoria*, 1198 pp.

VAN CAKENBERGHE, V. & VREE, F. de 1994. A revision of the Rhinopomatidae Dobson, 1872, with the description of a new subspecies (Mammalia: Chiroptera). *Senckenbergiana Biologica* 73: 1-24.

VAUGHAN, T. C., COCKRUM, E. L. & VAUGHAN, P. J. 1977. Four Vespertilionid bats new to the fauna of Tunisia. *Mammalia* 41: 517-522.

VESMANIS, I. 1972. Einige Kleinsäuger vom Galita-Archipel, Tunesien. *Senckenbergiana Biologica* 53: 189-195.

VESMANIS, I. 1976. Bemerkungen über zwei interessante Fledermaus-populationen in Tunesien. *Deutsch-Tunesische Rundschau, Bonn*, 14: 16-17.

WANDELER, A. I. 1967. Die Wirbeltiere von Nefta. Beitrag zur Ökologie einer Oase. *Natur - historisches Museum Bern, Jahrbuch 1963-1965*: 229-292.

WIERSEMA, G. J. & VREUGDENHIL, A. 1975. Proposition pour la protection de la grotte des chauves-souris près d'El Haouaria en Tunisie. Document dactylographié, 5 pp.

ZAVA, B. & MASSETI, M. 2007. First record of four species of bats from the national park of El Feidja (NW Tunisia) with a note on the non-flying mammals of the Khroumiria region. *Hystrix* (n.s.) 18: 83-90.

ANNEXE: Liste des localités de Tunisie mentionnées dans le texte et/ou les légendes des cartes: localisation, implantation administrative et coordonnées géographiques.

Localités	Localisation	Gouvernorat	Délégation	Coordonnées
Adjim		Medenine	Djerba - Adjim	33°44' N 10°45' E
Aïn Dhab	Djebel Serdj, 10km NO El Ouesslatia	Siliana	Siliana sud	35°55' N 09°30' E
Aïn Draham	Mine de kohl, 5km NE Aïn Draham	Jendouba	Aïn Draham	36°49' N 08°44' E
Aïn Draham (Grotte de Kaloi)	Tombeau antique	Jendouba	Aïn Draham	36°47' N 08°41' E
Aïn Jammalah	Toit de la pépinière forestière	Baja	Téboursouk	36°27' N 09°14' E

Beja		Beja	Beja Nord	36°44' N 09°10' E
Bizerte		Bizerte	Bizerte Nord	37°17' N 09°52' E
Bled Douarah	43km O Gafsa	Gafsa	Metlaoui	34°24'N 08°19' E
Bou Hedma	Parc National, Bordj, Oued Bou Hedma, 26 km SO sur C 124	Sidi Bouzid	Mezzouna	34°28'N 09°39' E
Bulla Regia	Palais romain d'Amphitrite, 7km NNO Jendouba	Jendouba	Jendouba Nord	36°33' N 08°45' E
Cap Serrat	Versant NE Djebel El Hamar	Bizerte	Sejenane	37°12' N 09°14' E
Carthage	Ruines	Tunis	Carthage	36°51' N 10°20' E
Carthage	Port punique	Tunis	Carthage	36°51' N 10°19' E
Chemtou	Carrière & théâtre romain, 17km O Jendouba	Jendouba	Jendouba Nord	36°29' N 08°35' E
Dghoumes	(= Dgomous), Entrée du Parc National, rive N Chott El Djerid, 20km E Degache	Tozeur	Degache	34°03' N 08°34' E
Djebel Abiod		Beja	Nefza	36°59' N 09°05' E
Djebel Ank	Mine de fer, 30 km ESE Gafsa	Gafsa	El Guettar	34°19' N 09°07' E
Djebel Barbrou	Mine Scarna, 10km NE Rohia	Siliana	Rouhia	35°43' N 09°08' E
Djebel Bou Kornine	(= Djebel Gattuna), sud Hammam Lif	Ben Arous	Hammam Lif	36°41' N 10°21' E
Djebel Gloub	Grotte, 10km O Fernana	Jendouba	Fernana	36°39' N 08°34' 'E
Djebel Ichkeul	Grotte, N Mateur	Bizerte	Tinja	37°08' N 09°40' E
Djebel Ichkeul (Sidi Messaoud)	Mine, 25km SO Bizerte	Bizerte	Tinja	37°08' N 09°40' E
Djebel Morra	Parc National Dghoumes, 20km E Degache	Tozeur	Degache	34°04' N 08°34' E
Djebel Orbata	6km NE Bou Omrane, 32km E Gafsa	Gafsa	El Guettar	34°24' N 09°08' E
Djebel Oust	Grotte, 6km S Oum Djeddour, E Thala	Kasserine	El Ayoun	35°34' N 08°58' E
Djebel Ressas	Mine, 28km SE Tunis	Nabeul	Grombalia	36°36' N 10°20' E
Djebel Ressas	Bassin d'irrigation, 28km SE Tunis	Nabeul	Grombalia	36°36' N 10°20' E
Djebel Saïkra	7km E Helg Jimel, 22km NO Medenine	Medenine	Medenine Nord	33°26' N 10°17' E
Djebel Serdj	Damous Saïd, 10km N Ouesslatia	Siliana	Siliana Sud	35°56' N 09°33' E
Djebel Sidi Bel Abiod	El Haouaria	Nabeul	El Haouaria	37°03' N 11°01' E
Djebel Trozza	Mine, 7km SE El Alâa, 50km OSO Kairouan	Kairouan	Alaâ	35°34' N 09°36' E
Djebel Zaghouan	Bassin d'irrigation, 4km O poste d'observation	Zaghouan	Zaghouan	36°21' N 10°07' E
Djebel Zaghouan	Cavernes et grottes	Zaghouan	Zaghouan	36°21' N 10°07' E
Djebel Zaghouan	Grotte du poste d'observation	Zaghouan	Zaghouan	36°21' N 10°07' E
Djebel Zaghouan	Mine, 3km SE Zaghouan sur route vers Aïn Ayed	Zaghouan	Zaghouan	36°21' N 10°07' E
Djebel Zaghouan	Temple des eaux	Zaghouan	Zaghouan	36°21' N 10°07' E
Djebel Zaghouan	6km O poste d'observation	Zaghouan	Zaghouan	36°21' N 10°07' E
Djebel Zaghouan	Grotte du Cheval	Zaghouan	Zaghouan	36°21' N 10°07' E
Djebel Zaghouan	Mine Sioitayeaa, 1km E Zaghouan sur C 133, 1km S autoroute	Zaghouan	Zaghouan	36°21' N 10°07' E

Djerba	2,5km E El May	Médenine	Djerba - Midoun	36°21' N 10°07' E
Douirat	17km OSO Tataouine	Tataouine	Tataouine Sud	36°21' N 10°07' E
Douz		Kébéli	Douz Nord	33°28' N 09°01' E
Dubosville	Région de Tunis	Tunis	Djebel Jelloud	36°47' N 10°12' E
El Akhouat	Mine, 10km SO Gaâfour	Siliana	Gaâ four	36°15' N 09°15' E
El Bathan	Plaine SE de la ville	Manouba	El Battan	36°48' N 09°51' E
El Djem		Mahdia	El Jem	35°18' N 10°42' E
El Feidja	Parc National, bâtisse et entrepôt du parc	Jendouba	Ghardimaou	36°45' N 08°38' E
El Hamaïn	Ecole	Béja	Medjez El-Bab	36°39' N 09°37' E
El Hamma de Gabès	Constructions romaines, sources chaudes (Gabès par Laurent 1941)	Gabès	El Hamma	33°54' N 09°48' E
El Hamma de Tozeur	(= El Hamma de Djerid), palmeraie STIL - aqueduc abandonné, 12km N Tozeur sur GP 3	Tozeur	Degache	34°01' N 08°08' E
El Hamrouni	Bassin (= GP3 - 4km NO), 6 km NO GP3 sur C77, 8 km NO Hajeb El Aioun	Sidi Bouzid	Jelma	35°25' N 09°28' E
El Haouaria	Grotte des chauves-souris (= Grotte de l'oued Tabouda = Ghar Tabouda = Grotte d'El Haouaria = Grotte de Djebel Sidi Bel Abiod), 4km NE	Nabeul	El Haouaria	37°03' N 11°01' E
El Haouaria	2 km N	Nabeul	El Haouaria	37°03' N 11°01' E
El Haouaria	Grottes romaines, 1,5 km NO	Nabeul	El Haouaria	37°03' N 11°01' E
El Ouidane	11 km O C27	Nabeul	El Mida	36°47' N 10°51' E
El Ouidane	Mine de charbon n°7, 60km E Tunis	Nabeul	El Mida	36°47' N 10°51' E
Enfidaville	Plaine, 4km N de la ville	Sousse	Enfidha	36°10' N 10°23' E
Entouna	Mine, 23,5 km SE Tunis sur GP1, 2 km O autoroute	Ben Arous	Mornag	36°42' N 10°18' E
Feriana	1km NNE Feriana	Kasserine	Feriana	34°57' N 08°34' E
Foum Tataouine	Tunnel dans les fortifications, 2km S Tataouine sur GP9, 1km E route	Tataouine	Tataouine Sud	32°54' N 10°26' E
Gabès		Gabès	Gabès Medina	33°53' N 10°07' E
Gafsa	Ville	Gafsa	Gafsa Nord	34°26' N 08°47' E
Gafsa	Grotte	Gafsa	Gafsa Nord	34°26' N 08°47' E
Gafsa	Carriè re E Gafsa	Gafsa	Gafsa Sud	34°25' N 08°48' E
Galite	Île, 85km ONO Bizerte, 65km NNE Tabarka	*	*	37°31' N 08°55' E
Gamouda	Sidi Bouzid	Sidi Bouzid	Sidi Bouzid Ouest	35°02' N 09°25' E
Ghar Kraiz	8km NO El Aroussa	Béja	Testour	36°26' N 09°23' E
Ghardimaou		Jendouba	Ghardimaou	36°27' N 08°26' E
Ghomrassen	(= 100 km S Gabès), 20km OSO Ghomrassen	Tataouine	Ghomrassen	32°59' N 10°07' E
Gorge de Seldja	Entre Redeyef et Metlaoui, 9km ONO Metlaoui	Gafsa	Metlaoui	34°21' N 08°19' E
Grombalia	Bâtiment, 10km O Grombalia sur MC34	Nabeul	Grombalia	36°31' N 10°27' E
Hammam Djedidi	27km E Zaghouan	Nabeul	Hammamet	36°25' N 10°27' E
Hammam Sousse		Sousse	Hammam Sousse	35°51' N 10°35' E
Hammamet		Nabeul	Hammamet	36°24' N 10°37' E
Ichkeul	Parc National, 24km SO Bizerte	Bizerte	Tinja	37°08' N 09°41' E
Kairouan		Kairouan	Kairouan Nord	35°41' N 10°07' E

Kasserine	Anfractuosités de rocher Djebel Châambi	Kasserine	Kasserine Nord	35°11' N 08°48' E
Kebili (Nefzaoua)		Kebili	Kebili nord	33°43' N 08°58' E
Kef el Agab	4km ONO Souk el Arba	Jendouba	Jendouba	36°30' N 08°45' E
Kef en Negcha	Parc National El Feidja	Jendouba	Ghardimaou	36°45' N 08°38' E
Kherredine	Entre la Goulette et El Kram	Tunis	Tunis	36°50' N 10°19' E
Ksar Haddada	Fissure dans une falaise, NO Tataouine	Tataouine	Tataouine Nord	32°56' N 10°27' E
Makthar	Ruines, sous les bains	Siliana	Makthar	35°51' N 09°12' E
Massicault	N Bordj El Amri	Manouba	Bordj El Amri	36°43' N 09°53' E
Matmata	10km NO Matmata	Gabes	Matmata	33°37' N 09°54' E
M'dhila	Mine de phosphate, 20km S Gafsa	Gafsa	M'dhila	34°15' N 08°45' E
Megrine	Région de Tunis	Ben Arous	Mégrine	36°46' N 10°14' E
Menzel Temime	Carrière de sable, 3km SE sur C27	Nabeul	Menzel Temime	36°46' N 10°59' E
Metlaoui - Redeyef	Grotte	Gafsa	Metlaoui	34°21' N 08°19' E
Mornag	Plaine, SO Djebel Bou Kornine	Ben Arous	Mornag	36°40' N 10°18' E
Moulares		Gafsa	Moularès	34°29' N 08°16' E
Nabeul		Nabeul	Nabeul	26°27' N 10°48' E
Nefta	Oasis	Nefta	Tozeur	33°52' N 07°53' E
Nefta	Mausolée Sidi Hassen Ayed, 4,5km S	Nefta	Tozeur	33°50' N 07°53' E
Nefza	Forêt de pins claire, 10km O Nefza	Nefza	Béja	36°59' N 08°58' E
Nefza	Forêt de pins dense, 9km O Nefza	Nefza	Béja	36°58' N 08°59' E
Oudna	Bâtiment, 1km SE station Oudna, près Khelidia, O Djbel Ressas	Ben Arous	Mohammedia	36°38' N 10°09' E
Oued Lebna	Estuaire, rive sud Cap Bon, 7,5km SSO Menzel Temime	Nabeul	Menzel Temime	36°43' N 10°58' E
Oued Medjerdja	Estuaire, rive SE lagune Ghar El Maleh, 6km SSE Ghar el Maleh	Bizerte	Ghar El Melh	37°07' N 10°13' E
Oued Zriba	Versant E montagne, 6km SSO Ez Zriba	Zaghouan	Zriba	36°18' N 10°13' E
Ras Rajel	Mine près cimetière, 6km O Tabarka	Jendouba	Tabarka	36°57' N 08°43' E
Redeyef		Gafsa	Redeyef	34°23' N 08°09' E
Redeyef	Mine, 4km S Redeyef sur route Aïoun Ameur	Gafsa	Redeyef	34°21' N 08°09' E
Sfax	Sfax ville	Sfax	Sfax Ville	34°44' N 10°46' E
Sidi Bouzid	Plaine	Sidi Bouzid	Sidi Bouzid Ouest	35°01' N 09°30' E
Sidi Daoud	Rive nord Cap Bon	Nabeul	El Haouaria	37°00' N 10°54' E
Sidi Mansour	Garage Service géologique, région Tunis	Tunis	Tunis	36°48' N 10°11' E
Sidi Toui	Parc National, 50km S Ben Guerdane	Medinie	Ben Guerdane	32°42' N 11°14' E
Souk el Arba	Ville de Jendouba	Jendouba	Jendouba	36°30' N 08°45' E
Sousse	Ville	Sousse	Sousse Medina	35°49' N 10°38' E
Tabarka	Siège de la délégation (Mu'tamadiyat)	Jendouba	Tabarka	36°57' N 08°45' E
Tamerza	Oasis	Tozeur	Tamerza	34°22' N 07°56' E
Tataouine	Fortifications montagne S	Tataouine	Tataouine Sud	32°55' N 10°26' E
Tebourba	Grotte du Djebel Lansarine, NO Tebourba	Manouba	Tebourba	36°50' N 09°50' E

Testour	Grotte entre Testour et El Aroussa	Beja	Testour	36°33' N 09°27' E
Thyna	Salines	Sfax	Tyna	34°40' N 10°42' E
Toujane	Grotte, 3km NO Toujane sur C104, 45km S Gabes	Gabes	Mareth	33°29' N 10°07' E
Tozeur	Ville	Tozeur	Tozeur	33°55' N 08°08' E
Tunis	Ville	Tunis	Tunis	36°48' N 10°11' E
Utique	Citerne, ruines	Bizerte	Utique	37°04' N 10°04' E
Zarzis	Ville	Medinine	Zarzis	33°30' N 11°07' E

Revue suisse de Zoologie 118 (2): 293-306; juin 2011

A new species of *Siamoglaris* from Thailand with complementary description of the type species (Psocodea: 'Psocoptera': Prionoglarididae)

Charles LIENHARD
Muséum d'histoire naturelle, c. p. 6434, CH-1211 Genève 6, Switzerland.
E-mail: charleslienhard@bluewin.ch

A new species of *Siamoglaris* from Thailand with complementary description of the type species (Psocodea: 'Psocoptera': Prionoglaridae). - A new species of the previously monotypic genus *Siamoglaris* Lienhard, *S. theresiae* sp. n., is described and illustrated, based on three males from Thailand (female unknown). The female of the type species, *S. zebrina* Lienhard, is described for the first time and complements to the description of the male of this species are given. The generic diagnosis is revised. For the first time in Psocoptera, numerous thin-walled papilliferous spatulate setae (scent setae?) were observed on female gonapophyses and paraprocts; they are illustrated by scanning electron micrographs. Figures of female terminalia of the closely related genus *Prionoglaris* Enderlein are also presented.

Keywords: Prionoglaridinae - *Prionoglaris* - scent setae - living fossils.

INTRODUCTION

The psocids mentioned in this study have been collected by the Thailand Inventory Group for Entomological Research (TIGER) in the course of their project on the insect fauna of Thailand, the field work of which was realized during the years 2006-2009 (see: http://sharkeylab.org/tiger/). The present paper contains the first published results on psocids collected during this monumental faunistic survey. 1839 samples containing psocids were sent to the Muséum d'histoire naturelle of the City of Geneva (Switzerland), where thousands of specimens were labeled and sorted to morphospecies by Mrs Thérèse Cuche. About 20 families of Psocoptera are represented in this material. One of them, the Prionoglarididae, is treated in the present paper; it is represented by 17 specimens of the endemic genus *Siamoglaris* Lienhard, 2004.

Within the order Psocodea (sensu Yoshizawa & Johnson, 2006) the 'Psocoptera' family Prionoglarididae belongs to the basal suborder Trogiomorpha and has recently been placed in an infraorder of its own, the Prionoglaridetae (see Yoshizawa *et al.*, 2006). Due to their basal position within Trogiomorpha and their similarity to fossils of this suborder, based on a plesiomorphic wing venation, the extant prionoglaridids are considered as "living fossils" (Lienhard, 2007). The family has been subdivided into two subfamilies by Lienhard (2004), Prionoglaridinae and Speleketorinae. The nominate subfamily contains the Palaearctic genus *Prionoglaris* Enderlein (3 species; see Lienhard & Smithers, 2002), the Neotropical genus *Speleopsocus* Lienhard (mono-

Manuscript accepted 11.01.2011

typic; see Lienhard *et al.*, 2010a) and the previously monotypic Oriental genus *Siamoglaris* Lienhard (Lienhard, 2004).

The latter genus was represented in the TIGER-project material by 9 males and 5 females belonging to the type species, *Siamoglaris zebrina* Lienhard, 2004, previously only known from the male holotype. The female is described in the following and complements to the description of the male are given. The remaining three *Siamoglaris* individuals discovered in this material are males and represent a new species described below. Based on these data a revised generic diagnosis is proposed and some morphological characters are discussed.

MATERIAL AND METHODS

Dissection and slide-mounting followed the methods described by Lienhard (1998). After clearing the male terminalia in lactophenol, complete or partial eversion of the retracted eversible distal structures of the phallosome could be provoked by a short immersion (some minutes) in Sellnick fluid (Sellnick, 1960: 45; Weidner, 1993: 5; Lienhard, 1998: 60), while observing the phallosome under a stereomicroscope.

The material examined is deposited in the arthropod collections of the Muséum d'histoire naturelle, Geneva, Switzerland (MHNG) and of the Queen Sirikit Botanical Gardens, Mae Rim, Chiang Mai Province, Thailand (QSBG). For all material examined the TIGER-project sample numbers are mentioned (T-number).

The following abbreviations are used in the descriptions: BL = body length (in alcohol); F = hindfemur (length); FW = forewing (length); HT = holotype; HW = hindwing (length); IO/D = shortest distance between compound eyes divided by anteroposterior diameter of compound eye in dorsal view of head; PT = paratype; T = hindtibia (length); t1, t2, t3 = tarsomeres of hindtarsus (length, measured from condyle to condyle).

DESCRIPTIONS AND DISCUSSIONS

Siamoglaris Lienhard, 2004

Lienhard, 2004: 866. Type species: *Siamoglaris zebrina* Lienhard, 2004: 866. Other species included: *Siamoglaris theresiae* sp. n. (see description below).

Revised diagnosis: See original diagnosis by Lienhard (2004), with the following additions or modifications. Habitus as shown in Fig. 1. Membranous extension of anterior preapical claw of each leg somewhat variable in size (Fig. 5e and Lienhard, 2004: fig. 5; see also Discussion below). Male terminalia (Figs 4a-c, 5f-g, 6c-e): Mediointernal structure of posterior part of phallosome not differentiated as a simple slender process like in *Prionoglaris* (see Lienhard, 1988, 1998), but as a relatively wide and weakly sclerotized internal tube bearing distally the opening of the ejaculatory duct and various membranous or sclerotized eversible structures of specific shapes. Female terminalia (Figs 2-3): In general similar to *Prionoglaris* (Fig. 7), but ovipositor valvulae and paraprocts lacking hooked stout setae and basal part of epiproct lacking pilosity. Ventral and dorsal gonapophyses almost completely reduced. External gonapophyses well-developed, basally rounded, apically angulate, pilose; besides normal pilosity bearing also numerous thin-walled broadened papilliferous setae (Figs 2b, 3). Some such setae also present in ventral half of paraproct (Fig. 3a).

Subgenital plate short and simple, its posterior margin forming a wide angle but lacking a distinct medio-apical lobe. Spermapore region simple.

DISCUSSION: The shape of the membranous part of the anterior preapical claws is somewhat variable (partially due to different degrees of swelling after slide-mounting of the legs). Contrary to Lienhard (2004: key on p. 871) no clear difference between *Siamoglaris* and *Prionoglaris* could be observed in this character (see Figs 5e and 7b). The internal basal bristle of the anterior pretarsal claws is also present in *Prionoglaris* (Fig. 7b), but usually it is very short and fine, difficult to distinguish from adjacent microtrichia; therefore it has not previously been recognized by Lienhard (1988: fig. 8; 1998: fig. 39e). The other differences between these two genera mentioned by Lienhard (2004) could be confirmed. However, in *Prionoglaris* the posterior parts of the phallosome are more heavily sclerotized than in *Siamoglaris* and no eversible structures have been observed. The opening of the ejaculatory duct is hardly visible in *Prionoglaris*, probably it is situated just dorsally of the base of the mediooventral process near the base of the mediointernal process (see figures in Lienhard, 1988, 1998). Lienhard (2004) has tentatively interpreted the presence of a pair of sclerotized hooked claspers apically on the eversible posterior parts of the phallosome as a generic character of *Siamoglaris*, but the new material shows that this character is only present in the type species.

The female genitalia of *Siamoglaris* are similar to those of the other prionoglaridine genera (*Prionoglaris*: Fig. 7e; *Speleopsocus*: see Lienhard *et al.*, 2010a: fig. 3b). The presence of special papilliferous setae on female terminalia of *S. zebrina* is here tentatively interpreted as an autapomorphy of the genus *Siamoglaris* (see also Discussion of the type species, below). The female of the monotypic Neotropical genus *Speleopsocus*, the male of which is still unknown, can easily be distinguished from *Siamoglaris* by several striking characters, as indicated by Lienhard *et al.* (2010a). The discovery of the female of *Siamoglaris* does not provide significant new information for a better understanding of phylogenetic relationships between the three genera of Prionoglaridinae. The trichotomy in this subfamily remains unresolved (see Lienhard *et al.*, 2010a). At present it seems that only molecular data (DNA analysis will be undertaken by Kazunori Yoshizawa, Sapporo) or the discovery of the male of *Speleopsocus* can bring some progress in this field.

Siamoglaris zebrina Lienhard, 2004 Figs 1-4

Siamoglaris zebrina Lienhard, 2004: 866; description of male.

TYPE MATERIAL: MHNG, ♂ holotype (re-examined), Thailand, Kanchanaburi Province, Sai Yok District, near Wang Badan Cave, ca. 2 km N of Sai Yok Noi Waterfall, dry stream bed (on low vegetation), 9.xii.2003, leg. P. Schwendinger.

NEW MATERIAL EXAMINED: MHNG and QSBG, Thailand, Kanchanaburi Province, Khuean Srinagarindra National Park, 9♂ and 5♀ in Malaise traps from the following localities, leg. TIGER-project: Huai Mae Kamint / Tourist center (1♂, 11-18.ix.2008, T3442; 2♂, 2♀, 18-25.ix.2008, T3443; 1♀, 25.ix-2.x.2008, T3444; 1♂, 1♀, 2-9.x.2008, T3445; 1♂, 23-30.x.2008, T3463; 1♂, 30.x-6.xi.2008, T3464); Tha Thung-na / Chong Kraborg (1♂, 1♀, 30.x-6.xi.2008, T3472; 2♂, lacking abdomen, 6-13.xi.2008, T4431, these two specimens could be identified as males due to their small body size and their relatively large compound eyes, i.e. IO/D 1.16 and 1.15, see also Complementary description of male, below).

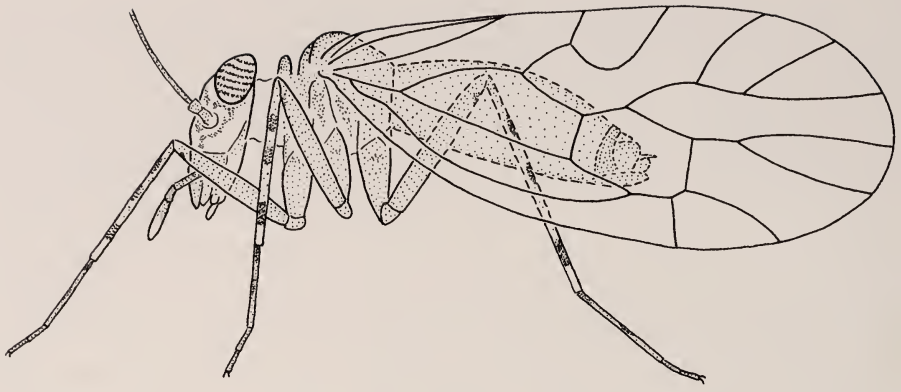


FIG. 1

Siamoglaris zebrina Lienhard, male: Habitus, lateral view (body length 2.5 mm); antenna incomplete; pilosity, hindwing and right appendages not shown.

DESCRIPTION OF FEMALE: Colouration and general morphology as described for male by Lienhard (2004). Body size distinctly larger than in male, but compound eyes relatively smaller (see Complementary description of male, below). Femora lacking dark brown transversal band of hypodermal pigment in 2/3 of their length (Fig. 4d, cf. Fig. 5i showing this band in *S. theresiae*). Colour pattern of eyes not well-preserved in the specimens examined (observed after two years in alcohol), but still partially visible (cf. Fig. 5a). Pterostigma colourless, transparent or very slightly opaque. Antennae damaged in all specimens examined. Anterodorsal region of abdomen without small humps (see also Fig. 6f, showing pair of humps present in male of *S. theresiae*). Terminalia shown in Figs 2, 3; see also revised generic diagnosis, above. Epiproct relatively small, pilosity only developed in apical half, consisting of a pair of long setae and some shorter hairs. Paraproct in middle with a transversal row of some long setae, in its apical half with a dense group of hairs, some of them differentiated as papilliferous setae, similar to those on the external gonapophysis (in some cases weakly differentiated, see Fig. 2b: 4); sense cushion well-differentiated, bearing one normal seta and numerous fine trichobothria, the latter without basal rosettes. Subgenital plate short, with a anteriorly narrowing pigmented area. External gonapophyses well-developed, bearing some long stout setae and many shorter acuminate hairs; towards posteroventral margin with numerous apically thin-walled and usually slightly curved papilliferous spatulate or club-shaped setae of unknown function (see Discussion, below). An approximately oval structure present on each side at base of external gonapophysis (shown by interrupted lines in Fig. 2a), originating from anteroventral margin of clunium, covered by rounded basal part of gonapophysis and lateral part of subgenital plate (rudiments of ventral and dorsal gonapophyses?). Spermapore region with a weakly sclerotized suboval posterior area and a membranous anterior area bearing the spermapore. Spermathecal duct very long and more or less spirally coiled

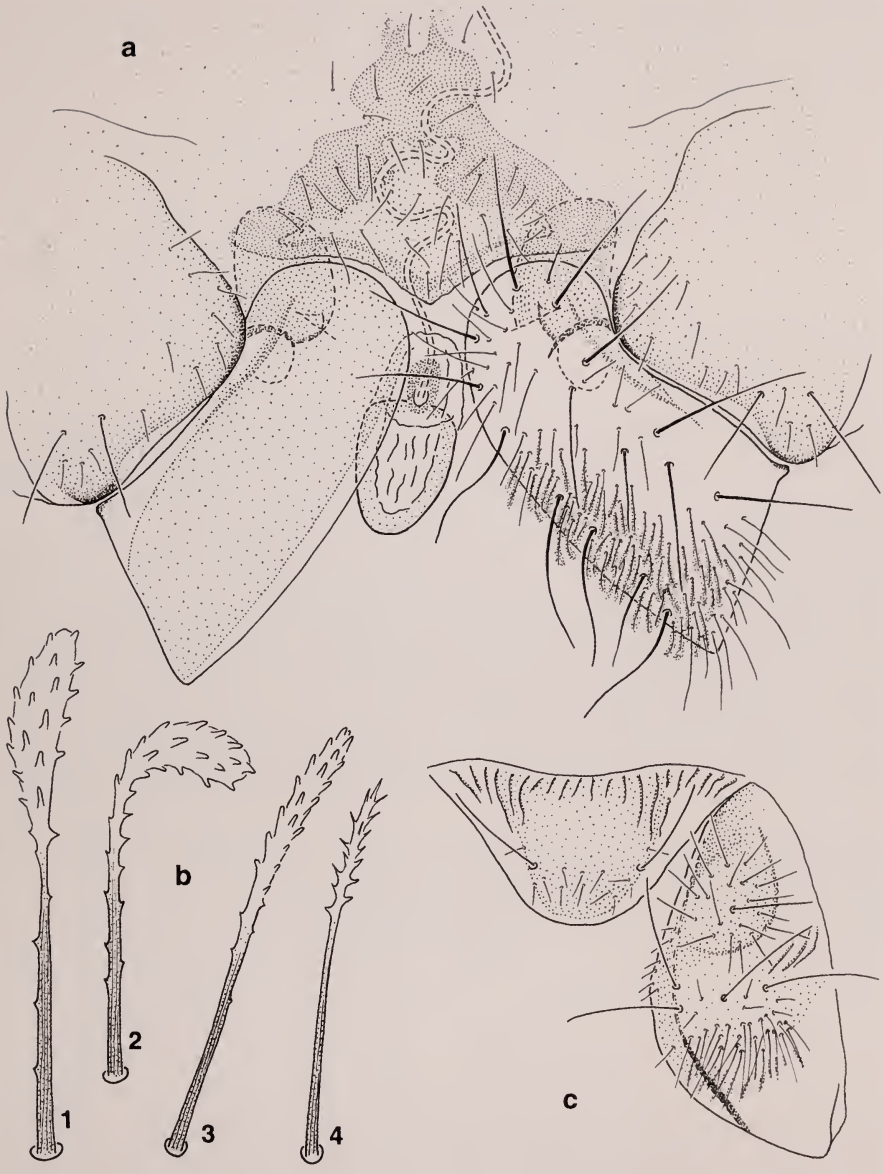


FIG. 2

Siamoglaris zebrina Lienhard, female: (a) Subgenital plate, ovipositor valvulae (pilosity on right side not figured), ventrolateral parts of clunium, spermapore region and distal part of spermathecal duct. (b) Papilliferous setae on external gonapophysis and paraproct; 1 erect seta, 2 curved seta, 3 slender seta, 4 weakly differentiated seta. (c) Epiproct and right paraproct.

(at least more than twice as long as the distal part of the spermathecal duct shown in Fig. 2a), spermathecal sac not examined (lost during dissection). Measurements (female of sample T3472): BL = 3.5 mm; FW = 4.2 mm; HW = 2.8 mm; F = 917 μm; T = 1610 μm; t1 = 818 μm; t2 = 182 μm; t3 = 185 μm; IO/D = 1.35.

COMPLEMENTARY DESCRIPTION OF MALE: Body size smaller than in female (BL♂ < 3 mm; BL♀ > 3 mm), but compound eyes relatively larger (IO/D♂ < 1.2; IO/D♀ > 1.3). Colouration as in female. Antennae damaged in all specimens examined. Anterodorsal region of abdomen without small humps (see also Fig. 6f, showing pair of humps present in male of *S. theresiae*). Terminalia (Fig. 4a-c): Paraproct simple (see Lienhard, 2004: fig. 14), its pilosity normal (i.e. lacking the papilliferous setae observed in female). Shape of apical part of phallosome variable due to different positions of the eversible distal structures and variable tumescence of the membranous blisters. For a view of all structures completely everted and blisters swollen see Fig. 4c and the figures of the holotype in Lienhard (2004); for retracted apical structures and collapsed blisters see Fig. 4a; for everted apical structures but collapsed blisters see Fig. 4b. Characteristical distal pair of sclerotized hooks visible in all positions. Rounded medioventral process (sensu Lienhard, 2004) posteriorly delimited by a transversal reticulate membrane; slightly concave mediodistal margin of this membrane well visible in ventral view (Fig. 4b), but also visible in dorsal view on cleared phallosome (Fig. 4c, interrupted line), always lacking sclerotized posterolateral lobes (see also Figs 5f, g and 6d, e showing posterolateral lobes present in *S. theresiae*).

DISCUSSION: The female terminalia of *S. zebrina* resemble those of the other known prionoglaridine genera due to symplesiomorphy. However, the presence of special papilliferous setae on the gonapophyses (some of them also on paraprocts) can be interpreted as an autapomorphy of *Siamoglaris*. This interesting character deserves additional comments. The socket and the basal part of these modified setae are identical to those of the adjacent acuminate hairs. The basal part is brown, thick-walled and longitudinally grooved (Fig. 2b) as usual in chaetal sensilla (grooves not visible in the scanning electron micrographs of Fig. 3, but clearly visible under a light microscope; see also Slifer & Sekhon, 1977 and Hu *et al.*, 2009). However, the distal half of these modified setae is thin-walled and completely transparent, and the surface area is augmented by its broadening (spatulate to club-shaped) and by the presence of many small papilliform spicules (Figs 2b; 3d, f). Several more acuminate spicules are also present in the basal half of many of these setae (Figs 2b, 3c). As far as I know, it is the first time that such modified setae have been observed in Psocoptera. In general, the pilosity of the female gonapophyses of psocids consists of normal acuminate setae (probably mechanoreceptors). The particular morphology of these modified setae suggests a possible function as scent organs involved in sexual behaviour (emitting an aphrodisiac pheromone?). Brush-like pheromone-diffusing scent scales of somewhat similar morphology have been observed in several Lepidoptera (Grassé, 1975; Wüest, 1996).

The presence of eversible distal structures on the phallosome, often retracted in alcohol preserved specimens, may pose a problem for the interpretation of the micromorphology of the posterior part of the phallosome. Therefore they have been illus-

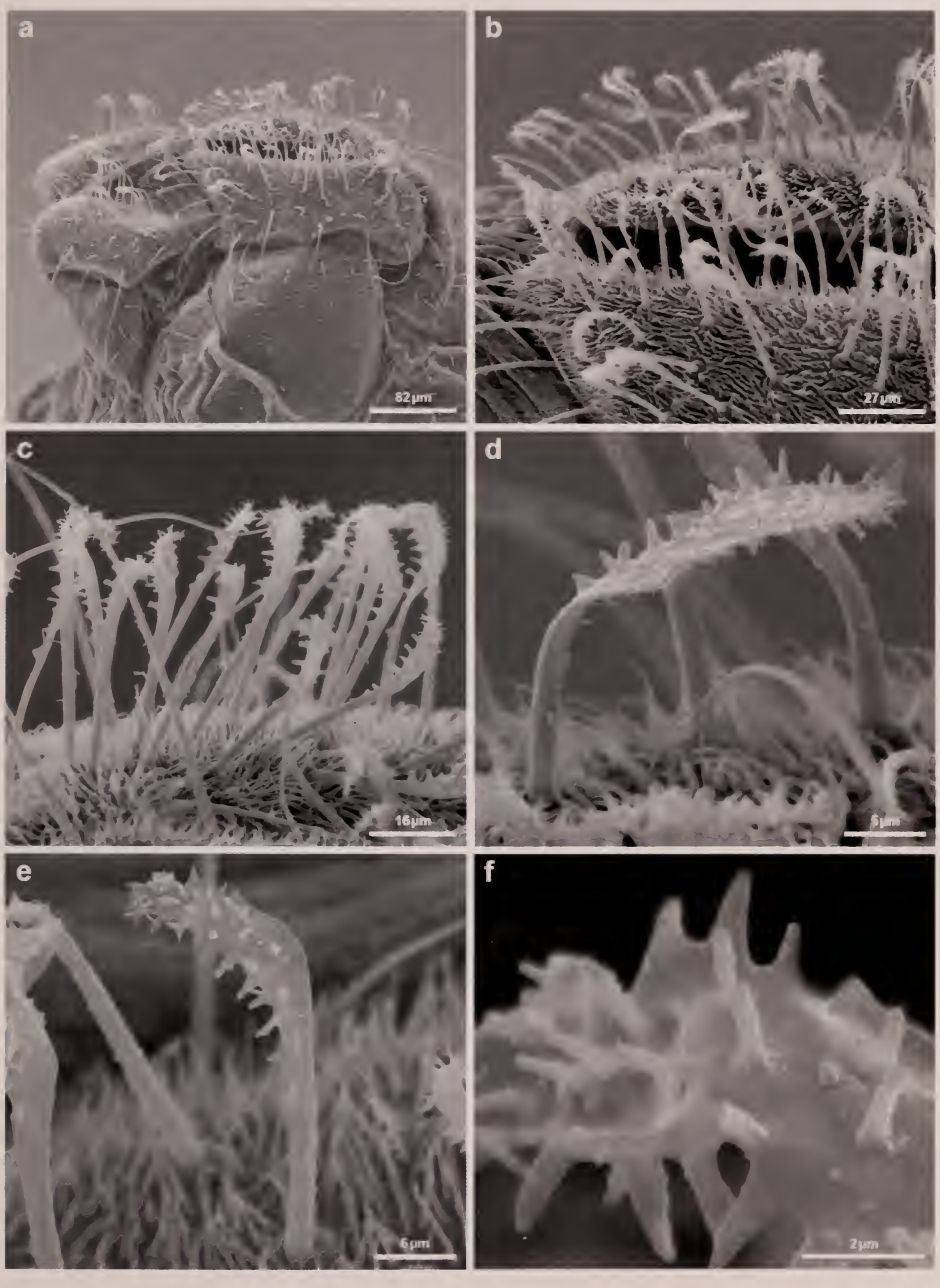


FIG. 3. *Siamoglaris zebrina* Lienhard, female, scanning electron micrographs (made by A. Piuz, MHNG): (a) Abdominal apex (ventral side above, paraprocts left). (b) Posteroventral margin of external gonapophyses (same position as in Fig. 3a). (c) Papilliferous setae on posteroventral margin of external gonapophysis. (d) Papilliferous seta on posteroventral margin of external gonapophysis (same seta also recognizable in Fig. 3b, slightly left above middle). (e) Ditto (other seta, not recognizable in Fig. 3b). (f) Detail of apical part of same seta.

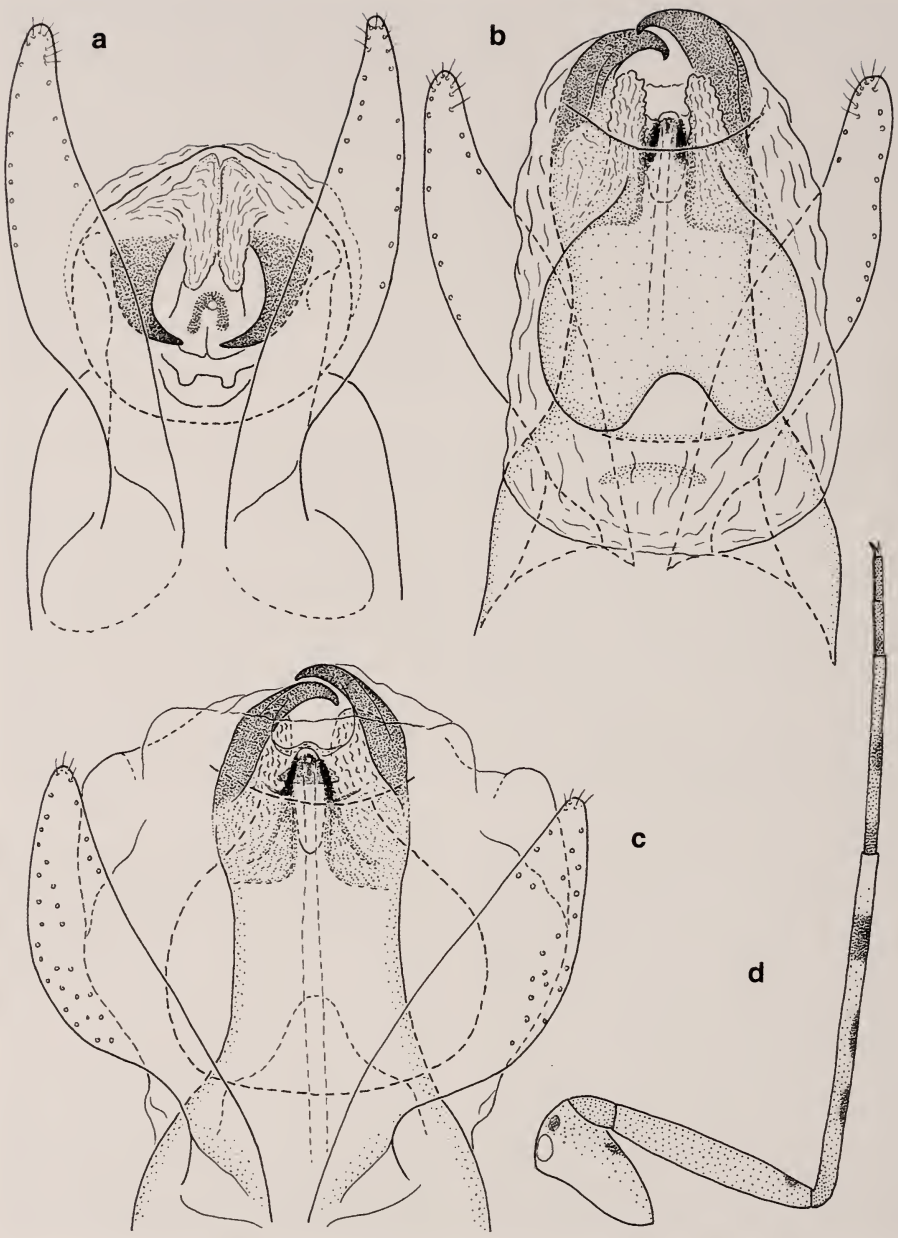


FIG. 4

Siamoglaris zebrina Lienhard, male: (a) Posterior part of phallosome (dorsal view) with retracted distal structures. (b) Ditto (same specimen, ventral view) after artificially provoked eversion of distal structures (see Material and methods). (c) Ditto (other specimen, dorsal view) with naturally everted distal structures and swollen membranous blisters. (d) Hindleg (pilosity not shown).

trated here in the retracted (Fig. 4a) and in the everted position (Fig. 4b, c). In Fig. 4c the membranous blisters of this region of the phallosome are presented in the swollen position, though not exhibiting the maximal swelling as shown for the holotype by Lienhard (2004: fig. 11). In this figure of the holotype the slightly concave mediodistal margin of the reticulate membrane is not well recognizable (probably due to the excessive swelling of lateral blisters), but in the re-examined phallosome of the holotype it is well visible (blisters collapsed after permanent slide-mounting). The eversion of the distal structures of the phallosome could be directly observed under the stereo - microscope for the specimen shown in Fig. 4a, b (see Material and methods). In the retracted position the distal part of the phallosome is anterodorsally folded and the tips of the pair of sclerotized claspers are anteriorly directed, well visible in dorsal view (Fig. 4a). During eversion this part rises dorsally and finally unfolds backwards, so that the free tips of the hooked claspers are situated at the posterior end of the phallosome (Fig. 4b). Several intermediate states can be observed in alcohol preserved material. When identifying males of *Siamoglaris* one has to pay attention to this phenomenon and not mistake it for variation in the morphology of the terminal structures of the phallosome. For a distinction between *S. zebrina* and *S. theresiae* see Discussion of the latter species.

Almost nothing is known about the biology of this species. The type locality is situated about 200-300 m from the main entrance of Wang Badan Cave, in a rocky limestone region full of subterranean crevices (Lienhard, 2004). The new material has been collected in a very similar limestone region of Kanchanaburi Province. Therefore it seems possible that *Siamoglaris zebrina* has some affinities to caves or similar subterranean habitats, at least during its nymphal life, as known for most Prionoglarididae (see Lienhard *et al.*, 2010a, 2010b).

Siamoglaris theresiae sp. n. Figs 5-6

HOLOTYPE: QSBG, ♂ (on 3 microscopical slides), Thailand, Chiang Mai Province, Doi Chiang Dao Wildlife Sanctuary, nature trail, 491m, Malaise trap, 30.ix-7.x.2007, leg. Songkran & Apichart, T3174.

PARATYPES: MHNG, 2♂, Thailand, Kamphaeng Phet Province, Mae Wong National Park, Chong Yen, 1306m, Malaise trap, 8-15.x.2007, leg. C. Piluek & A. Inpuang (T3686) and 17-24.iii.2008, leg. C. Piluek (T3641).

DESCRIPTION OF MALE (female unknown): Habitus as in *S. zebrina* (cf. Fig. 1). Colouration in general as describd for *S. zebrina* by Lienhard (2004), with the following slight differences: head anteroventrally with more dark pigment (Fig. 5a); colour pattern of the legs highly contrasted, femora with a dark brown transversal band of hypodermal pigment in 2/3 of their length (Fig. 5i); some brown pigmentation present along the pterostigmal veins in forewing (Fig. 6a of PT, forewings of HT damaged). Colour pattern of eyes not well-preserved in the specimens examined (after 2-3 years in alcohol) but still partially visible (Fig. 5a). General morphology as described for *S. zebrina* by Lienhard (2004), with the following differences. Vertex with a pair of small lateral protuberances near compound eyes (Fig. 5a). Antennae damaged in all specimens examined. Both maxillary palps broken in HT. Maxillary palp of PT (sample T3641) as figured for *S. zebrina* by Lienhard (2004: figs 1 and 10), its terminal article with 5 thin-walled conical sensilla in apical half (as figured for

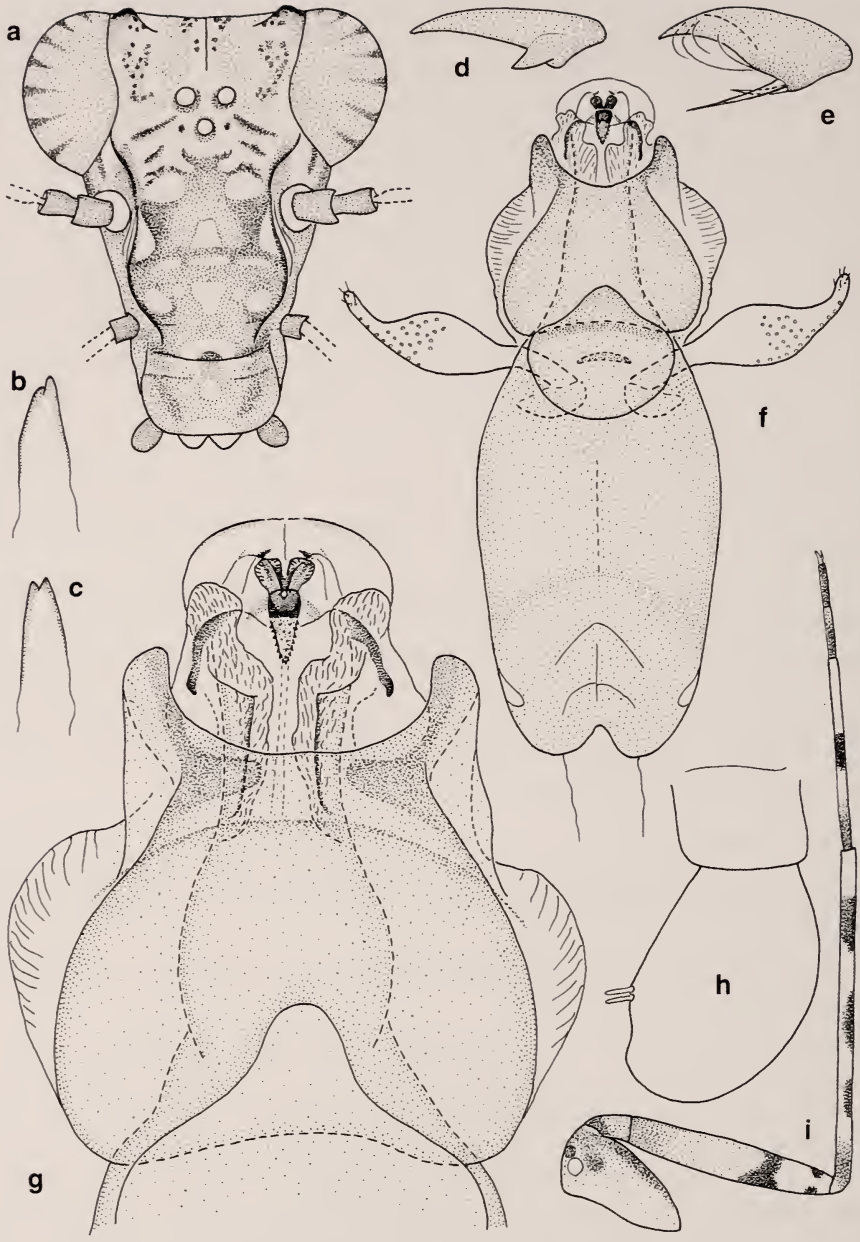


FIG. 5

Siamoglaris theresiae sp. n., male holotype: (a) Head (frontal view, pilosity not shown). (b) Remnant of left lacinia (length about 70 μm). (c) Remnant of right lacinia. (d) Posterior pretarsal claw of midleg (internal view). (e) Anterior pretarsal claw of midleg (external view). (f) Phallosome (ventral view) with naturally everted distal structures and slightly swollen blisters. (g) Posterior part of phallosome (ventral view) showing details of everted distal structures. (h) Labial palpus (pilosity not shown, except for thin-walled internal sensilla). (i) hindleg (pilosity not shown).

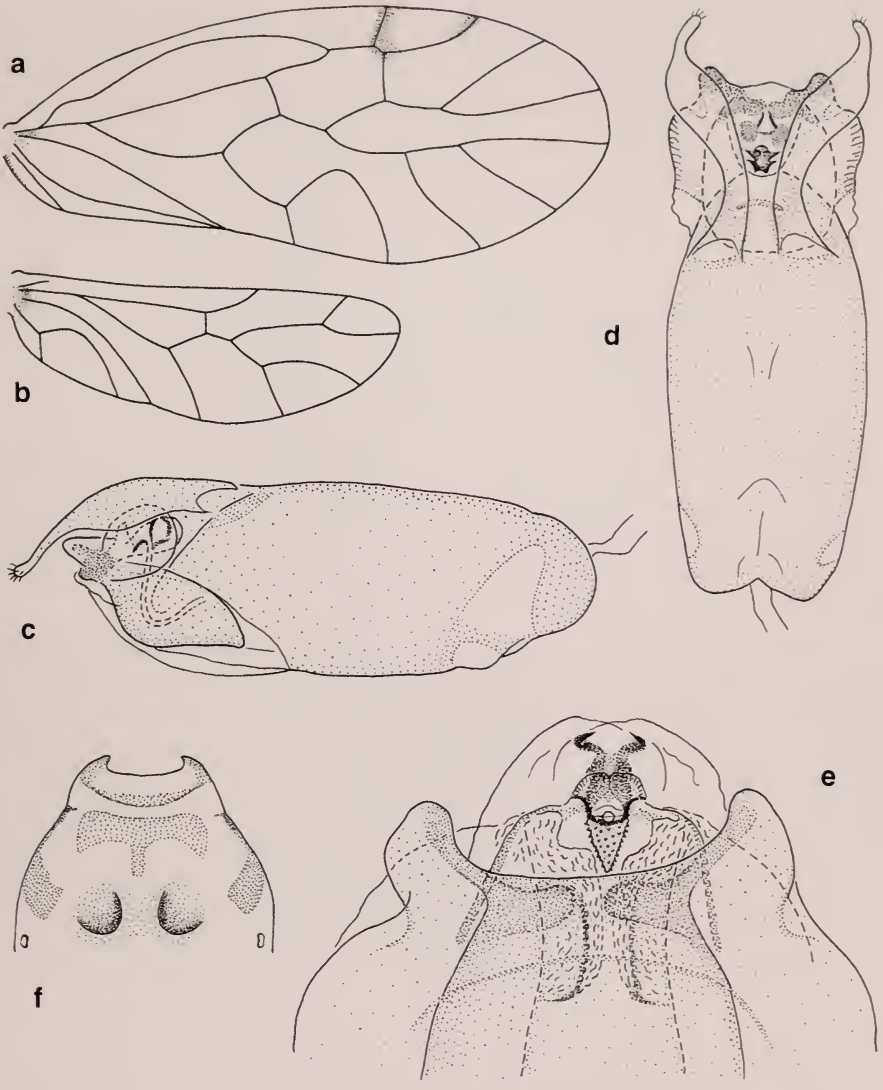


FIG. 6

Siamoglaris theresiae sp. n., male paratype (sample T3686): (a) Forewing. (b) Hindwing. (c) Phallosome (lateral view) with retracted distal structures. (d) Ditto (dorsal view). (e) Posterior part of phallosome (ventral view) with artificially provoked partial eversion of distal structures (see Material and methods). (f) Abdominal base (dorsal view) showing pair of small hemispherical humps anteromedially of spiracles of segment 3.

S. zebrina by Lienhard, 2007: fig. 3b). Remnant of lacinia relatively short (length about 70 μm), apically weakly sclerotized and slightly bidenticulate (Fig. 5b, c). Anterodorsal region of abdomen with a pair of small hemispherical humps (Fig. 6f). Terminalia (Figs 5f-g, 6c-e): Epiproct, paraproct and hypandrium simple, similar to those of *S. zebrina* (Lienhard, 2004: figs 14, 15). Apex of dorsolateral appendages of

phallosome rather abruptly narrowed (Figs 5f, 6d). Shape of apical part of phallosome variable due to movable distal structures and inflatable membranous blisters. For a view of all structures completely everted see Fig. 5f, g; for apical structures retracted see Fig. 6c, d; for partially everted apical structures see Fig. 6e. Eversible structures lacking conspicuous hooked claspers but bearing a small finely spiculate conical lobe near opening of ejaculatory duct; this median lobe directed anteriad after eversion of the apical structures of the phallosome (Figs 5f, g and 6e); distal part of ejaculatory duct curved in retracted state (Fig. 6c, interrupted lines). Medioventral process (sensu Lienhard, 2004) posteriorly delimited by a transversal reticulate membrane bearing a pair of slightly sclerotized posterolateral lobes (Figs 5f, g and 6e); these conspicuous lobes also visible in retracted state (Fig. 6d). Measurements (HT except for wing lengths): BL = 2.3 mm; FW = 4.0 mm (PT); HW = 2.7 mm (PT); F = 846 μm; T = 1450 μm; t1 = 804 μm; t2 = 210 μm; t3 = 193 μm; IO/D = 1.06.

Etymology: The species is dedicated to my friend and colleague Thérèse Cuche (MHNG) in recognition of her invaluable assistance in my research on Psocoptera during more than 20 years. After retiring in 2007 she continues to work voluntarily for the Geneva Museum. Due to her competent sorting to morphospecies and labeling of the thousands of psocids collected by the TIGER-project this fascinating material became accessible to scientific studies.

Discussion: The new species is easy to distinguish from *S. zebrina* by the presence of a pair of small protuberances of the vertex, near the compound eyes (Fig. 5a), and of a pair of small hemispherical humps anterodorsally on the abdomen (Fig. 6f). These characters are probably present in both sexes, but as the female is unknown, the possibility of sexual dimorphism cannot be ruled out. Two colour characters should also be mentioned here, although probably of limited diagnostic value, i.e. the presence, in *S. theresiae*, of a brown transversal band in about 2/3 of the femora (Fig. 5i) and of some brown pigmentation along the pterostigmal veins in the forewing (Fig. 6a). The phallosomes of the two species of *Siamoglaris* differ by the shape of the dorsolateral appendages, distally more abruptly narrowed in *S. theresiae* (Figs 5f, 6d) than in *S. zebrina* (Fig. 4), by the presence of a pair of sclerotized terminal claspers in *S. zebrina* (Fig. 4), absent in *S. theresiae* (Figs 5f, g and 6d, e), by the presence of a pair of slightly sclerotized lateral lobes at the posterior margin of the medioventral part in *S. theresiae* (Figs 5f, g and 6d, e), absent in *S. zebrina* (Fig. 4), and by some details of the eversible posterior structures, especially the presence, medially near the opening of the ejaculatory duct, of a spiculate conical lobe in *S. theresiae* (Figs 5g, 6e) which could not be observed in *S. zebrina* (Fig. 4b, c). The mechanism of everting the distal parts of the phallosome (observed in one paratype) corresponds to that described for *S. zebrina*. For *S. theresiae* it has to be noted that the characteristic spiculate conical lobe near the opening of the ejaculatory duct is difficult or impossible to observe in the retracted state (Fig. 6d).

Almost nothing is known about the biology of *S. theresiae*. The type locality is situated at the foot of a large limestone mountain with caves (e. g. Chiang Dao Cave) and subterranean crevices (Peter Schwendinger, pers. comm.). The paratypes were collected in a area with isolated limestone outcrops. Therefore it seems possible that

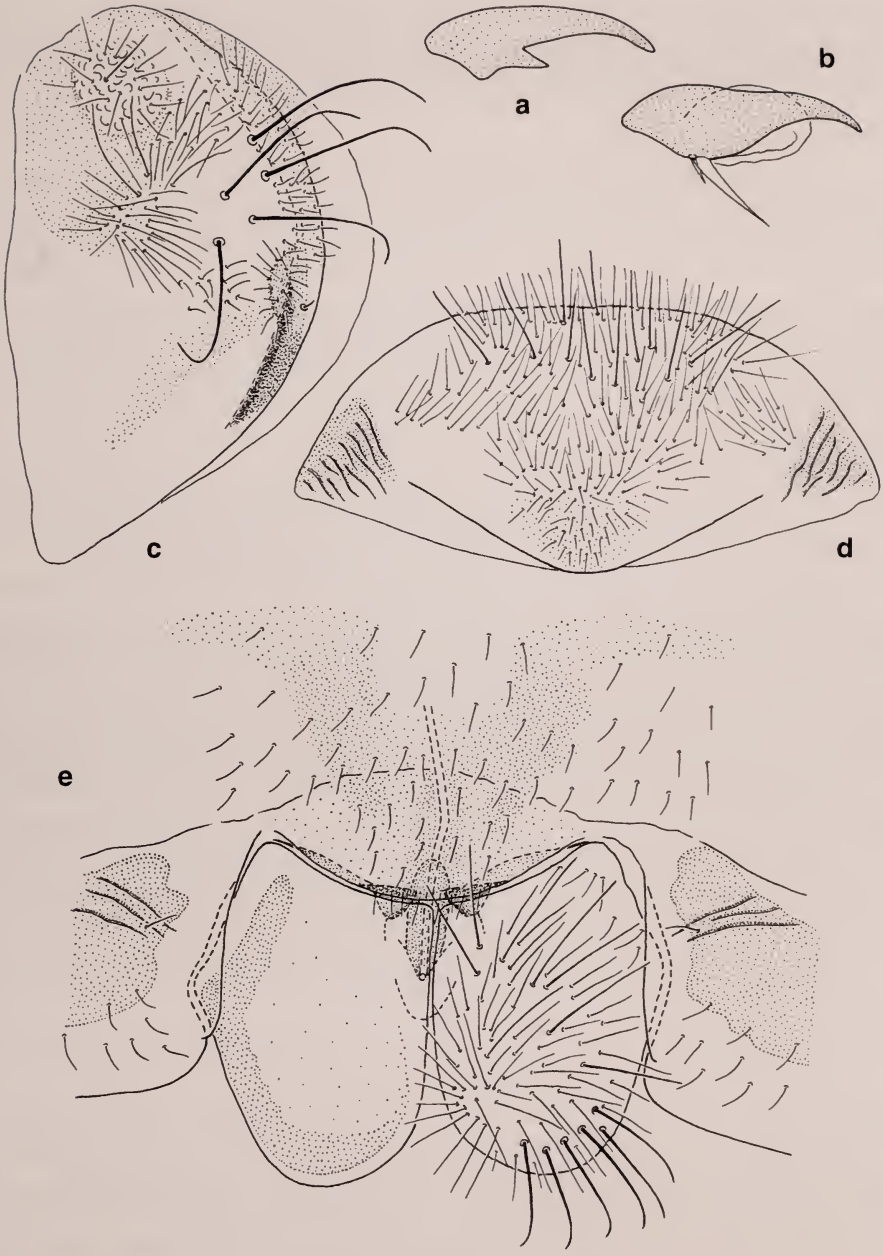


FIG. 7

Prionoglaris stygia Enderlein: (a) Posterior pretarsal claw of hindleg (internal view). (b) Anterior pretarsal claw of hindleg (external view). (c) Left paraproct of female (specimen from the type locality). (d) Epiproct of female (same specimen; posterior margin pointing to bottom of figure plate). (e) Subgenital plate, ovipositor valvulae (pilosity on right side not shown), ventrolateral parts of clunium, spermapore region and distal part of spermathecal duct (same specimen).

also this species has some affinities to caves or similar subterranean habitats, at least during its nymphal life, as has been observed in most Prionoglarididae and postulated for *S. zebrina* (see Discussion of the latter species, above).

ACKNOWLEDGEMENTS

I am very grateful to Michael Sharkey and Stephanie Clutts (both University of Kentucky, Lexington, KY, USA) for entrusting the Psocoptera collected in the course of the TIGER-project to the MHNG, to Thérèse Cuche (MHNG) for her tireless sorting and labeling of this huge collection, to Kazunori Yoshizawa (Hokkaido University, Sapporo, Japan) and Peter Schwendinger (MHNG) for reviewing the manuscript and making valuable suggestions, to André Piuz (MHNG) and Manuela Lienhard (St Blaise) for technical assistance and to John Hollier (MHNG) and Jean Wüest (Geneva) for interesting discussions.

REFERENCES

Grassé, P. P. 1975. Phanères épidermiques (pp. 48-67). In: Grassé. P. P. (ed.). Insectes: téguments, système nerveux, organes sensoriels. Traité de Zoologie, vol. VIII, fasc. III. *Masson, Paris*, 910 pp.

Hu, F., Zhang, G. N. & Wang, J. J. 2009. Antennal sensillae of five stored-product psocids pests (Psocoptera: Liposcelididae). *Micron* 40: 628-634.

Lienhard, C. 1988. Vorarbeiten zu einer Psocopteren Fauna der Westpaläarktis. IV. Die Gattung *Prionoglaris* Enderlein (Psocoptera: Prionoglarididae). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 61: 89-108.

Lienhard, C. 1998. Psocoptères euro-méditerranéens. *Faune de France* 83: XX+517 pp.

Lienhard, C. 2004. *Siamoglaris zebrina* gen. n., sp. n., the first representative of Prionoglarididae from the Oriental Region (Insecta: Psocoptera). *Revue suisse de Zoologie* 111(4): 865-875.

Lienhard, C. 2007. Description of a new African genus and a new tribe of Speleketorinae (Psocodea: 'Psocoptera': Prionoglarididae). *Revue suisse de Zoologie* 114(3): 441-469.

Lienhard, C. & Smithers, C. N. 2002. Psocoptera (Insecta): World Catalogue and Bibliography. *Instrumenta Biodiversitatis (Muséum d'histoire naturelle, Genève)* 5: xli+745 pp.

Lienhard, C., Holuša, O. & Grafitti, G. 2010. Two new cave-dwelling Prionoglarididae from Venezuela and Namibia (Psocodea: 'Psocoptera': Trogiomorpha). *Revue suisse de Zoologie* 117(2): 185-197. (= Lienhard *et al.*, 2010a).

Lienhard, C., Oliveira do Carmo, T. & Lopes Ferreira, R. 2010. A new genus of Sensitibillini from Brazilian caves (Psocodea: 'Psocoptera': Prionoglarididae). *Revue suisse de Zoologie* 117(4): 611-635. (= Lienhard *et al.*, 2010b).

Sellnick, M. 1960. Oribatei (Nachtrag). *Tierwelt Mitteleuropas* 3 (Lief. 4): 45-134.

Slifer, E. H. & Sekhon, S. S. 1977. Sense organs on the antennal flagellum of psocids (Insecta, Psocoptera). *Journal of Morphology* 151(3): 315-323.

Weidner, H. 1993. Bestimmungstabellen der Vorratsschädlinge und des Hausungeziefers Mitteleuropas. 5th rev. ed. *Gustav Fischer, Stuttgart*, XI + 328 pp.

Wüest, J. 1996. L'appareil à phéromone d'*Argynnis paphia* et de *Mesoacidalia aglaja* mâles (Lépidoptères, Nymphalides) en microscopie électronique à balayage. *Bulletin romand d'entomologie* 14: 47-56.

Yoshizawa, K. & Johnson, K. P. 2006. Morphology of male genitalia in lice and their relatives and phylogenetic implications. *Systematic Entomology* 31: 350-361.

Yoshizawa, K., Lienhard, C. & Johnson, K. P. 2006. Molecular systematics of the suborder Trogiomorpha (Insecta: Psocodea: 'Psocoptera'). *Zoological Journal of the Linnean Society* 146: 287-299.

Revue suisse de Zoologie 118 (2): 307-318; juin 2011

Centrorhynchidae (Acanthocephala) including the description of new species of *Centrorhynchus* from birds from the Côte d'Ivoire, Africa.

Lesley R. SMALES
Parasitology Section, South Australian Museum, North Terrace, Adelaide 5000 South Australia, Australia. Email: l.warner@cqu.edu.au

Centrorhynchidae (Acanthocephala) including the description of new species of *Centrorhynchus* from birds from the Côte d'Ivoire, Africa. - Centrorhynchidae, including *Centrorhynchus chabaudi*, Golvan, 1958, and two new species *C. mariauxi* and *C. halcyonicola* are reported from the Côte d'Ivoire, for the first time. The new species are distinguished from congenerics by a combination of proboscis armature and the morphometrics of the male reproductive system.

Keywords: Parasite - Acanthocephala - *Centrorhynchus* - Africa - Côte d'Ivoire - birds - *Accipiter* - *Halcyon* - *Kaupifalco*.

INTRODUCTION

The Centrorhynchidae (Palaeacanthocephala) is a cosmopolitan family occurring in birds and mammals and comprising three genera; *Centrorhynchus* Van Cleave, 1916, usually found in raptores, *Sphaerirostris* Golvan, 1956, usually found in passerines (Corvidae and Turdidae) and *Neolacunisoma* Amin & Canaris, 1997 found in shorebirds (Golvan, 1956, 1960, 1994; Amin & Canaris, 1997). *Centrorhynchus* is a large genus of about 90 known species (Golvan, 1994, Richardson & Nickol, 1995; Khan *et al*., 2001, 2002a; Bhattacharya, 2003; Bilqees & Khan, 2005; Ghazi *et al*., 2005; Lunaschi & Drago, 2010). The exact number of valid species in the genus is difficult to determine because the literature is confounded by many synonymies and misidentifications, some yet to be resolved. The species of *Centrorhynchus* described by Khan *et al*. (2002b) from a house crow, for example, may on further examination be found to belong in the genus *Sphaerirostris*. Eleven species, including *Centrorhynchus chabaudi* Golvan, 1958, *C. gendrei*, Golvan, 1957, *C. globocaudatus* (Zeder, 1800) and *C. milvus* Ward, 1956 from West Africa, have been reported from the African continent (Ward, 1956; Golvan, 1957, 1958; Dimitrova & Gibson, 2005). No centrorhynchids have been reported as yet from the Republic of the Côte d'Ivoire.

Between 1985 and 1988, during the course of a Ph D project of Dr J. Mariaux to study the cestode parasites of the birds of the Republic of Côte d'Ivoire, an incidental collection of Acanthocephala from 22 species representing 15 families of birds was made. Within this collection three bird species were infected, one with *C. chabaudi* and two with new species of *Centrorhynchus*. In this paper a redescription of *C. chaubaudi*, with new host records and geographic locations documented, is given and the new species of *Centrorhynchus* are described.

Manuscript accepted 11.10.2010

MATERIALS AND METHODS

The birds examined included 8 individuals of 3 species from 2 families. The collection localities of hosts from which *Centrorhynchus* spp. were dissected, with the number of hosts examined in parentheses were as follows:

Halcyon malimbica forbesi (Shaw, 1811) from Korhogo 9° 27'N 4°03'W and Lamto Research Station 6° 13'N 5°00'W (5);

Kaupifalco m. monogrammicus (Temminck, 1824) from Lamto 6° 13'N 5°00'W (2);

Accipiter badius sphenuris Gmelin, 1788 from Lamto 6° 13'N 5° 00'W (1).

On dissection all specimens were fixed with neutral buffered 4% formalin and stored in 75% ethanol. Before microscopic examination all specimens were cleared in lactophenol or beechwood creosote to be studied as wet mounts. All measurements were taken using an eyepiece micrometer and are given in micrometers unless otherwise stated. Figures were drawn with the aid of a drawing tube.

Golvan's (1994) review of the Acanthocephala has been used as the foundation source for listing the valid species of *Centrorhynchus* supplemented by information from all the more recent publications. All specimens collected for this study are registered in the Muséum d'Histoire Naturelle, Geneva, Switzerland (MHNG).

RESULTS

The three species of *Centrorhynchus* found are given in Table 1. These all represent new host and locality records. Comparative measurements of all the species of *Centrorhynchus* known to occur in West Africa are given in Table 2.

TABLE 1. Acanthocephala from three bird hosts from the Republic of Côte d'Ivoire, West Africa, collected between 9.02.1987 and 13.02.1987.

Host	Host field no.	Locality	Centrorhynchidae
Accipitridae			
Accipiter badius	CI 618	Lamto	*Centrorhynchus chabaudi*
Kaupifalco monogrammicus	CI 586	Lamto	*Centrorhynchus mariauxi*
Alcedinidae			
Halcyon malinbica	CI 625	Lamto	*Centrorhynchus halcyonicola*
	CI 519	Korhogo	*Centrorhynchus halcyonicola*

TABLE II Comparative measurements of *Centrorhynchus* spp. from West Africa; data from Dimitrova

	C. chaubadi		*C. gendrei*		*C. globocaudatus*
	male	female	male	female	male
Trunk length mm	22	48	46	84	22
Neck length	150	450	-	-	500
Proboscis length	884	1350	800	1300	1030
rows hooks	30-34		38-40		30-32
hooks per row	17-23		34-40		20-21
true hooks thorn length	55-96		38-84		45-67.5
Proboscis receptacle length	2250	2200	1500		1400
Lemnsci length	2900	3400	2000-2500		2100
Testes	935x425		350x 160		820x440
	1020x408		400x120		900x450
Cement glands mm	11.4		29		12.6
Genital apparatus female, length		2000		2000	
Egg		60x23		30-35x20-22	

Centrorhynchus chabaudi Golvan, 1958 Figs 1-4

MATERIAL EXAMINED: One male, one immature female from *Accipiter badius* Gmelin, 1788, small intestine; Côte d'Ivoire, Lamto, 12.02.1987, J. Mariaux (MNHG INVE 38488).

DESCRIPTION

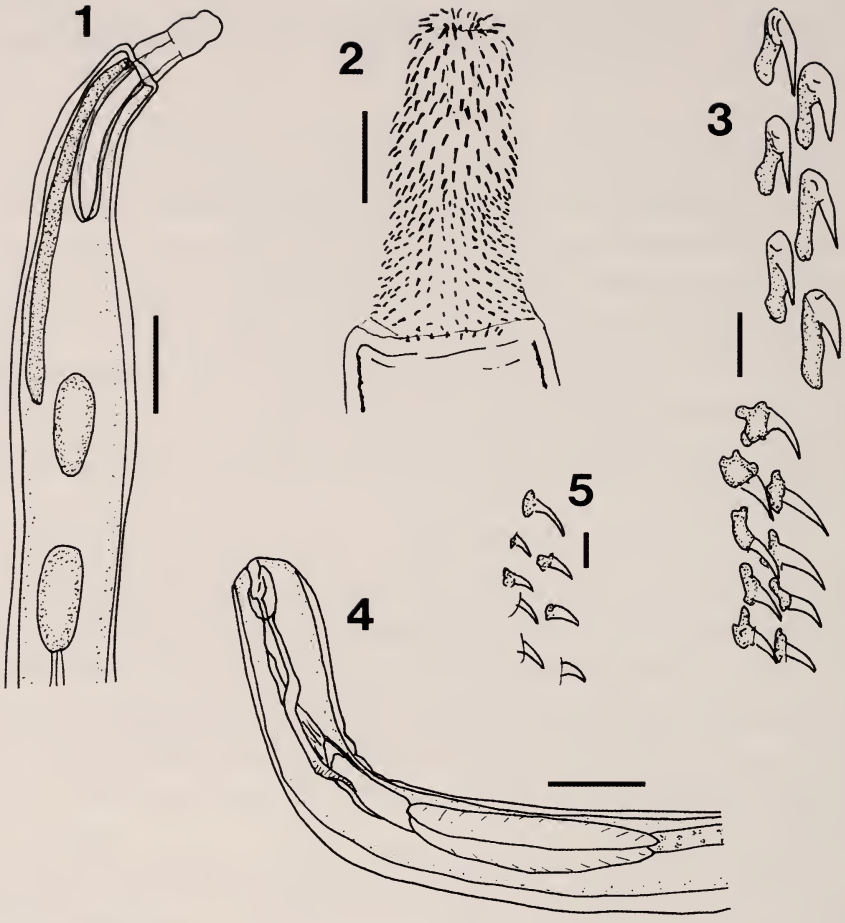
General: Trunk spineless, elongate, sub cylindrical, dilated anteriorly in region of lemnisci and proboscis receptacle. Proboscis in 2 parts, widest anterior to constriction, constriction at insertion of proboscis receptacle about 55-63% of distance from apex to proboscis base. Proboscis armed with 30-34 rows 15-22 hooks and spines. Anterior 4-5 hooks with large simple roots, next 5-6 hooks transitional with short roots with luniform- cresentic manubria, next 6-11 hooks spiniform, inserted on posterior part of proboscis, the more anterior of these with small, roughly triangular shaped roots. Neck spineless, well defined, shorter than broad. Proboscis receptacle double walled. Lemnisci tubular, inserted at base of neck, extend posteriorly beyond proboscis receptacle. Cerebral ganglion located at mid region of proboscis receptacle, just posterior to neck. Principal canals of lacunar system lateral, connected by transverse anastomoses.

Male: based on one specimen. Trunk 22 mm long, 1200 at widest part. Proboscis total length 884, greatest width 340, just anterior to constriction; posterior part 374 long. Hooks I-V thorns 55-80 long, hooks V-XI thorns 40-50 long, spines X-XXII 20-40 long. Neck 150 long, 374 wide at base. Proboscis receptacle 2250 long, 350 wide; lemnisci 2900 long. Testes oval, tandem, not contiguous, 0.5mm apart; anterior testis, 3.06 mm from anterior end of trunk, 935 long, 425 wide; posterior testis 1020 long, 408 wide. Cement glands elongate, tubular, begin immediately posterior to posterior testis, 11.4 mm long; number not determined; cement ducts elongated, 2805 long; Saefftigen's pouch and retracted bursa 2210 long; entire male system occupying about 86% trunk length.

Female: based on 1 immature female. Trunk 15 mm long, dilated anterior portion 3060 long, 510 wide, main trunk 255 wide. Proboscis partially inverted about 910 long, greatest width 400, just anterior to constriction; posterior part 370 long.

et al., 1995, Golvan, 1956, 1957, 1958; Ward, 1956; Dimitrova & Gibson, 2005; and this study.

C. milvus		*C. mariaux*			*C. halcyonicola*
female	male	female	male	female	male
20-21	12-20	24-48	25	70+	20
600-800	150	-	300	-	-
1110-1130	800-1000	1100-1200	605	780	640
36-38	28-38		34-36		38-40
18	18-26		15-19		14-17
41-60	35-50		20-25.5		40-45
1100-1200	1300-1350	1600	1360	1400-2200	1370
	1800	2800	1273	1615	1530
	800x300		525x268		40x340
	1100x500		556x275		510x290
	5-10		17.5		14
2440		1000		2000	
		45-50x20-24		45x22	



FIGS 1-5

Centrorhynchus chabaudi Golvan, 1958. (1) Male anterior end. (2) Male proboscis showing armature. (3) Male anterior and transitional hooks. (4) Male posterior end. (5) Male spiniform hooks. Scale bars: 1, 4, 750 μm; 2, 200μm; 3, 50 μm; 5, 10 μm.

Hooks V-VII 30-40 long, spines 20-26. Neck 135 long by 400 wide. Proboscis receptacle 1020 long, 205 wide; lemnisci 3400 long. Genital apparatus not observed, no mature eggs seen. Genital pore sub terminal.

COMMENTS: *Centrorhynchus chabaudi* was described by Golvan (1958) from two female worms up to 48mm long, main trunk 1000 wide, with a proboscis armature of 30-34 longitudinal rows of 15-16 hooks. The proboscis was 1350 long and 650 wide just anterior to the constriction and 700 wide at the base, with the neck 850 long by 450 wide. Hooks I-V thorns 55-96 long, hooks VI-X thorns 57-67 long, spines XVI 36 long. Neck 450 long, 850 wide at base. The proboscis receptacle was 2200 long by 400

wide and the lemnisci about 2000 long. Golvan (1958) also described the female genital apparatus (uterine bell to genital pore, 2000 long, genital pore sub terminal, at base of distinct terminal digitiform process) and eggs (oval, external shell thickened, sculptured with longitudinal ridges and grooves, 60 long, 23 wide).

The type host *Gyps africanus* (Salvadore, 1865) was given as *Pseudogyps africanus*, the white backed vulture, collected from Nioro du Sahel in 'the Sudan.' This locality is a town in the Kayes Region of the Republic of Mali bordering on the Côte d'Ivoire to the south. There have been no further records of *C. chabaudi* since then.

The two specimens, both the male and the immature female, from *A. badius* from Lamto in the Côte d'Ivoire conformed to the description given by Golvan (1958) as to general body shape and the proportions of the proboscis and lemnisci and in particular to the proportions and shapes of the proboscis hooks and spines. The proboscis armature varied only in the number of spines in each row. The number of spines on the specimens examined by Golvan (1958) is not clear. He describes the proboscis armature as having a total of 15 or 16 hooks, which would give 6- 7 spines per row. In his figure 4, however, a total of 17 hooks is shown. This would suggest 6-8 spines for the specimens from Nioro du Sahel compared with the 10-11 spines for the specimens from Lamto. This variation in number of spines can be accommodated as either individual variation (only four worms having been examined in total) or perhaps host induced variation. The finding of a male specimen of *C. chabaudi* has enabled the preparation of a more complete description of the species. The number of cement glands, however, three or four, could not be determined from the whole mount of the male and there was no other specimen that could be dissected to confirm the number.

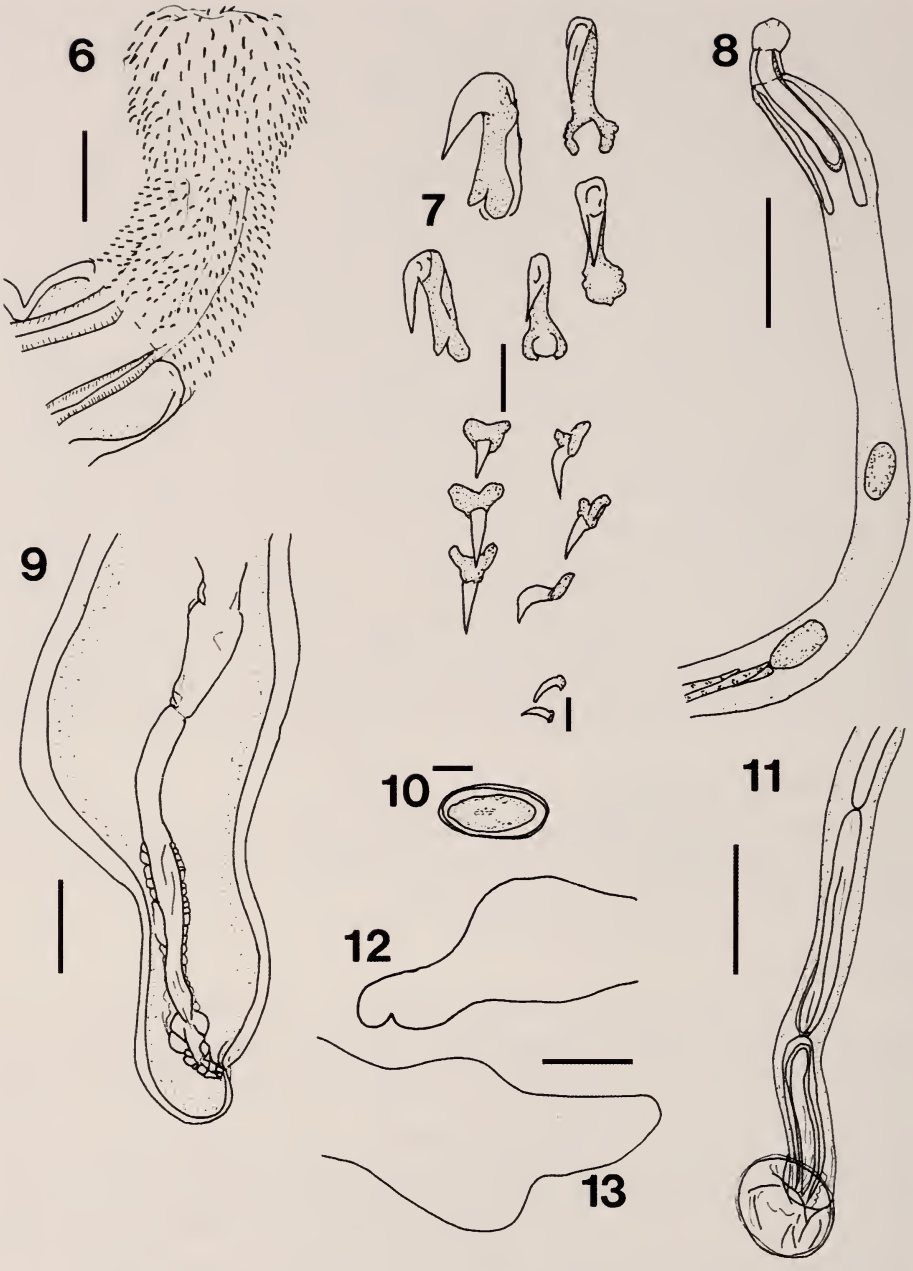
***Centrorhynchus mariauxi* sp. n.** Figs 5-13

MATERIAL EXAMINED: Holotype male, paratypes, 8 pieces males, 2 females without proboscis, 4 pieces females from *Kaupifalco m. monogrammicus* (Temminck, 1824) small intestine; Côte d'Ivoire, Lamto, 9.02.1987, J. Mariaux (MNHG INVE 38486, INVE 69971). Prevalence: 50%.

DESCRIPTION

General: Trunk, spineless, elongate, cylindrical, female dilated posteriorly from about 500 to about 1500 above posterior end. Proboscis in 2 parts with constriction at insertion of proboscis receptacle, about 45% of distance from apex to proboscis base; anterior proboscis sub spherical. Proboscis armed with 34-36 rows 15-19 hooks. Anterior 2-3 hooks with large simple roots, thorns 20-25.5 (male) long; next 4-5 hooks transitional, having short roots with luniform- cresentic manubria, thorns 25.5- 44 (male) long; 9-11 spiniform hooks inserted on posterior part of proboscis posterior to constriction, thorns 20-40 (male) long. Neck spineless, well defined, shorter than broad. Proboscis receptacle double walled. Lemnisci tubular, inserted at base of neck, extend posteriorly beyond proboscis receptacle. Cerebral ganglion located at mid region of proboscis receptacle, just posterior to neck. Principal canals of lacunar system lateral, connected by transverse anastomoses.

Male: based on one intact specimen. Trunk 25 mm long, 1200 at widest part. Proboscis total length 605, greatest width 368; posterior part 335 long 315 wide. Neck



FIGS 6-13

Centrorhynchus mariauxi n. sp. (6) Holotype male, proboscis showing armature. (7) Holotype male, anterior, transitional and spiniform hooks. (8) Holotype male anterior end. (9) Female posterior and showing ovejector. (10) Egg. (11) Holotype male, posterior end showing bursa. (12) Female posterior end lateral view. (13) Female posterior end dorsal view. Scale bars: 6, 9, 200μm; 7a, 35μm; 7b, 18μm; 8, 11, 1mm; 10, 15μm; 12, 13, 500μm.

300 long, 400 wide. Proboscis receptacle 1360 long, 235 wide; lemnisci 1273 long. Testes oval, tandem, not contiguous 1.1mm apart; anterior testis, 3.00 mm from anterior end of trunk, 529 long, 268 wide; posterior testis 556 long, 275 wide. Cement glands, 3, elongate, tubular, begin immediately posterior to end of posterior testis, 17.5 mm long; cement ducts elongated, 1800 long; Saefftigen's pouch 1250 long; entire male system occupying about 88% trunk length.

Female: based on anterior end one specimen, posterior end one specimen and longest piece. Trunk longer than 70mm, main trunk 500-600 wide, dilated posterior part 700-900 wide. Proboscis total length, 780 greatest width 390, posterior part 420 long 350 wide. Proboscis receptacle 1400-2200 long, 290-400 wide; lemnisci 1615 long. Genital apparatus, uterine bell to genital pore, 2000 long. Genital pore sub terminal. Eggs oval, external shell smooth, thick, 45 long, 22 wide.

COMMENTS: *Centrorhynchus mariauxi* n. sp. conforms to the diagnosis of the genus given by Golvan (1956, 1960). In his examination of the morphological characters available in the family for systematic analysis those of the proboscis armature, the number of longitudinal rows of hooks, the number of hooks in each row and the dimensions of the thorns and roots of the hooks were the most useful. Further he determined that the number of hooks per row was the most stable of these characters (Golvan 1956). Accordingly he subdivided the genus *Centrorhynchus* into 3 groups; those species with less than 30 longitudinal rows of hooks, those with 30-40 rows and those with more than 40 rows of hooks. With a proboscis armature of more than 30 rows *C. mariauxi* falls into Group 2 (Golvan 1956). The hook formula of 34-36 longitudinal rows of 15-19 hooks comprising 6-8 hooks with roots and 9-11 spiniform hooks distinguishes it from all other species in that group. Since then about 50 valid species of *Centrorhynchus* have been added to the genus including 20 species that have between 30 and 40 longitudinal rows of hooks.

Species known to occur in continental Africa that have a proboscis armature of 30-40 rows of hooks include *C. chabaudi*, from the Sudan and now the Côte d'Ivoire, *C. gendrei* from the Republic of Guinea, *C. milvus* from Egypt and Senegal, *C. clitorideus* (Meyer, 1931) from Egypt, *C. globocaudatus* from Egypt and West Africa, *C. polemati* Troncy, 1970 from Chad and *C. undulatus* Dollfus, 1951 from Morocco. Of these only *C. chabaudi* with 17-24, *C. milvus* with 18-21 and *C. undulatus* with 21 have a similar number of hooks per row. *C. chabaudi* can be distinguished by having 5-6 anterior hooks with longer thorns, 55-96 compared with 20-25 for *C. mariauxi* and small triangular roots on the anterior-most rows of spiniform hooks. The lemnisci of *C. mariauxi* are shorter and the testes smaller, further apart and more posterior than those of *C. chabaudi* (see Golvan, 1957 and this study). *C. milvus* differs from *C. mariauxi* in the hook pattern and proboscis length; 8-9 hooks with large roots, 5-6 transitional hooks and 5-6 spines on a longer proboscis, 0.8-1.19mm, compared with 2-3 large, 4-5 transitional and 9-11 spiniform hooks on a shorter proboscis, 0.61-0.77 (Ward, 1956; Dimitrova & Gibson 2005). The description of *C. undulatus* (females only) is brief. The only measurements are of the trunk, 15-18 mm, much shorter than for female *C. mariauxi* which are longer than 70 mm. Comparison of text and figures for *C. undulatus* suggests that the proboscis was about 1mm long with an armature of

21 hooks per row comprising 6 with large simple roots, thorns about 35-45 long, 3 transitional forms and 12 spiniform hooks (Dollfus, 1951). These differences seem sufficient to distinguish the two species. Comparative measurements for the west African species are given in table 2.

There are 12 known extra- limital species with 30-40 longitudinal rows of hooks: namely *C. bethaniae* George & Nadakal, 1987, *C. brygooi* Golvan, 1965, *C. conspectus* Van Cleave & Pratt, 1940, *C. crotophagicola* Schmidt & Neiland, 1966, *C. fukiensis*, Wang 1966, *C. guira* Lunaschi & Drago, 2010, *C. hagiangensis* Petrochenko & Phan, 1969, *C. kuntzi* Schmidt & Neiland, 1966, *C. madagascarensis* (Golvan, 1957), *C. nicaraguaensis* Schmidt & Neiland, 1966, *Centrorhynchus* cf p*olymorphus* Travassos, 1926, *C. undulatus* (Nitzsch in Giebel, 1886) (see Dollfus 1951; Golvan 1957, 1965, 1994; Hartwich 1956; Schmidt & Neiland 1966;Wang 1966, George & Nadakal 1987; Richardson & Nickol 1995; Dimitrova *et al.* 1997; Dimitrova & Gibson 2005; Lunaschi & Drago, 2010). None of the species listed, however, has a similar hook pattern to that of *C. mariauxi* with as few as 2-3 true hooks in each row.

The most similar extra-limital species is *C. conspectus* Van Cleave & Pratt, 1940 which has 28-38 rows of 16 -19 hooks of which 4-5 have long simple roots and 12-15 are spiniform, but differs from *C. mariauxi* in having no transitional hooks (Richardson & Nickol 1995). Other species with a similar total number of proboscis hooks differ in numbers and sizes of each hook form. For example *C. nicaraguensis* has 39 rows of 17 hooks but no transitional hooks; and *C. crotophagicola* has 32-35 rows of 15-17 hooks, but differs in having 8-9 hooks with long simple roots and 7-9 hooks with manubria (Schmidt & Neiland, 1966).

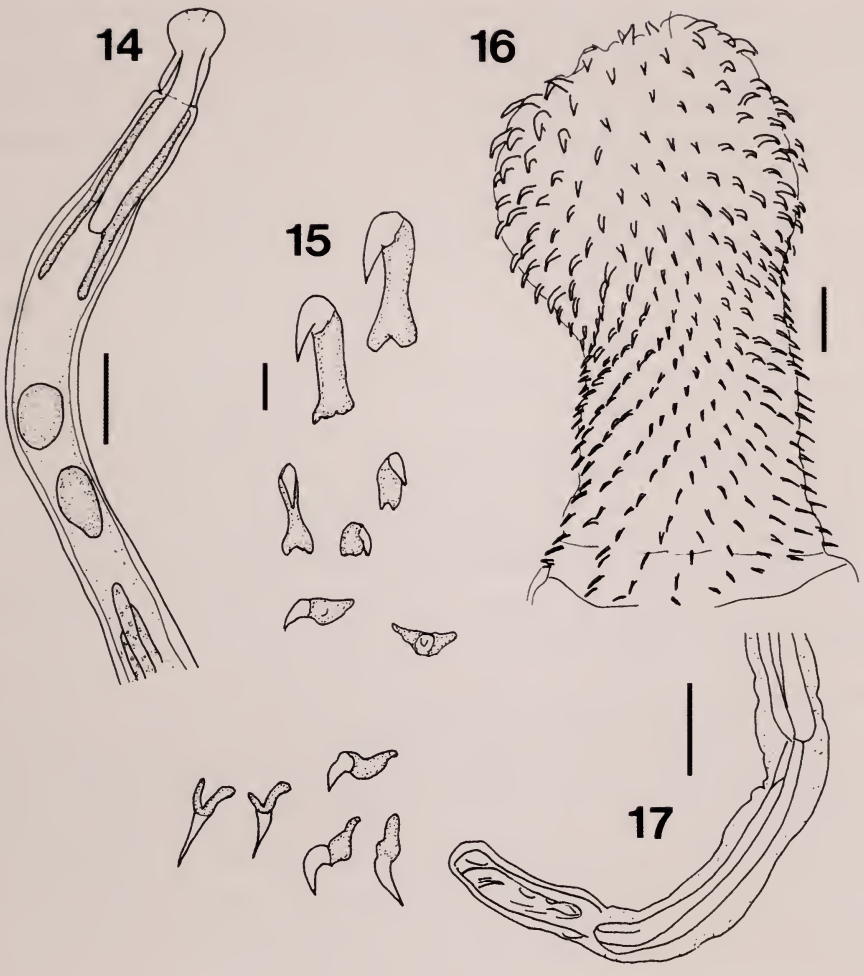
C. acanthotrias (Linstow, 1883) was assigned to *C. buteonis* by Meyer (1932, see Yamaguti 1963), listed as *Echinorhynchus s. l.* by Petrochenko (1985) and under genera incertae sedis by Yamaguti (1963) and Amin (1985). Never the less the species was noted by Petrochenko (1958) as 'obvious that it belongs to the Centrorhynchinae or even *Centrorhynchus*' and listed as a valid species by Golvan (1994). However the description is incomplete. Having 33-40 longitudinal rows of hooks the most anterior ones with straight roots, the median ones with bifurcated roots and the posterior ones with simple roots (Petrochenko 1958) *C. acanthotrias* may also be similar to C. mariauxi.

***Centrorhynchus halcyonicola* sp. n.** Figs 14-17

Material examined: Holotype male from *Halcyon malimbica* (Shaw, 1811) small intestine; Côte d'Ivoire, Korhogo, 27.01.1987, J. Mariaux (MNHG INVE 38485). – 1 male, proboscis missing and 1 piece male from *H. malimbica* small intestine; Côte d'Ivoire, Lamto, 13.02.1987, J. Mariaux (MNHG INVE 38490). Prevalence: 40 %.

Description

General: Trunk, spineless, elongate, cylindrical. Proboscis in 2 parts with constriction at insertion of proboscis receptacle about half way between apex and proboscis base, anterior part sub cylindrical. Proboscis armed with 38-40 rows 14-17 hooks. Anterior 2-3 hooks with large simple roots, thorns 40-40.5 long; next 2-3 hooks transitional, having laterally directed manubria, thorns 25- 30 long; next 2 hooks tran -



FIGS 14-17

Centrorhynchus halcyonicola n. sp. (14) Holotype male, anterior end. (15) Holotype male, anterior transitional and spiniform hooks. (16) Holotype male, proboscis showing armature. (17) Holotype male, posterior end, bursa not everted. Scale bars: 14, 17, 500μm; 15, 20μm; 16, 80μm.

sitional with anteriorly directed manubria, thorns 40 long; 8-9 spiniform hooks inserted on posterior part of proboscis posterior to constriction, thorns 20-40 long. Neck spineless, not well defined. Proboscis receptacle double walled. Lemnisci tubular, inserted at base of neck, extend posteriorly beyond proboscis receptacle. Cerebral ganglion located at mid region of proboscis receptacle. Principal canals of lacunar system lateral, connected by transverse anastomoses.

Male: measurements taken from holotype. Trunk 20 mm long, 400 at widest part. Proboscis total length 640, greatest width 335; posterior part 335 long 268 wide.

Proboscis receptacle 1370 long 205 wide; lemnisci 1530 long. Testes oval, tandem, close together, not contiguous 150 apart; anterior testis, 1.8 mm from anterior end of trunk, 440 long, 340 wide; posterior testis 510 long, 290 wide. Cement glands, 3, elongate, tubular, begin posterior to posterior testis, 14 mm long; cement ducts elongated, 1955 long; Saefftigen's pouch and infolded bursa 1105 long; entire male system occupying about 85% trunk length.

COMMENTS: Although only male specimens were available for examination they were sufficiently distinctive to allow differentiation from all other species of *Centrorhynchus*. Despite the proboscis being slightly inverted in the only intact specimen the total length and hook formula could be calculated by observing the clearly visible inverted portion of the proboscis. *Centrorhynchus halcyonicola* sp. n. with a proboscis armature of 38-40 rows of 14-17 hooks falls within the same group as *C. mariauxi* as discussed above. Within that group *C. halcyonicola* is closest to *C. mariauxi* which has 34-36 rows of 15-20 hooks, 2-4 of which are hooks with large simple roots. The shapes of the roots of the transitional hooks of *C. halcyonicola*, however differ from those of *C. mariauxi* (figs 7, 15), the thorns of the anterior hooks are longer in *C. halcyonicola*, 40-40.5 compared with 20-25.5 and there are fewer spines. *Centroryhnchus halcyonicola* further differs from *C. mariauxi* in the size of the testes, larger in *C. halcyonicola*, and the proportions of the male system, the testes being placed more anteriorly and closer together in *C. halcyonicola*.

Similarly *C. halcyonicola* differs from all other species known from Africa as discussed above for *C. mariauxi*.

The proboscis hook morphology of *C. halcyonicola* is similar to that described for *C. alcuonis* (Müller, 1780) from *Asio atus*, Linneaus, 1758, the long eared owl and *Strix aluco* Linneaus, 1758, the tawny owl from Hungary by Dimitrova *et al.* (1995), particularly in regard to the shapes of the roots of the anterior and transitional hooks. The armature differs, however, in the number of rows of hooks, 38-40 compared with 28 and *C. alcuonis* further differs in the size of the proboscis receptacle, 1370 compared with 1450-1800 and the proportions of the male system (Dimitrova *et al.*, 1995). Both owl species also occur in North Africa supporting the possibility that there could be a link between the two species of *Centrorhynchus*.

DISCUSSION

The hosts and distribution of *C. chabaudi* have been extended in this study to include another West African country, the Republic of the Côte d'Ivoire, and accipitrid host, *A. badius*. The finding of two new species in the Côte d'Ivoire increases the number of species of *Centrorhynchus* known from West Africa from four, *C. chabaudi* from *A. badius* and *Gyps africanus*, *C. gendrei* from *K. monogrammicus* as *Asturinula monogrammica*, *C. milvus* from *Milvus migrans* (Boddart, 1783) and *Lamprophis fuliginosus* (Boie, 1827) as *Boaedon fuliginosus* and *C. globocaudatus* from *Falco ardosiaceus* Viellot, 1823, to six. Five of these species can easily be distinguished by differences in the armature of the proboscis (Golvan, 1956, 1957, 1958; Dimitrova & Gibson, 2005) as well as host species. The sixth, *C. gendrei*, occurs in the same host, *K. monogrammicus*, as *C. mariauxi* but differs in proboscis armature and morpho - metrics (Golvan, 1958).

ACKNOWLEDGEMENTS

My thanks to Prof. Mariaux for giving access to the specimens and for hospitality in Geneva.

REFERENCES

AMIN, M. O. 1985. 4. Classification. *In*: CROMPTON, D. W. T. & NICKOL, B. B. (eds). Biology of the Acanthocephala. *Cambridge University Press, Cambridge*, 519 pp.

AMIN, M. O. & CANARIS A. 1997. Description of *Neolacunisoma geraldschmidti* gen. n., sp. n., (Acanthocephala: Centrorhynchidae) from South African shorebirds. *Journal of the Helminthological Society of Washington* 62: 275-280.

BHATTACHARYA, S. B. 2003. Fauna of Sikkim (part 5) *In*: ALFRED, J. R. B. (ed.) *State Fauna Series* 9: 71-78.

BILQEES, F. M. & KHAN, A. 2005. Two new helminth parasites from Pakistan, with redescription of the acanthocephalan *Centrorhynchus fasciatum* (Westrumb, 1821). *Pakistan Journal of Zoology* 37: 257-263.

DIMITROVA, Z. M. & GIBSON, D. I. 2005. Some species of *Centrorhynchus* Luhe, 1911 (Acanthocephala: Centrorhynchidae) from the collection of the Natural History Museum, London. *Systematic Parasitology* 62: 117-134.

DIMITROVA, Z. M., MURAI, E. & GENOV, T. 1995. Some species of the family Centrorhynchidae Van Cleave, 1916 (Acanthocephala) from Hungarian birds. *Parasitologica Hungarica* 28: 89-99.

DIMITROVA, Z. M., GEORGIEV, B. B. & GENOV, T. 1997. Acanthocephalans of the family Centrorhynchidae (Paleoacanthocephala) from Bulgaria. *Parasitologica Hungarica* 28: 89-99.

DOLLFUS, R. P. 1951. Miscellanea Helminthologica Maroccana I. Quelques Trématodes, Cestodes et Acanthocéphales. *Archives de l'Institut Pasteur du Maroc* 4: 104-229.

GEORGE, P. V. & NADAKAL A. M. 1987. *Centrorhynchus bethaniae* sp. n. (Acanthocephala: Gigantorhynchidae) from bird, *Accipter badius* (Gemlin) of Kerala India. *Japanese Journal of Parasitology* 36: 9-12.

GHAZI, R. R., KHAN, A. & NOORUN-NISA, M. 2005. Two new species of helminth parasites from frog (*Rana tigrina* Daudin). *Pakistan Journal of Zoology* 37: 107-111.

GOLVAN, Y. J. 1956. Le genre *Centrorhynchus* Lühe 1911 (Acanthocephala- Polymorphidae) Révision des espèces européennes et description d'une nouvelle espèce africaine parasite de rapace diurne. *Bulletin de l'instut Française Afrique Noire* 20: sér. A: 732-785.

GOLVAN, Y. J. 1957. Acanthocéphales d'oiseaux, sixième note deux espèces nouvelles parasites d'oiseaux d'Afrique occidentale Française: *Gordiorhynchus (Gordiorhynchus) gendrei* n. sp. et *Pseudogordiorhynchus antonmeyeri* n. gen et n. sp. *Annales de Parasitologie* 32: 83-97.

GOLVAN, Y. J. 1958. Acanthocéphales d'Afrique occidentale française récoltés par le Dr Pierre-Claude Morel. *Bulletin de l'instut Française Afrique Noire* 20: sér. A: 60-72.

GOLVAN, Y. J. 1960. Le Phylum des Acanthocephala 3^{e} note La Classe des Paleoacanthocephala (Meyer 1931). *Annales de Parasitologie* 35: 575-593.

GOLVAN, Y. J. 1965. Acanthocéphales de Madagascar récoltés par E.R. Brygoo. *Annales de Parasitologie* 40: 303-316.

GOLVAN, Y. J. 1994. Nomenclature of the Acanthocephala. *Research and Reviews for Parasitology* 54: 135-205.

HARTWICH, G. 1956. Südamerikanische Acanthocephalen aus der Zoologischen Sammlung des Bayerischen Staates. *Zoologicher anzeiger* 156: 229-308.

KHAN, A., GHAZI, R. R. & BILQEES, F. M. 2001. Acanthocephalan parasite *Centrorhynchus nickoli* n. sp. from Eurasian Roller (*Coracias garrulous* Linn). *Proceedings of Parasitology* 32: 33-39.

Khan, A., Khatoon, N. & Bilqees, F. M. 2002a. *Centrorhynchus sindhensis*, New Species (Acanthocephala: Centrorhynchinae) from the snake (Naja naja) intestine. *Pakistan Journal of Zoology* 34: 309-310.

Khan, A., Rafia, R. G. & Bilqees, F. M. 2002b. Two new species of acanthocephalan parasites of house crow (*Corvus splendens* Vieillot). *Pakistan Journal of Zoology* 34: 139-146.

Lunaschi, L. I. & Drago, F. B. 2010. A new species of *Centrorhynchus* (Acanthocephala, Centrorhynchidae) endoparasite of Guira guira (Aves, Cuculidae) from Argentina. *Helminthologia* 47: 38-47.

Petroschenko, V. I. 1958. Acanthocephala of domestic and wild animals. Vol II. *Academy of Sciences of the USSR. Israel Program for Scientific Translations, Jerusalem 1971.* 478 pp.

Richardson, D. J. & Nickol, B. B. 1995. The genus *Centrorhynchus* (Acanthocephala) in North America with description of *Centrorhynchus robustus* n. sp., redescription of *Centro - rhynchus conspectus*, and a key to the species. *Journal of Parasitology* 81: 767-772.

Schmidt, G. D. & Neiland, K. A. 1966. Helminth fauna of Nicaragua. III. Some Acanthocephala of birds, including three new species of *Centrorhynchus*. *Journal of Parasitology* 52: 739-745.

Wang, P. C. 1966. Notes on Acanthocephala from Fukien. *Acta Zootaxonomica Sinica*: 3 14-18.

Ward, H. L. 1956. A new species of *Centrorhynchus* (Acanthocephala) from the kite *Milvus migrans* in Egypt. *Journal of Parasitology* 41: 39-42.

Yamaguti, S. 1963. Acanthocephala. Vol V Systema Helminthum. *Interscience, New York.* 423 pp.

Revue suisse de Zoologie 118 (2): 319-327; juin 2011

Heptapterus mbya (Siluriformes: Heptapteridae), a new species of catfish from the Paraná river basin, in Argentina

María de las Mercedes AZPELICUETA[1], Gastón AGUILERA[2]
& Juan Marcos MIRANDE[3]
[1] División Zoología Vertebrados, Museo de La Plata, Paseo del Bosque,
1900 La Plata, Argentina. E-mail: azpeli@fcnym.unlp.edu.ar
[2] CONICET-Fundación Miguel Lillo, Miguel Lillo 251,
4000 San Miguel de Tucumán, Argentina. E-mail: aguileragaston@gmail.com
[3] CONICET-Fundación Miguel Lillo, Miguel Lillo 251,
4000 San Miguel de Tucumán, Argentina. E-mail: mcmirande@gmail.com

***Heptapterus mbya* (Siluriformes: Heptapteridae), a new species of catfish from the Paraná river basin, in Argentina.** - We describe a new species of heptapterid catfish of the genus *Heptapterus* from the streams Cuña-Pirú, Azul, and Moreno, in the province of Misiones, Argentina. *Heptapterus mbya* sp. n. is distinguished from all other congeners by dark plumbeous body and a low number of anal-fin rays that are branched (11-12) out of a total number of 15-17 anal fin rays, a large eye (13.8-17.9 % of HL), prepectoral distance 31.9-37.8 % of SL, distance between the last dorsal-fin ray and the adipose-fin origin 5.24-8.33 % of SL, adipose-fin base 47.4-58.5 % of SL, 13 principal caudal-fin rays, and 10-13 gill rakers on the first arch.

Keywords: new *Heptapterus* - Southernmost South America - Neotropical ichthyofauna

INTRODUCTION

The genus *Heptapterus* is distributed throughout the rivers and streams of southernmost South America. The type species of the genus is *H. mustelinus* originally collected in the Río de la Plata, as cited by Valenciennes in 1835. In this paper we describe a new species, *Heptapterus mbya* sp. n., collected from the streams Azul, Moreno, and Cuña-Pirú in the Province of Misiones, Argentina. *Heptapterus mbya* sp. n. is a new endemic heptapterid catfish species to be added to the ichthyofauna of the Cuña-Pirú Valley. The Cuña-Pirú stream is located inside the Parque Provincial Salto Encantado and traverses the deep Cuña-Pirú Valley, eventually empting into the Paraná. The Azul and Moreno streams are the very headwaters of Garuhapé stream, an affluent of the Paraná. The Parque Provincial Salto Encantado and the Cuña-Pirú Valley comprise 13.227 ha in the middle of Misiones and constitute a protected area where man-made transformations of the environment are minimal. Some endemic species from the area have been described, such as the characiforms *Astyanax tupi* Azpelicueta, Mirande, Almirón & Casciotta and *A. troya* Azpelicueta & Casciotta, Almirón and the freshwater catfish *Rhamdella cainguae* Bockmann & Miquelarena.

Manuscript accepted 01.03.2011

MATERIAL AND METHODS

The measurements, following Aguilera *et al.* (2011), are straight-line distances made with a caliper down to nearest 0.1 mm. The vertebral count includes the elements of the Weberian complex and the compound preural+ural centra counted as one. The proportions are expressed as percentages of standard length (SL), head length (HL), or otherwise as indicated. Specimens were cleared and counterstained following Taylor and Van Dyke (1985). Multivariate analysis was perfomed with SPSS version 1997 in order to detect significant variables that can be used to distinguish *H. mbya* sp. n. from *H. mustelinus*.

Institutional acronyms follow Fricke & Eschmeyer (2010), with the exception of ZVC-P (Zoología de Vertebrados, Facultad de Ciencias, Montevideo).

COMPARATIVE MATERIAL: *Heptapterus mustelinus* (Valenciennes, 1835): MACN 359, 1 ex., 190.0 mm SL, Río de la Plata, in Olivos; MACN 2050, 1 ex., 120.0 mm SL, Río de la Plata, without precise locality; MACN 3370, 3 ex., 115.0-137.2 mm SL, Río de la Plata, in Vicente López; MACN 6187, 9 ex., 88.4-234.0 mm SL, Río de la Plata in Buenos Aires, Obras Sanitarias. All from Uruguay, Río de la Plata basin: ZVC-P 304, 3 ex., 146.0-169.0 mm SL, Departamento (Dep.) Canelones, río Mosquito; ZVC-P 3422, 10 ex., 68.1-144.8 mm SL, Dep. Florida, arroyo Milano, affluent of río Santa Lucía; ZVC-P 3874, 2 ex., 46.3-96.0 SL, Dep. Maldonado, arroyo Espinoso; ZVC-P 4147, 3 ex., 48.6-61.2 mm SL, Dep. Colonia, río San Juan; ZVC-P 5633, 4 ex., 116.2-128.6 mm SL, Dep. Montevideo, río Santa Lucía, cañada del Dragón in río de las Piedras. *Heptapterus qenqo*: All from Argentina, in Tucumán: AI 248, 1 ex. C&S, 121.8 mm SL, Dep. Juan Bautista Alberdi, río Chavarria; AI 252, 3 ex., 107.3-178.9 mm SL, Dep. Trancas, río Vípos, río Salí basin; CI-FML 3954, holotype, 183.5 mm SL, Dep. Trancas, río Rearte, río Salí basin; CI-FML 3955, 1 ex., 213.1 mm SL, Dep. Monteros, río Los Sosa, río Salí basin; CI-FML 3956, 1 ex. C&S, 168.9 mm SL, Dep. Burruyacu, río Medina, río Salí basin; CI-FML 3957, 1 ex. C&S, 121.8 mm SL, Dep. Juan Bautista Alberdi, río Chavarría; CI-FML 3958, 2 ex., 95.0-107.0 mm SL, Dep. Burruyacu, río Medina, río Salí basin; CI-FML 3959, 2 ex., 123.1-140.2 mm SL, Dep. Trancas, río Choromoro, río Salí basin; CI-FML 3960, 1 ex., 106.6 mm SL, Dep. Trancas, río Choromoro, río Salí basin; CI-FML 3961, 1 ex., 123.5 mm SL, Dep. Chicligasta, río Cochuna, río Salí basin; CI-FML 3962, 1 ex., 67.3 mm SL, Dep. Trancas, río Vípos, río Salí. *Heptapterus stewarti* Haseman, 1911: FMNH 54234, holotype, photographed by M. Littman. *Heptapterus sympterygium* Buckup, 1988: MZUSP 19179, holotype, photographed by E. Baena. Images have been examined from the All Catfish Species image base (Morris, Yager & Sabaj, 2010).

RESULTS

Heptapterus mbya, sp. n. Figs. 1-3, Tables 1, 2

HOLOTYPE: CI-FML 4008, 136.0 mm SL, Argentina, Misiones, río Paraná basin, arroyo Moreno at Ruta Provincial 202 (26° 54' 24" S-54° 54' 50" W) headwaters of arroyo Garuhapé, October 21, 2004, M. Azpelicueta, D. Aichino, D. Méndez (Fig. 1).

PARATYPES: All specimens come from Argentina, province of Misiones. AI 247, 4 ex. (1 C&S), 88.0-116.5 mm SL, arroyo Azul (200 m downstream from Puente Quemado, 27° 00' 46" S-54° 57' 06" W), October 21, 2004, M. Azpelicueta, D. Aichino, D. Méndez; AI 269, 2 ex.,

85.0-116.3 mm SL, arroyo Cuña-Pirú (26° 30' 20" S-54° 48' 03" W), March 10, 2005, M. Azpelicueta; CI-FML 4009, 2 ex., 136.6-165.8 mm SL, same collecting data; CI-FML 4010, 2 ex., 126.8-136.6 mm SL, arroyo Azul (27° 00' 46" S-54° 57' 06" W), October 21 2004, coll. M. Azpelicueta, D. Aichino, D. Méndez. MHNG 2722.092, 4 ex., 85-129.4 mm SL, same collecting data.

DIAGNOSIS: *Heptapterus mbya* sp. n. is distinguished from other species of the genus by the following combination of characters: adipose and caudal fins confluent, largest specimen less than 170 mm SL (maximum length 166.0 mm), dark plumbeous body, low number of anal-fin rays that are branched (11-12) out of a total number of 15-17 anal fin rays, a large eye 13.8-17.9 % of HL, prepectoral distance 31.9-37.8 % of SL, distance between last dorsal-fin ray and adipose-fin origin 5.24-8.33 % of SL, adipose-fin base 47.4-58.5 % of SL, 10-13 gill rakers on first branchial arch, 13 principal branched caudal rays, and 56-58 vertebrae. *Heptapterus qenqo* (Aguilera *et al.*, 2011) has the same number of anal-fin rays but it is distinguished by the presence of rudimentary serrae at base of the pectoral-fin spine (absent in *H. mbya* sp. n.).

DESCRIPTION: Morphometric data of the holotype and 14 paratypes are presented in Table 1. *Heptapterus mbya* sp. n. has a maximum of 166.0 mm SL (Figs. 1, 2). The body is covered by a deep layer of mucus; numerous sensory pits (pit organs) are distributed all over the body and fins. There are rare minute black soft structures, very fine, spiniform, embedded in soft tissues of the caudal fin, dorsal surface of pectoral and pelvic fins of females and males, independent of body size but with low number in young specimens. Spine-like structures form parallel rows, specially notably on caudal membrane (Fig. 3).

Dorsal profile of body nearly straight from snout tip to posterior region of head, scarcely convex from this point to dorsal-fin origin, straight from dorsal-fin origin to adipose-fin origin, then slightly tapering to end of caudal peduncle. Ventral profile slanting ventrally or straight from snout tip to pectoral-fin origin, straight or convex between pectoral and pelvic fins, straight between pelvic and anal fins, and scarcely slanting dorsally to end of caudal peduncle. Maximum body width at level of pectoral fins; posterior half of body increasingly laterally compressed to caudal peduncle. Maximum body depth at dorsal-fin origin, contained 8.2-10.2 times in SL.

Head relatively small contained 4.9-6.2 times in SL; head dorsoventrally depressed (depth of head between eyes 2.3-2.9 times into HL; depth of head at supraoccipital 1.8-2.2 into HL). Head covered by thick skin and a layer of mucus, head surface smooth with many sensory pits. Snout of moderate length (contained 2.6-3.0 in HL), rounded in dorsal view. Upper jaw scarcely projecting (projection 4.3-8.2 % of HL); premaxillary teeth covered by lower jaw when mouth closed. Anterior nostril with a very well developed tubular rim. Posterior nostrils preceded by large semi-circular membrane. Distance between posterior nostrils and eye shorter than internarial distance. Eye placed dorsally, covered by skin, small (its length 5.5-7.2 times in HL); interorbital relatively wide and straight, containing eye diameter 0.6-1.3 times (13.4-18.1 % of HL). Width of head at eye level 1.3-1.6 times into HL (71.8-78.7 % of HL). Mouth subterminal, opening anteriorly, wide; lips thin. Premaxilla with slightly rounded posterolateral corners; its anteroposterior length 3.6-4.2 times in premaxillary width (6 specimens measured). All teeth conical and fine, placed in 8-10 irregular rows in premaxilla, larger specimens with more rows; 6-8 tooth rows on dentary at

FIG. 1
Heptapterus mbya sp. n., holotype, CI-FML 4008, 136.0 mm SL, lateral view.

FIG. 2
Heptapterus mbya sp. n., holotype, CI-FML 4008, 136.0 mm SL, dorsal view.

FIG. 3
Heptapterus mbya sp. n. Spiniform structures embedded on most superficial mucous layer of the caudal fin. CI-FML 4008, detail of the holotype, 136.0 mm SL. Bar= 1 mm.

TABLE 1. Measurement data for *Heptapterus mbya* sp. n. expressed in percentages of the standard dimensions given above measurements. SL in mm.

	Holotype	Mean	Min	Max
Standard Length	136.0		85.0	165.8
Percent of SL				
Predorsal-fin length	34.7	34.5	30.6	37.1
Preadipose-fin length	50.8	50.2	43.4	54.8
Prepectoral-fin length	17.6	17.2	15.0	18.9
Prepelvic-fin length	35.7	35.1	31.9	37.8
Preanal-fin length	58.8	60.2	55.2	64.9
Body depth at dorsal-fin origin	12.9	11.9	8.8	13.9
Caudal peduncle depth	6.3	6.4	5.8	7.2
Caudal peduncle length	20.9	20.6	17.9	24.2
Head length	19.1	18.8	16.1	20.4
Body width	13.8	13.9	11.8	15.4
Second dorsal ray	7.3	7.8	5.9	9.4
Second dorsal-fin ray	9.6	9.9	7.6	12.1
Dorsal-fin base	10.0	9.4	8.5	10.0
Last dorsal-fin ray to adipose-fin origin	6.9	6.9	5.2	8.3
Adipose-fin length	50.5	51.3	47.4	58.5
Adipose-fin depth	3.6	3.4	2.9	4.6
First pectoral-fin ray	10.2	10.6	9.0	11.8
Second pelvic-fin ray	11.4	11.0	9.4	12.7
Anal-fin base	19.8	18.8	14.5	21.6
Anal-fin height	3.0	4.5	3.0	6.0
Dorsal-fin origin to caudal-fin base	67.6	66.9	64.3	70.9
Pelvic-fin origin to caudal-fin base	62.7	65.1	62.7	67.2
Anal-fin origin to caudal-fin base	39.1	39.3	36.2	42.1
Pectoral-fin to pelvic-fin origins	20.5	19.9	17.8	21.8
Pelvic-fin to anal-fin origins	25.0	26.3	24.8	28.7
Percent of head length				
Snout length	32.6	35.2	32.6	37.6
Horizontal eye diameter	16.5	15.4	13.8	17.9
Eye to posterior margin of head	52.6	51.0	48.6	52.8
Bony interorbital	15.3	15.4	13.3	18.0
Head depth at occiput	53.0	49.2	45.4	53.8
Head width	74.2	74.9	71.8	78.7
Gape width	43.8	43.7	40.0	47.5
Anterior tip to anterior nostril	11.5	12.5	10.4	14.1
Distance between nares	12.6	11.6	9.5	13.3
Posterior naris to anterior eye margin	11.9	10.5	8.2	12.2
Percent of peduncle length				
Caudal peduncle depth	30.5	31.5	26.6	37.4

symphysis and fewer posteriorly. Origin of maxillary barbel close to anterior nostril, above rictus; basal third of maxillary barbel resting in a deep sulcus. Maxillary barbel usually reaching a vertical through mid of pectoral fin and scarcely surpassing pectoral-fin origin in few specimens. Tip of outer mental barbel usually reaching pectoral-fin origin, scarcely reaching branchiostegal membrane in two specimens. Tip of inner mental barbel scarcely reaching branchiostegal membrane.

Dorsal fin with one soft segmented ray and six branched rays; first dorsal-fin ray small, about two thirds of first branched ray. Second branched dorsal-fin ray

longest, about twice of last branched ray. Dorsal-fin origin anterior to a vertical through pelvic-fin insertion; in small specimens, dorsal-fin origin located scarcely anterior or at same level of pelvic-fin origin. Last adpressed dorsal-fin ray close to adipose-fin origin, increasingly so in smaller specimens. Adipose-fin origin located at a vertical through tip of pelvic fins or little posterior. Adipose fin long, confluent with caudal fin; adipose fin low, 12-18 times in its base.

Caudal fin rounded, its upper lobe longer and broader than lower lobe. Principal caudal-fin rays 1+(6-7)+1. Dorsal procurrent caudal-fin rays 12-14, ventral procurrent caudal-fin rays 17-21 (counted in 6 specimens). Anal fin short, low, its origin at a vertical through anterior fourth of adipose fin; in small specimens, anal-fin origin placed at anterior third of adipose fin. Distal margin of anal fin straight or slightly convex. Tips of last anal-fin rays close to or surpassing origin of caudal fin. Anal-fin with 15-17 rays (iii-v, 11-13; 2 with 11 branched rays; 9 including holotype with 12; 4 with 13). Pectoral fin i,6-8 (1 with 6 branched rays; 10 with 7 including holotype; 4 with 8); first pectoral-fin ray soft and segmented. Distal margin of pectoral fin rounded. First ray short, 1.2-1.7 times in fin length; third ray longest. Tip of pectoral fin reaching half length between pectoral and pelvic fin origins. A large axillary gland pore, above pectoral-fin insertion, close to posterior angle of opercle. Pelvic fin with i,6 rays; second branched ray longest; its distal margin rounded. Tip of pelvic fin reaching one third of distance between pelvic and anal fin origins. Inner pelvic-fin ray surpassing anus and urogenital papillae.

Urogenital papillae located immediately behind anus, somewhat tubular in males. Gonads of males with broad, finger-like projections.

Lateral line complete, ending on caudal peduncle; anterior lateral line ossicles without small plate-like expansions. Pores of cephalic sensory canals distributed as follows: supraorbital branch with four pores, infraorbital branch with six pores, mandibular branch with five pores, preopercular branch with six pores, and pterotic branch with 3 pores.

Swim bladder small, bilobed in shape (as an eight) transversely placed. Gill rakers somewhat short, slightly laterally compressed. Ten to thirteen gill rakers on first arch, distributed as follows: 0-3 on epibranchial, 1 on cartilage between epibranchial and ceratobranchial, 8-9 on ceratobranchial.

In two specimens, total number of vertebrae 56-58 (29-31 precaudal, 27 caudal); 9-10 pairs of ribs.

COLOR UPON CAPTURE: Background dark gray, whitish only on vent; a very slender lateral stripe from opercle to end of caudal peduncle. All unpaired fins dark gray with a notably darker margin on anal fin; pectoral and pelvic fins yellowish. Transverse dorsal bands barely visible.

COLOR IN ALCOHOL: Dark gray on dorsum, gray on sides of body and very light gray on ventral surface; head dark gray. Four transverse bands almost black, first one over supraoccipital region, second one at level of pectoral fins; third one at dorsal-fin origin, many times continued with an oval spot around dorsal-fin base; fourth band at adipose-fin origin. A very slender stripe developed from a dark area posterior to opercle to end of caudal peduncle. A light area on cheek. All fins dark gray, especially

FIG. 4
Type locality, arroyo Moreno at Ruta Provincial 202, province of Misiones, Argentina (26° 54' 24"S-54° 54' 50" W).

caudal fin. Dorsal fin with a light stripe near its base; anal fin with a dark band along its margin. Minute black rounded chromatophores scattered all over body, at different depths of skin. Large black, deep and star-like chromatophores spread on body. Chromatophores on myosepta, making myomeres very evident.

ETYMOLOGY: The Guaraní word *mbya* is the name of the aborigines that live in the Cuña-Pirú Valley and the Parque Provincial Salto Encantado. The name is applied as a noun in apposition.

DISTRIBUTION AND HABITAT: *Heptapterus mbya* sp. n. is found in the Cuña-Pirú, Moreno (Fig. 4), and Azul streams. The three streams are located in the río Paraná basin in Misiones, Argentina; the latter two, though, are headwaters of the Garuhapé stream. The largest number of specimens were collected in a pond about 1 m deep, with a slow current, and a sandy bottom; the place was bordered by dense vegetation, completely covered by shadow. The parameters measured were temperature at 18-20 °C, conductivity= 81μS/cm, and pH= 6.3.

DISCUSSION

Heptapterus mustelinus, the type species of the genus, is the only member of *Heptapterus* recorded from the basins of Argentina, southernmost Brazil and Uruguay (Buckup, 1988; Bockmann & Guazelli, 2003). The type locality is the Río de la Plata

TABLE 2. Disciminant ratios, using eight measurements, for differentiation of *Heptapterus mbya* sp. n. and *H. mustelinus*.

	H. mbya		*H. mustelinus*	
	mean	min-max	mean	min-max
anal-fin base/dorsal-adipose length	0.37	0.31-0.47	0.16	0.13-0.22
pelvic-fin length/interorbital width	0.27	0.22-0.34	0.44	0.34-0.67
pelvic-anal fin origins/internarial length	0.21	0.18-0.25	0.60	0.36-0.92
pelvic-anal fin origins/interorbital width	0.11	0.09-0.13	0.18	0.14-0.21
anal-fin base/pelvic-fin length	0.60	0.50-1.04	0.38	0.28-0.43
anal-fin base/pelvic-anal fin origins	0.71	0.43-0.86	1.09	0.92-1.43
anal-fin base/internarial length	0.12	0.09-0.19	0.08	0.07-0.09
anal-fin base/posterior nostril-eye	0.11	0.08-0.15	0.07	0.06-0.08
interorbital width/interdorsal length	0.43	0.34-0.57	1.04	0.69-1.43
interorbital width/internarial length	0.76	0.64-0.93	0.49	0.43-0.55

where the species is still common, especially in areas with lime. *Heptapterus mustelinus* is distinguished from *H. mbya* sp. n. by a higher number of anal-fin rays (18-22 vs. 15-17), a longer anal-fin base (20.9-28.0 % of SL vs. 14.2-21.6), shorter distance between pelvic and anal-fin origins (20.4-24.0 % of SL vs. 24.8-28.7), shorter distance between last dorsal-fin ray insertion and adipose-fin origin (3.1-4.9 % of SL vs. 5.2-8.3), and wider interorbital (18.9-24.9 % of HL vs. 13.3-18.0). Moreover, multivariate analysis detected ten additional ratios of sufficient differences to enable a discrimination of *H. mbya* sp. n. from *H. mustelinus* (Table 2).

At present, a new species of *Heptapterus* has recently been published (Aguilera *et al.*, 2011); the specimens of this new species have been collected in northwestern Argentina, in the Salí river basin. *Heptapterus qenqo* is distinguished from *H. mbya* sp. n. by the presence of rudimentary serrae on first pectoral-fin ray of adults, smaller eye (7.4-14.2 % of HL vs. 13.8-17.9), larger postorbital length (52.5-56.0 % of HL vs. 48.6-52.8), wider interorbital (17.6-24.1 % of HL vs. 13.3-18.0), and a maxillary barbel not reaching the first pectoral-fin ray in adults vs. one reaching half pectoral length in *H. mbya* sp. n.

The number of anal-fin rays distinguishes *Heptapterus mbya* sp. n. (15-17) from *H. bleekeri* (20-22), *H. fissipinnis* (23), *H. multiradiatus* (36), *H. ornaticeps* (19), *H. stewarti* (30), and *H. sympterygium* (22-29). Additionally, *Heptapterus mbya* sp. n. is distinguished from *H. bleekeri* by greater eye diameter (2.1-2.7 vs. 3.5 times in snout length), narrower interorbital distance (5.5-7.5 vs. 5 times in HL), and longer predorsal distance (2.7-3.3 vs. 2.6 times in SL); from *H. multiradiatus* by a shorter dorsal-fin base (1.8-2.2 vs. 1.5 times in HL); from *H. fissipinnis* by a smaller eye diameter (5.6-7.2 vs. 5.5 times in HL); and from *H. sympterygium* by the presence of anal and caudal fins separated. The adipose and the caudal fins confluent differentiates *H. mbya* sp. n. from *H. tapanahoniensis*, it with the adipose and caudal fins separated.

ACKNOWLEDGEMENTS

We thank D. Aichino and D. Méndez for their assistance in the field, M. Rinas for collecting permits from Ministerio de Ecología de Misiones, G. Chiaramonte and M. Loureiro for the loan of specimens, L. Rasia for help with photographs of caudal

structures, the Agencia Nacional de Promoción Científica y Tecnológica (PICT 12348 and 12359), and the Consejo Nacional de Investigaciones Científicas y Técnicas (PIP 5365) for financial support, J. Lundberg and one anonymous reviewer for improvement this paper, S. Körber and H-G. Evers for providing us with important bibliographic information, and D. Haggerty for improving the English style.

REFERENCES

AGUILERA, G., MIRANDE, J. M. & AZPELICUETA, M. DE LAS M. (2011). A new species of *Heptapterus* Bleeker 1858 (Siluriformes, Heptapteridae) from the Río Salí basin, northwestern Argentina. *Journal of Fish Biology* 78: 240-250.

BOCKMANN, F. A. & GUAZELLI, G. M. 2003. Family Heptapteridae (Heptapterids) (pp. 406–431). In: Reis, R. E.; S. O. Kullander & C. J. Ferraris JR. *Check list of the Freshwater Fishes of South and Central America*. Edipucrs, Porto Alegre, Brazil, 729 pp.

BUCKUP, P. A. 1988. The genus *Heptapterus* (Teleostei, Pimelodidae) in Southern Brazil and Uruguay, with the description of a new species. *Copeia* 1988 (3): 641-653.

FRICKE, R. & ESCHMEYER, W. N. 2010. A guide to fish collections in The Catalog of fishes. Electronic version available at http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp

MORRIS, P. J., H. M. YAGER, [programmers] & M. H. SABAJ PÉREZ [editor] 2010. ACSImagebase: A digital archive of catfish images compiled by participants in the All Catfish Species Inventory. [WWW image Database] URL http://acsi.acnatsci.org/base

SPSS 1997. SPSS Base 9.0. SPSS Inc., Chicago, USA

TAYLOR, W. R. & VAN DYKE, G. C. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. *Cybium* 9: 107-119.

VALENCIENNES, A. 1835. Poissons, pl. 2. *In*: D'ORBIGNY, A. Voyage dans l'Amérique méridionale. Vol. 9. *Bertrand and Levrault*, Paris.

Revue suisse de Zoologie 118 (2): 329-343; juin 2011

Note sulle *Typhloreicheia* (Holdhaus, 1924) siciliane del "gruppo *praecox*" con descrizione di una nuova specie (Coleoptera Carabidae: Scaritinae).

Paolo MAGRINI
Via Gianfilippo Braccini 7, I-50141 Firenze, Italia. E.mail: duvalius@paolomagrini.it
(Coll. esterno Museo Zoologico "La Specola" di Firenze, Italia)

Cosimo BAVIERA
Dipartimento di Biologia Animale ed Ecologia Marina dell'Università degli studi di Messina, Salita Sperone 31, I-98166 Sant'Agata, Messina, Italia.
E.mail: cbaviera@unime.it

On Sicilian *Typhloreicheia* (Holdhaus, 1924) of the "*praecox* group" with description of a new species (Coleoptera Carabidae: Scaritinae). - Taxonomic status of taxa belonging to *Typhloreicheia* "*praecox* group" is discussed and a new species from western Sicily differs from all the other known taxa in the external morphology and its aedeagus shape is described. Also included are images, dichotomic keys and distribution maps for all the sicilian species.

Keywords: *Typhloreicheia* - New species - Taxonomy - Sicily - Italy - Key to species.

INTRODUZIONE

Le *Typhloreicheia* siciliane di più antica descrizione furono inserite da Casale (1985), in un unico "gruppo praecox", comprendente la specie nominale e quattro taxa, tutti ritenuti di livello sottospecifico, presenti nella Sicilia centro-occidentale. Le specie successivamente descritte: *Typhloreicheia berninii* Magrini, Bastianini & Petrioli, 2003; *Typhloreicheia zingarensis* Magrini & Baviera, 2003; *Typhloreicheia messanae* Magrini, 2008 e *Typhloreicheia bavierai* Magrini, Degiovanni & Petrioli (in stampa), appaiono tutte ben distinte dai taxa del gruppo di *T. praecox* (sensu Casale) per vari caratteri di morfologia esterna e, spesso, edeagici.

Alla luce poi dell'abbondante materiale raccolto, insieme ad alcuni colleghi, negli ultimi anni per alcune specie e al riesame di buona parte degli esemplari precedenti, ci siamo convinti del valore specifico di tutti i taxa finora descritti per l'isola, che si presentano ben localizzati, senza forme di passaggio e con chiare differenze morfologiche, che anche in assenza spesso di una lamella copulatrice edeagica, ne rendono facile l'identificazione. Inoltre, durante le ricerche effettuate negli ultimi tempi, abbiamo avuto modo di raccogliere, in due vicine località del trapanese, una piccola serie di esemplari, che abbiamo identificato come appartenenti ad una specie inedita di questo gruppo: approfittiamo di questa breve nota per descriverla e aggiornare la buona revisione di Casale del 1985.

Manoscritto accettato il 10.12.2010

MATERIALI E METODI

I materiali utilizzati nel presente lavoro sono depositati nelle collezioni qui elencate con i rispettivi acronimi.

MHNG: Coll. Museo di Storia Naturale di Ginevra (Svizzera); MZC: Coll. Museo Zoologico "Cambria", Messina (Italia); MSNG: Coll. Museo civico di Storia naturale "Giacomo Doria", Genova (Italia); CM: Coll. P. Magrini, Firenze (Italia); CB: Coll. C. Baviera, Messina (Italia); CD: Coll. A. Degiovanni, Bubano di Mordano, Bologna (Italia); CP: Coll. A. Petrioli, Asciano, Siena (Italia); CBA: Coll. M. Bastianini, Follonica, Grosseto (Italia); CBU: Coll. P. Bulirsch, Praga (Repubblica Ceca).

Riportiamo inoltre qui di seguito le abbreviazioni delle misure riportate nella tabella.

L: lunghezza complessiva, dall'apice delle mandibole all'estremità delle elitre; HMW: larghezza massima del capo al rigonfiamento temporale; LA: lunghezza delle antenne; PL: lunghezza del pronoto, misurata lungo la linea mediana; PMW: larghezza massima del pronoto; EL: lunghezza elitre, misurata dalla base dello scutello all'angolo suturale; EW: larghezza massima delle elitre; PMW/PL: rapporto massima larghezza/lunghezza del pronoto; EL/EW: rapporto lunghezza/larghezza delle elitre; EW/PMW: rapporto larghezza elitre/larghezza pronoto; LE: lunghezza edeago; AN: lunghezza articolo antennale.

Le macrofotografie riportate nel testo sono state eseguite da uno di noi (P. M.) mediante camera digitale Nikon D1 applicata su microscopio ottico binoculare Nikon Labophot II, con obiettivi diaframmati.

TAXONOMIA

Typhloreicheia belloi sp. n.

HOLOTYPUS: ♂, Sicilia, Monte Sparagio (Trapani), m 550 s.l.m., 16.III.2008, leg. C. Baviera e C. Bellò, MZC.

PARATYPI: 6 ♂♂ e 10 ♀♀: 1 ♀, Castello di Baida, Monte Sparagio (Trapani), m 300 s.l.m., 16.III.2008, leg. C. Baviera e C. Bellò, MHNG. – 1 ♂, Castello di Baida, Monte Sparagio (Trapani), m 300 s.l.m., 16.III.2009, leg. P. Magrini, CM. – 1 ♂ e 2 ♀♀, Monte Sparagio (Trapani), m 420 s.l.m., 16.III.2009, leg. P. Magrini, CM. – 1 ♂, Monte Sparagio (Trapani), m 420 s.l.m., 16.III.2009, leg. P. Magrini, CB. – 1 ♂, Purgatorio (Custonaci, Trapani), m 300 s.l.m., 17.III.2009, leg. A. Degiovanni, CM. – 1 ♂, 4 ♀♀, Purgatorio (Custonaci, Trapani), m 300 s.l.m., 17.III.2009, leg. A. Degiovanni, CD. – 1 ♀, Castello di Baida, Monte Sparagio (Trapani), m 300 s.l.m., 16.III.2009, leg. P. Magrini, CBA. – 1 ♀, Monte Sparagio (Trapani), m 420 s.l.m., 16.III.2009, leg. P. Magrini, CBU. – 1 ♂, Monte Sparagio (Trapani), m 400 s.l.m., 20.III.2009, leg. A. Degiovanni, CD. – 1 ♀, Monte Sparagio (Trapani), m 420 s.l.m., 16.III.2010, leg. P. Magrini, CP.

DIAGNOSI E DESCRIZIONE: Una *Typhloreicheia* di dimensioni medio-piccole, convessa, di aspetto robusto e di colore rossiccio scuro uniforme; tegumenti lucidi, con microscultura a maglie poligonali ben evidente su tutto il corpo e in particolare su capo e pronoto (fig. 1).

Capo di normali dimensioni, molto più stretto del torace, larghezza massima al rigonfiamento temporale; tempie moderatamente convesse, glabre; solchi frontali larghi, profondi e molto allungati, divergenti solo posteriormente; occhi totalmente assenti. Clipeo ampio e convesso, con la zona mediana del margine anteriore subretti-

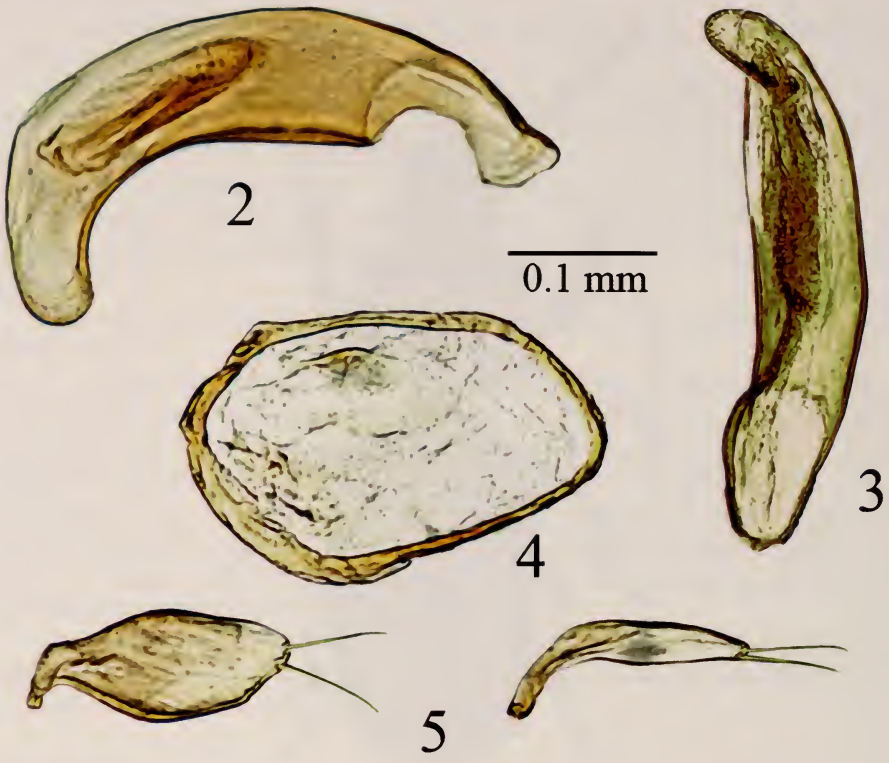
FIG. 1
Typhloreicheia belloi n. sp., di Monte Sparagio (Trapani), holotypus ♂, (MZC): habitus.

linea, rilevato in carena solo all'apice. Labbro superiore con margine distale festonato e con cinque setole marginali. Mandibole falcate. Chetotassi cefalica senza particolarità di rilievo, ma con setole molto lunghe.

Antenne lunghe e piuttosto gracili. Primo articolo antennale cilindrico; secondo decisamente allungato, poco più lungo del terzo e del quarto presi insieme, questi ultimi più sottili dei seguenti; gli articoli dal quinto al decimo subsferici e moniliformi; undicesimo in corto ovale.

Pronoto tanto largo quanto lungo, discretamente allargato nella porzione basale; lati regolarmente arcuati; angoli anteriori piccoli, acuti, appuntiti e appena salienti, margine anteriore leggermente convesso o lineare, distintamente crenellato; doccia marginale sottile e regolare; peduncolo allungato; due setole marginali per ogni lato, distanziate dal margine esterno della doccia; l'anteriore a livello del primo quinto, la posteriore a livello del terzo quinto.

Elitre convesse, in corto ovale, con margini anteriore e posteriore larghi e piuttosto squadrati, omeri ampiamente arrotondati; margine basale delle elitre subrettilineo; doccia marginale ampia e regolare, con denticoli omerali poco sporgenti, ben evidenti solo nella prima metà dell'elitra; apice elitrale arrotondato. Larghezza



FIGG. 2-5
Typhloreicheia belloi n. sp. Holotypus. (2) Edeago in visione laterale. (3) Edeago in visione ventrale. (4) Urite. (5) Parameri.

massima delle due elitre alla metà o poco dopo. Strie profonde, grossolanamente e irregolarmente punteggiate, svanite all'apice; interstrie convesse. Setole discali presenti in serie su tutte le interstrie, escluse la prima e l'ottava. Setola basale presente, come la preapicale e le apicali; setole marginali della serie ombelicata come nelle specie congeneri.

Zampe di media lunghezza; le tre spine delle protibie robuste.

Edeago molto arcuato, privo di lamella copulatrice, con apice largo, spatoliforme, ampiamente arrotondato all'apice (figg. 2 e 17-20). Vescicola setifera fortemente pigmentata sul lato ventrale e prossimale, con cordoni di spine disposti in fasci paralleli e piccoli fasci arcuati nella zona apicale della vescicola. Edeago in visione ventrale inclinato a sinistra (fig. 3). Urite IX largo e ovale (fig. 4). Parameri normalmente conformati, forniti di due grandi setole, poco allungate (fig. 5).

LOCALITÀ TIPICA: Sicilia, Monte Sparagio (Trapani).

DERIVATIO NOMINIS: Dedichiamo con piacere il nuovo taxon all'amico Cesare Bellò di Castelfranco Veneto (TV), appassionato e competente specialista di Peritelini

FIG. 6
Typhloreicheia praecox (Schaum, 1857), di Monte Pellegrino (Palermo) topotypus, (MSNG), habitus.

(Curculionidae), a cui va il merito di aver individuato il magnifico sito del Monte Sparagio, un lembo di Sicilia ancora ben conservato, dove abbiamo raccolto i primi esemplari di questa nuova entità.

AFFINITÀ E NOTE COMPARATIVE: La nuova specie si interpone, nell'ambito del gruppo praecox, fra l'areale di *Typhloreicheia praecox* (Schaum, 1857) del Monte Pellegrino (Palermo) e quello di *Typhloreicheia doderoana* Casale, 1985, del Monte San Giuliano a (Trapani) (fig. 33).

Dalla prima di distingue agevolmente per la diversa chetotassi discale elitrale, con setole presenti in tutte le interstrie (dalla 2 alla 7), mentre in *praecox* le setole sono presenti solo nelle interstrie 3-5-7; per il corpo con pronoto e elitre più stretti e molto meno convessi e dilatati e per le antenne più lunghe. Dalla seconda per le antenne più lunghe e per l'edeago con apice molto più lungo, incurvato e spatoliforme. Per i confronti con le altre specie del gruppo praecox vedasi la chiave analitica, la Tabella delle misure e l'iconografia riportata nel testo.

NOTE ECOLOGICHE: Tutti gli esemplari sono stati raccolti mediante vagliatura di terra alla base di *Olea europaea* var. *sylvestris* (Miller) o sotto pietre interrate in bosco rado di *Quercus*.

CATALOGO TASSONOMICO E COROLOGICO DELLE SPECIE DEL "GRUPPO *PRAECOX*"

Il gruppo comprende attualmente 6 specie di dimensioni medio-piccole, con corpo convesso, tutte endogee e fornite di un edeago privo di lamella copulatrice (per ulteriori dettagli, oltre a quelli riportati nel testo, rimandiamo a Holdhaus, 1924 e Casale, 1985):

1. *Typhloreicheia praecox* (Schaum, 1857)
   Monte Pellegrino (Palermo): nota solo della località tipica. Nella zona sommitale del monte, in pascolo, sotto pietre o vagliando la terra prelevata sotto cespugli.

Tabella delle misure delle specie di *Typhloreicheia* del "gruppo *praecox*

	L	LA	L / LA	PM W	PL	PMW / PL	EL
Typhloreicheia praecox							
Minimo	2,18	0,61	3,13	0,54	0,54	0,97	1,17
Massimo	2,41	0,73	3,57	0,59	0,59	1,02	1,22
Media	2,29	0,68	3,34	0,57	0,57	0,99	1,19
Typhloreicheia baudii							
Minimo	2,21	0,73	2,71	0,51	0,50	0,91	1,17
Massimo	2,54	0,93	3,06	0,59	0,58	1,15	1,33
Media	2,39	0,83	2,88	0,54	0,53	1,02	1,24
Typhloreicheia binaghii							
Minimo	2,12	0,67	2,95	0,48	0,48	0,93	1,16
Massimo	2,25	0,73	3,14	0,50	0,51	1	1,20
Media	2,21	0,71	3,05	0,49	0,50	0,97	0,18
Typhloreicheia doderoana							
Holotypus ♂	2,25	0,73	3,04	0,56	0,54	1,02	1,20
Minimo	2,21	0,64	3,04	0,53	0,51	0,97	1,17
Massimo	2,34	0,73	3,47	0,58	0,58	1,04	1,24
Media	2,27	0,68	3,28	0,55	0,54	1,01	1,21
Typhloreicheia meridionalis							
Holotypus ♂	2,28	0,77	2,95	0,50	0,51	0,98	1,17
Paratypus ♀	1,96	0,70	2,77	0,46	0,48	0,96	1,11
Typhloreicheia belloi sp. n.							
Holotypus ♂	2,28	0,80	2,84	0,54	0,54	0,98	1,20
Minimo	2,15	0,70	2,84	0,50	0,50	0,96	1,16
Massimo	2,50	0,80	3,57	0,58	0,54	1,03	1,24
Media	2,31	0,73	3,15	0,53	0,53	0,99	1,18

2. *Typhloreicheia baudii* (Ragusa, 1883)
   Monti Sicani (Palermo): Bosco di Ficuzza (Palermo) e probabilmente Bosco Adriano (Palazzo Adriano) (cfr. Vitale, 1927; Casale, 1985). Silvicola, sotto pietre fortemente interrate in terreno argilloso o vagliando il terriccio in profondità alla base di alberi del genere *Quercus*, spesso in associazione con *Duvalius marii* Vanni, Magrini & Pennisi, 1992.
3. *Typhloreicheia binaghii* Casale, 1985
   Madonie (Palermo): Castelbuono (pendici Pizzo Carbonara 1400 m); Piano Battaglia (pendici Monte Mufara 1300 m); Piano Zucchi (fra gli 800 e i 1000 m); Pomieri (Petralia Sottana). Silvicola, sotto pietre anche moderatamente interrate e vagliando il terriccio.
4. *Typhloreicheia doderoana* Casale, 1985
   Trapanese occidentale: Monte San Giuliano (Trapani). Non conosciamo catture recenti di questo taxon, noto solo della località tipica, che appare oggi assai antropizzata.

EW	EL / EW	EW / PMW	LE	HM W	AN 1°	AN 2°	AN 3°	AN 4°	AN 11°
0,75	1,46	1,33	0,37	0,35	0,12	0,12	0,04	0,04	0,08
0,80	1,58	1,38	0,37	0,38	0,08	0,10	0,05	0,05	0,09
0,77	1,55	1,35	0,37	0,37	0,10	0,11	0,044	0,044	0,083
0,67	1,61	1,27	0,39	0,35	0,09	0,10	0,05	0,06	0,09
0,77	1,79	1,34	0,43	0,41	0,13	0,13	0,07	0,06	0,11
0,72	1,71	1,31	0,40	0,38	0,11	0,11	0,06	0,06	0,10
0,67	1,65	1,35	0,35	0,34	0,08	0,10	0,04	0,04	0,08
0,70	1,71	1,46	0,38	0,37	0,09	0,11	0,06	0,06	0,09
0,69	1,68	1,41	0,36	0,35	0,088	0,106	0,05	0,05	0,088
0,72	1,66	1,28	0,41	0,38	0,08	0,11	0,05	0,05	0,09
0,70	1,64	1,26	0,38	0,35	0,08	0,09	0,04	0,04	0,08
0,74	1,71	1,33	0,41	0,40	0,09	0,11	0,05	0,05	0,09
0,72	1,67	1,29	0,39	0,37	0,084	0,10	0,044	0,042	0,088
0,69	1,69	1,36	0,35	0,35	0,08	0,11	0,05	0,05	0,10
0,64	1,72	1,37		0,33	0,08	0,10	0,05	0,05	0,10
0,72	1,66	1,34	0,37	0,38	0,12	0,11	0,06	0,05	0,09
0,66	1,62	1,27	0,35	0,33	0,10	0,11	0,05	0,04	0,08
0,74	1,73	1,34	0,40	0,38	0,12	0,13	0,06	0,06	0,10
0,70	1,67	1,30	0,38	0,37	0,11	0,12	0,056	0,05	0,09

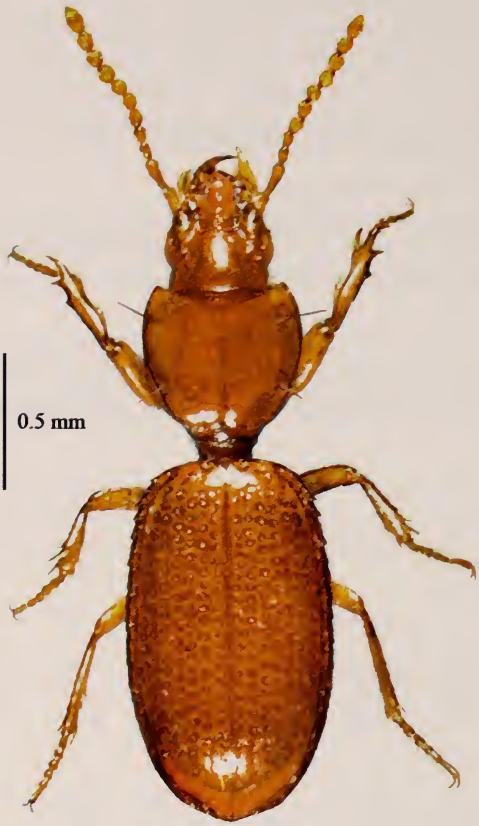


FIG. 7
Typhloreicheia baudii (Ragusa, 1883), di Ficuzza (Palermo) topotypus, (CM), habitus.

5. *Typhloreicheia meridionalis* Casale, 1985
Piazza Armerina (Enna): nota solo su due esemplari raccolti nella località tipica nel 1912. Come per il taxon precedente non conosciamo catture recenti e la zona ha subito negli ultimi 100 anni drastiche riduzioni di latifoglie del genere *Quercus*, sostituite da specie dei generi *Pinus* e *Eucalyptus*, essenze verosimilmente meno gradite al genere *Typhloreicheia*.
6. *Typhloreicheia belloi* Magrini e Baviera, 2011
Trapanese orientale: Monte Sparagio (Trapani): da m 420 a 550 s.l.m.; Castello di Baida (Monte Sparagio, Trapani) 300 m s.l.m.; Purgatorio (Custonaci, Trapani). Vagliando terriccio prelevato alla base di *Olea europaea var. sylvestris* (Miller), *Quercus spp.* e sotto pietre profondamente interrate ai margini del bosco.

FIG. 8
Typhloreicheia doderoana Casale, 1985, di Monte San Giuliano (Trapani), topotypus, (CM), habitus.

CHIAVE ANALITICA DELLE *TYPHLOREICHEIA* DEL GRUPPO *PRAECOX*

1a Setole elitrali presenti solo nelle interstrie 3-5-7. Antenne molto corte, pronoto molto ampio e allargato (fig. 11), omeri fortemente arrotondati, addome ampiamente rigonfio (ognuno di questi caratteri è il più accentuato nell'ambito del gruppo). Elitre corte e larghe con EL/EW compreso fra 1,46 e 1,58, in tutte le altre specie del gruppo superiore a 1,60. Edeago allungato, con apice curvo e sottile (figg. 21-23) . . . . . *praecox* (Schaum, 1857) (fig. 6), Monte Pellegrino (Palermo)

1b Setole elitrali presenti in tutte le interstrie, dalla 2 alla 7 2

2a Pronoto fortemente ristretto alla base (figg. 12, 14, 15) 3

2b Pronoto poco ristretto alla base (figg. 13, 16) 4

3a Apice dell'edeago fortemente incurvato, uncinato (fig. 24) . . . . . *meridionalis* Casale, 1985 (fig. 10), Piazza Armerina (Enna)

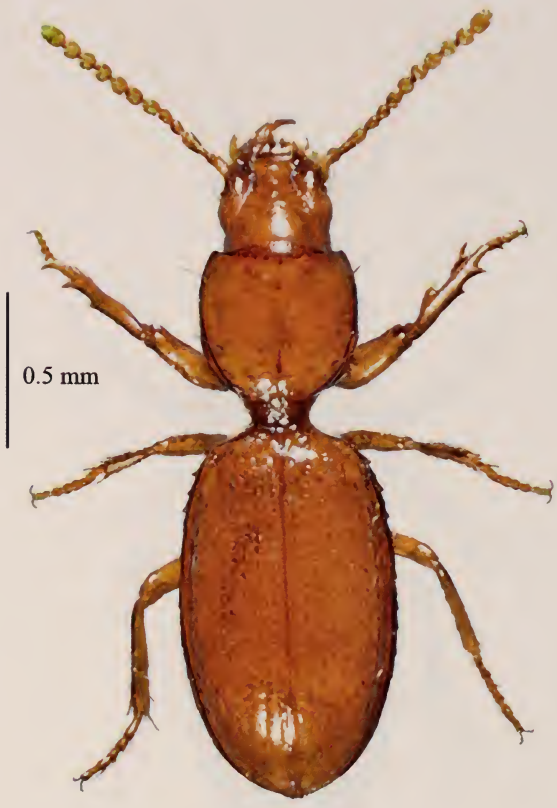


FIG. 9
Typhloreicheia binaghii Casale, 1985, di Piano Zucchi (Palermo), topotypus, (CM), habitus.

3b Apice dell'edeago non o appena incurvato, comunque non uncinato 5

4a Antenne generalmente più corte (0,64-0,73 mm), edeago con apice corto e poco incurvato (figg. 25-28) . . . . . *doderoana* Casale, 1985 (fig. 8), Monte San Giuliano (Trapani)

4b Antenne generalmente più lunghe (0,70-0,80 mm), edeago con apice lungo e incurvato, spatoliforme (figg. 2, 17-20) . . . . . *belloi* n. sp. (fig. 1), Monte Sparagio e Purgatorio (Trapani)

5a Omeri fortemente spioventi, pronoto più stretto alla base (fig. 14) ed elitre più larghe (EW/PMW 1,35-1,46). Edeago di piccole dimensioni (0,35-0,38 mm), diafano, con apice corto e largo alla base (figg. 31-32) *binaghii* (fig. 9), Casale, 1985, Castelbuono, Piano Zucchi e Piano Battaglia (Palermo)

5b Omeri poco spioventi, pronoto meno ristretto alla base ed elitre strette (EW/PMW 1,27-1,34) (fig. 12). Edeago di dimensioni più grandi (0,39-0,43 mm), poco diafano, con apice lungo, più incurvato e dilatato (figg. 29-30) . . . . . *baudii* (Ragusa, 1883) (fig. 7), Ficuzza (Palermo)

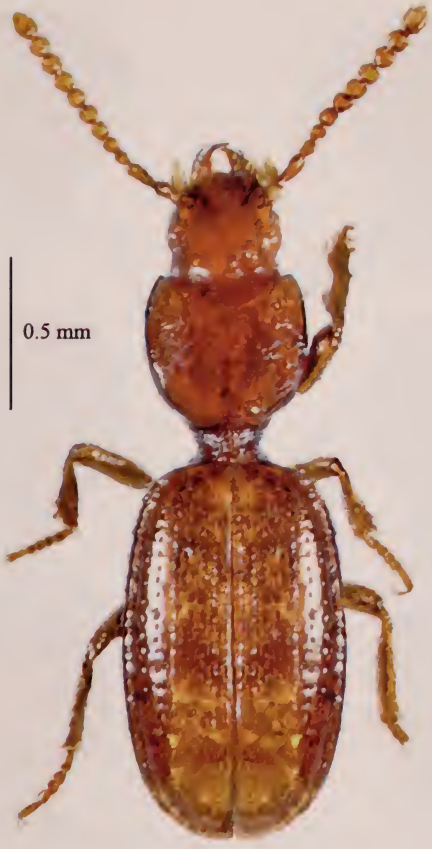


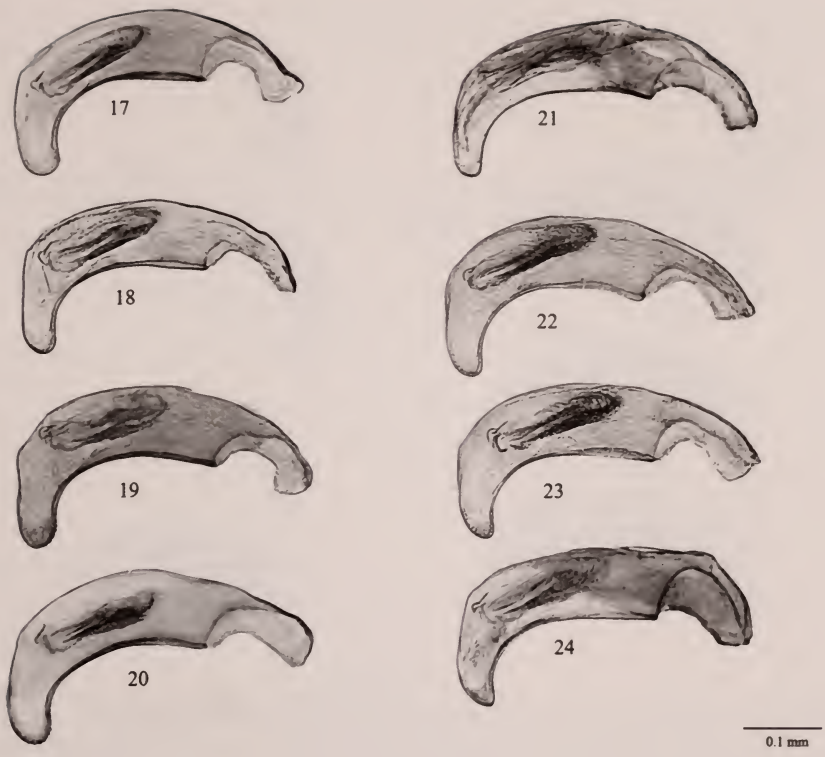
FIG. 10
Typhloreicheia meridionalis Casale, 1985, di Piazza Armerina (Enna), holotypus, (MSNG), habitus.

RINGRAZIAMENTI

Desideriamo ringraziare tutti i colleghi che hanno contribuito alle ricerche o che ci hanno fornito materiale di confronto utile per la stesura della presente nota: Marco Bastianini di Follonica (GR); Augusto Degiovanni di Bubano (BO); Andrea Petrioli di Asciano (SI); Sarah Whitman di Firenze. Un ringraziamento in particolare al Dr. Roberto Poggi, Direttore del Museo civico di Storia naturale "G. Doria" di Genova, che con la consueta cortesia ci ha dato modo di esaminare tutto il materiale siciliano, tipico e non, presente presso il suo Istituto, fondamentale per la stesura della presente nota. Un ringraziamento anche al referee anonimo per tutti gli utili suggerimenti forniti.

FIGG. 11-16

Pronoto di: (11) *Typhloreicheia praecox*, topotypus. (12) *Typhloreicheia baudii*, topotypus. (13) *Typhloreicheia doderoana*, topotypus. (14) *Typhloreicheia binaghii*, topotypus. (15) *Typhloreicheia meridionalis*, holotypus. (16) *Typhloreicheia belloi*, n. sp. holotypus.



FIGG. 17-24

Edeago di *Typhloreicheia belloi*, n. sp.: (17) Holotypus; (18) Paratypus 1, Monte Sparagio, Trapani (CM); (19) Paratypus 2, Castello di Baida, Trapani (CM); (20) Paratypus 3, Purgatorio, Trapani (CM).

Edeago di: (21) *Typhloreicheia praecox*, topotypus (MSNG); (22-23) *Typhloreicheia praecox*, topotypus (CM); (24) *Typhloreicheia meridionalis*, holotypus (MSNG).

FIGG. 25-32

Edeago di *Typhloreicheia doderoana*, topotypus: (25-26) CM; (27-28) MSNG.
Edeago di: (29-30) *Typhloreicheia baudii*, topotypus (CM); (31) *Typhloreicheia binaghii*, topotypus (CM); (32) *Typhloreicheia binaghii* di Pomieri (Petralia Sottana), Madonie (Palermo), m 1300 s.l.m. sub *Quercus*, 16.V.2008, leg. C. Baviera (CB).

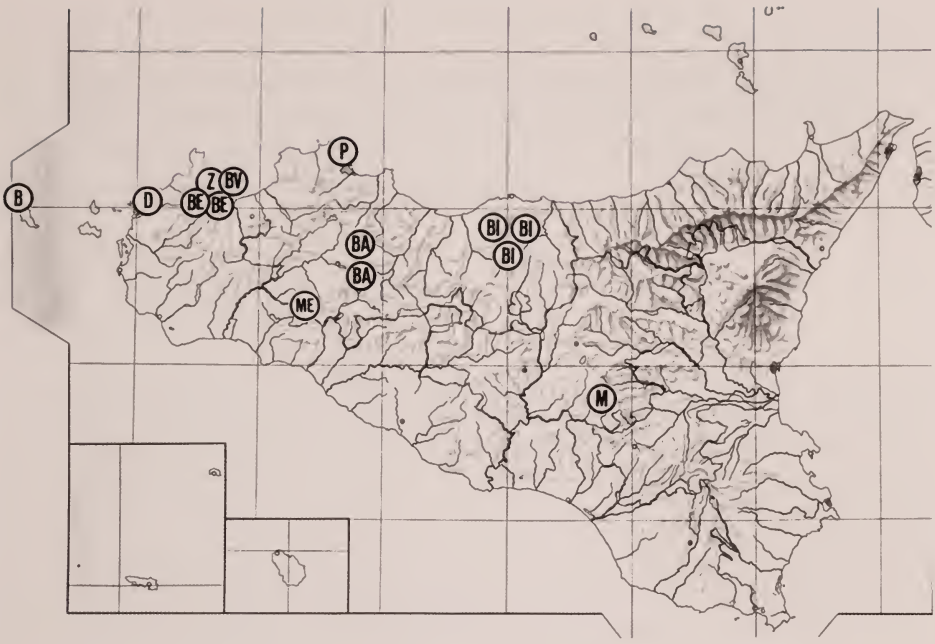


FIG. 33

Distribuzione del genere *Typhloreicheia* in Sicilia.
P: *Tyhloreicheia praecox* (Schaum, 1857); BA: *Typhloreicheia baudii* (Ragusa, 1883); BI: *Typhloreicheia binaghii* Casale, 1985; D: *Typhloreicheia doderoana* Casale, 1985; M: *Typhloreicheia meridionalis* Casale, 1985; B: *Typhloreicheia berninii* Magrini, Bastianini & Petrioli, 2003; Z: *Typhloreicheia zingarensis* Magrini & Baviera, 2003; ME: *Typhloreicheia messanae* Magrini, 2008; BV: *Typhloreicheia bavierai* Magrini, Degiovanni & Petrioli, 2011; BE: *Typhloreicheia belloi* n. sp.

BIBLIOGRAFIA

CASALE, A. 1985. Note su *Typhloreicheia* italiane, con descrizione di nuovi taxa di Sicilia (Col. Carabidae, Scaritinae). *Annali del Museo civico di Storia Naturale "G. Doria"*, Genova, 85: 259-271.

HOLDHAUS, K. 1924. Monographie du genre *Reicheia* Saulcy (Coleoptera Carabidae). *Abeille*, 32: 161-220.

MAGRINI, P. 2008. Una nuova *Typhloreicheia* endogea della Sicilia (Coleoptera, Carabidae). *Fragmenta entomologica*, Roma, 39 (2):179-185.

MAGRINI, P., BASTIANINI, M. & PETRIOLI, A. 2003. Una nuova *Typhloreicheia* dell'Isola di Marettimo (Isole Egadi: Sicilia) (Coleoptera, Carabidae). *Atti del Museo di Storia naturale della Maremma*, 19 (2001): 93-98.

MAGRINI, P. & BAVIERA, C. 2003. Una nuova *Typhloreicheia* troglobia della Sicilia (Coleoptera Carabidae). *Naturalista siciliano*, S. IV, 27 (3-4): 213-223.

MAGRINI, P., DEGIOVANNI, A. & PETRIOLI, A. 2011. Una nuova *Typhloreicheia* Holdhaus, 1924 della Sicilia (Coleoptera Carabidae). *Fragmenta entomologica*, Roma, 42 (2) (2010): 387-393.

VITALE, F., 1927. Coleotteri nuovi o poco conosciuti di sicilia. *Memorie della Società entomologica italiana*, 6:44-54.

Revue suisse de Zoologie 118 (2): 345-400; juin 2011

An annotated list of the Orthoptera (Insecta) species described by Alphonse Pictet (alone, and with Henri de Saussure) with an account of the primary type material present in the Muséum d'histoire naturelle in Geneva.

John HOLLIER
Muséum d'histoire naturelle, C.P. 6434, CH-1211 Genève 6, Switzerland.
Email: john.hollier@ville-ge.ch

An annotated list of the Orthoptera (Insecta) species described by Alphonse Pictet (alone, and with Henri de Saussure) with an account of the primary type material present in the Muséum d'histoire naturelle in Geneva. - Pictet described 193 species or subspecies, most of them in collaboration with Saussure. The names are listed alphabetically, and the location of the type material (if known) and the current nomenclatural combination are given. When there is primary type material in the Geneva Natural History Museum (MHNG) the sex, label data and condition of the specimens is given, along with their location within the collection.

Keywords: Ensifera - Caelifera - type-catalogue - Biologia Centrali-Americana.

INTRODUCTION

Alphonse Pictet (1838-1903) came from a family with strong links to the Geneva Natural History Museum (MHNG). His father, François-Jules Pictet (1809-1872), was professor of Zoology in Geneva for nearly thirty years and can be considered the "godfather" of the MHNG, while his brother Edouard Pictet (1835-1879) made some important contributions to the Museum's Neuroptera collections (Hollier, 2007). In his studies of the Orthoptera Alphonse Pictet collaborated with Henri de Saussure (1829-1905), another of François-Jules Pictet's pupils and one of the leading authorities on the Orthopteroid insects at that time. Four papers (Pictet 1888; Pictet & Saussure, 1887, 1891, 1892) dealt primarily with material in the Museum or Saussure's collections (the latter were officially donated to the MHNG in 1903, but the distinction between the two collections was not always made clear in the literature before that). Their collaboration on the first Orthoptera volume of the *Biologia Centrali-American* (BCA) (Saussure & Pictet, 1897, 1898) was a very different project. The BCA was an encyclopedia of the natural history of Mexico and Central America published in 215 parts in London by the editors Frederick DuCane Godman and Osbert Salvin (of the British Museum (Natural History)). The work was largely based on material collected specifically for the project by naturalists such as Herbert H. Smith (1851-1919), who went on to become curator of the Carnegie Museum of Natural History (Philadelphia, USA), and George C. Champion (1851-1927) who also acted as managing editor for

Manuscript accepted 03.01.2011

the series. Unless otherwise stated in the description, the assumption is that the type material of the species described in the BCA is in the Natural History Museum in London (BMNH).

The MHNG collection was revised by Saussure, and his successor Johann Carl (see Hollier, 2010), and the material has been studied by many specialists, so that it is not always possible to tell who attached type labels to the specimens. The Neotropical material was examined by Carlos Carbonell (Montivedeo, Uruguay), who labelled many specimens as holotypes or "hololectoypes" although many of these have not been officially designated. Poitr Naskrecki (Harvard, USA) examined and photographed many of the Tettigonioidea types and put the images on OSF.

Pictet described 193 species, mainly in collaboration with Saussure. Type material of 158 of these has been identified in the collection of the Geneva Natural History Museum (MHNG). Presumed types of two further species have been on loan from the MHNG collections since the 1970s. Type material of 65 species is in the BMNH (in some cases syntypes of a given species occur in both collections). Pictet and Saussure did not designate holotypes, and did not normally label type material as such, and some of the specimens labelled as syntypes may be holotypes by monotypy.

Some unavailable names are attributed to Pictet in the literature and these are treated at the end of the catalogue.

ARRANGEMENT AND FORMAT

The species are listed alphabetically. The format for each is:

species name Author, work: page [*Original generic placement*].

Type locality (as given in the original descrition). Type series.

Number of specimens. Specimen: "Label data" [format of label]. Following the recommendations of Ohl & Oswald (2004) the condition of each specimen is noted, although minor damage to the tips of the antennae or wing margins is not enumerated. Other comments. Location of material in the MHNG main Orthoptera collection.

Currently valid binomen of taxon (according to OSF).

The abbreviation OSF refers to *Orthoptera Species File Online* (Eades & Otte, 2010).

CATALOGUE

acutipennis Pictet & Saussure, 1892: 16-17, fig. 9 [*Chlorotribonia*].

Java. Unspecified number of ♂ and ♀.

Two ♂ and three ♀ syntypes. A ♂ with labels: "624 10, JAVA" [printed on yellow paper]; "Chlorotribonia brevifolia de Haan, ♂ Java" [handwritten on yellow paper]; "Mioacris acutipennis P. & S., det. C. de Jong 1938" [determination handwritten on white card with de Jong's name and date printed]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A ♂ with labels: "Chlorotribonia brevi - folia de Haan" [handwritten on yellow paper]; "Mioacris acutipennis P. & S., det. C. de Jong 1938" [determination handwritten on white card with de Jong's name and date printed]; "Chlorotribonia acutipennis P. + S., det. C. de Jong 1938, LECTOTYPE ♂" [determination and "LECTO" handwritten on white card with de Jong's name, date and

"TYPE" printed]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the tarsi of the left front and middle legs are missing. A ♀ with labels: "♀ Java" [handwritten on yellow paper]; "Chlorotribonia brevifolia de Haan" [handwritten on yellow paper]; "Mioacris acutipennis P. & S., det. C. de Jong 1938" [determination handwritten on white card with de Jong's name and date printed]; "Chlorotribonia acutipennis P. + S., det. C. de Jong 1938, LECTOTYPE ♀" [determination and "LECTO" handwritten on white card with de Jong's name, date and "TYPE" printed]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded. A ♀ with labels: "JAVA, FRUHSTORF." [printed on whitish paper]; "Chlorotribonia brevifolia de Haan" [handwritten on yellow paper]; "Mioacris acutipennis P. & S. ♀, det. C. de Jong 1938" [determination handwritten on white card with de Jong's name and date printed]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the left antenna is missing. A ♀ with labels: "JAVA, FRUHSTORF." [printed on whitish paper]; "Chlorotribonia brevifolia de Haan" [handwritten on yellow paper]; "Mioacris acutipennis P. & S. ♀, det. C. de Jong 1938" [determination handwritten on white card with de Jong's name and date printed]; "Syntypus" [printed on red paper]. Specimen set with wings folded. Although the species is mentioned by de Jong (1938: 36) he did not designate a lectotype. Images on OSF. Box E7.

Mioacris acutipennis (Pictet & Saussure, 1892).

acutipennis Saussure & Pictet, 1898: 383, 384-385, pl. 19, figs 9-10 [*Eriolus*].

Panama, Bugaba (Champion). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Eriolus acutipennis Saussure & Pictet, 1898.

albimacula Saussure & Pictet, 1898: 451, pl. 22, figs 3-5 [*Celidophylla*].

Nicaragua, Chontales (Janson). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Celidophylla albimacula Saussure & Pictet, 1898.

amplifolia Saussure & Pictet, 1898: 455, 456, pl. 22, fig. 17 [*Chlorophylla*].

Ecuador?, Cashiboya. Unspecified number of ♀.

No specimens found in MHNG collections. Vignon (1931: 77) could not trace the type material.

A junior synonym of *Cycloptera speculata* (Burmeister, 1838).

angustipennis Saussure & Pictet, 1897: 341, 344-345 [*Anaulacomera*].

Guiana; Cayenne. Unspecified number of ♂.

Specimen missing. Box B31.

Anaulacomera angustipennis Saussure & Pictet, 1897.

arbustorum Saussure & Pictet, 1897: 325 [*Plagiopleura*].

Brazil, Espiritu Santo. More than one ♂ (size variation mentioned).

Two ♂ syntypes. A ♂ with labels: "Plagiopleura arbustorum Sss. et Pict." [handwritten on green paper]; "Holotypus, Plagiopleura arbustorum S & P" [handwritten on red card with "Holotypus" printed]. Specimen set with wings spread; two tarsal segments are missing from both front legs. A ♂ with labels: "Espirito Santo, Brasil, ex coll. Fruhstorfer" [printed on green card]; "Plagiopleura arbustorum Sss. et Pict." [handwritten on green paper]; "Geneva" [printed on a strip of yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the tibia and tarsi of the left front leg are lost, as are both middle legs and the left hind leg. The specimen with folded wings appears to be the variety "minor" referred to in the original description. Images on OSF. Box B23.

Plagiopleura arbustorum Saussure & Pictet, 1897.

arcuata Saussure & Pictet, 1898: 455, 456, pl. 22, fig. 19 [*Chlorophylla*].

Ecuador (Mus. Genavense). One damaged ♂.

No specimens found in MHNG collections. Vignon (1931: 78) could not trace the type.

Cycloptera arcuata (Saussure & Pictet, 1898).

argentinus Pictet & Saussure, 1887: 372 [*Diponthus*].

République Argentine, Buenos-Ayres. Unspecified number of ♀.

One ♀ syntype with labels: "Buenos Ayres" [handwritten on white paper]; "Prionacris argentinus Pict. et Sss." [handwritten on green paper]; "Diponthus argentinus P. et S." [handwritten on green paper]; "Diponthus argentinus P.-S., Holotypus ♀, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread; the right antenna is missing. Images on OSF. Box Z15.

Diponthus argentinus Pictet & Saussure, 1887.

aridifolia Saussure & Pictet, 1898: 452, 454, pl. 22, figs 12-13 [*Mimetica*].

Costa Rica, Rio Sucio (Rogers). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Mimetica aridifolia Saussure & Pictet, 1898.

ater Saussure & Pictet, 1897: 287, 291, pl. 14, figs 8-9 [*Stenopelmatus*].

Costa Rica (Rogers). Unspecified number of ♂.

One ♂ syntype with labels: "R. Susio, Costa Rica, H. Rogers" [printed on white paper]; "Stenopelmat. ater P. et Sss" [handwritten on green paper]; "Holotypus, Steno - pelmatus ater Pict. & Sauss." [handwritten by Hubbell on red card with "Holotypus" printed]. Specimen lacks most of the left antenna and the last tarsal segment of the right middle leg. Although Hubbell labelled this specimen as the holotype it is actually a syntype and there are further syntypes in the BMHN according to their database. OSF states that one of these is the lectotype, but no such designation seems to have been published. Box O1.

Stenopelmatus ater Saussure & Pictet, 1897.

atriceps Pictet & Saussure, 1891: 305-306, fig. 8 [*Gryllacris*].

Indes orientales. Unspecified number of ♀.

One ♀ syntype with labels: "Gr. atriceps Pic. + Ss." [handwritten on lined white paper]; "Gryllacris atriceps, ♀ P. et S." [handwritten on yellow paper]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Indes orient." handwritten in the lower right corner. The specimen is set with right wings spread and left wings folded; most of the spread wings have been lost, as have both antennae, both front legs, the right middle leg and the left hind leg. The ovipositor has been broken off near the base and is missing. Box N3.

A junior synonym of *Stictogryllacris picteti* (Kirby, 1906).

atricula Pictet & Saussure, 1891: 315-316, fig. 16 [*Gryllacris*].

Amérique. Unspecified number of ♂ and ♀.

No specimens found in the MHNG collections. Griffini (1909: 402) considered this species a synonym of *G. picta* Brunner von Wattenwyl, 1888. He placed a ♀ specimen in the collection under that name, but stated it was not the type of *G. atricula* because the measurements did not match. The whereabouts of the type material is unknown. Box N4.

Brachybaenus atricula (Pictet & Saussure, 1891).

azteca Saussure & Pictet, 1898: 376, 379, pl. 19, fig. 1 [*Copiophora*].

Mexico, Teapa in Tabasco (H. H: Smith). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Copiphora azteca Saussure & Pictet, 1898.

azteca Saussure & Pictet, 1898: 346-347, pl. 16, figs 17-19 [*Ctenophlebia*].

Mexico; Atoyac in Vera Cruz, Teapa in Tabasco (H. H. Smith); Nicaragua, Chontales (Janson); Panama, Bugaba, Volcan de Chiriqui (Campion). Unspecified number of ♂ and ♀.

One ♂ and two ♀ syntypes. A ♂ with labels: "Bugaba, 800-1500 ft., Champion." [printed on white card]; "Ctenophlebia azteca Brunn." [handwritten on green paper]; "Geneva" [printed on a strip of yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; most of both antennae is missing, as is the right hind leg. The abdomen is much shrivelled. A ♀ with labels: "Teapa, Tabasco, Feb. H.H.S." [printed on white card]; "Ctenophlebia azteca Brunn." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the left antenna is missing. A ♀ with labels: "Chontales, Nicaragua, Janson" [printed on white card]; "Ctenophlebia azteca Brunn." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae and the tibia and tarsi of the right hind leg are lost. There are further syntypes in the BMNH (images on OSF). Box B32.

Viadana azteca (Saussure & Pictet, 1898).

azteca Saussure & Pictet, 1897: 296, pl. 14, fig. 19 [*Glaphyrosoma*].

Mexico, Teapa in Tabasco (H. H. Smith). Unspecified number of ♀.

No specimens found in MHNG collections. The type material ought to be in the BMNH but OSF does not list the type depository and the species is not listed on the BMNH database.

Lutosa azteca (Saussure & Pictet, 1897).

azteca Saussure & Pictet, 1898: 415, 419 [*Gongrocnemis*].

Mexico, Cordova in Vera Cruz (Höge, Saussure). Unspecified number of ♂ and ♀ (size variation mentioned).

Four ♂ syntypes. A ♂ with labels: "Cordova, Mexico, Hoege" [printed on white card]; "Gongrocnemis azteca Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; most of the right antenna is missing. A ♂ with labels: "Cordova, Mexico, Hoege" [printed on white card]; "Gongrocnemis azteca Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; most of the left antenna, the tarsi of the right front leg and the left front and middle legs are lost. A ♂ with labels: "Potrero, Sumichrast" [handwritten on white paper]; "Gongrocnemis azteca Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the right antenna is missing and the right hind leg is detached and secured through the femur on the original pin. A ♂ with labels: "Gongroc-, nemis, azteca, Ss., ♂ Type!" [handwritten on green paper]; "Syntypus" [printed on red paper]. The species name label in the insect box has the locality "Mexico" handwritten in the lower left corner. Specimen set with wings spread; most of both antennae are missing. The left hind leg is detached and secured through the femur on the original pin, and the top of the abdomen has split so that the end is now curved under the body parallel to the proximal part. The specimens collected by Höge are smaller than the others, which presumably represent the varieties. Although the description treats both sexes no ♀ specimens were identified in the MHNG collection. Box E20.

A junior synonym of *Gongrocnemis bivittata* Brunner von Wattenwyl, 1895.

aztecum Pictet & Saussure, 1892: 26, fig. 21 [*Acanthoprion*].

Mexico, Oudonga. Unspecified number of ♀.

Two ♀ syntypes. A ♀ with labels: "Mexique, Oudouga" [handwritten on white paper]; "azteca" [handwritten on white paper]; "Aprion aztecum P. & Sauss." [handwritten on green paper]; "Holotypus" [printed on red card]; "Probably a syntype" [handwritten on red paper]. Specimen set with left wings spread and right wings folded; the antennae, the last tarsal segment of the left front leg, two tarsal segments of the left middle leg, the right middle leg and the left hind leg are missing. A ♀ with labels "Acanthaprion azteca P. & Ss." [handwritten on white paper]; "Aprion aztecus p. & Sauss." [handwritten on green paper]; "Probably a syntype of A. aztecum Pict. & S. 1892, Hollier 2010" [handwritten on red paper]. Specimen set with wings folded; the antennae, the left front leg, left middle leg, the tibia and tarsi of the right middle leg, the left hind leg and two tarsal segments of the right hind leg are lost. There is a detached hind leg secured on a separate pin, but it is not clear to which specimen it belongs. Images on OSF. Box E8.

Acanthoprion aztecum Pictet & Saussure, 1892.

aztecus Saussure & Pictet, 1897: 299, 300, pl. 14, fig. 23 [*Ceuthophilus*].

Mexico, Atoyac in Vera Cruz (Schumann). Unspecified number of ♂ and ♀.

No specimens found in MHNG collections. There is a ♀ syntype, erroneously referred to as the holotype on OSF, in the BMNH according to their database.

Argyrtes aztecus (Saussure & Pictet, 1897).

aztecus Saussure & Pictet, 1898: 389, 391-392 [*Conocephalus*].

Mexico, Teapa in Tabasco (H.H. Smith); Costa Rica (Rogers), Rio General, Pacific Coast (var minor). Unspecified number of ♂ and ♀ (size variation mentioned).

One ♂ and two ♀ syntypes. A ♂ with labels: "Teapa, Tabasco. Feb. H.H.S." [printed on white card]; "Conocephalus aztecus Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the right antenna and the tarsi of the left middle leg are lost. A ♀ with labels: "Teapa. Tabasco. Feb. H.H.S." [printed on white card]; "Conocephalus aztecus Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the ends of the antennae and the tarsi of the right middle leg are missing. A ♀ with labels: "Teapa. Tabasco. Feb. H.H.S." [printed on white card]; "Conocephalus aztecus Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the tibia and tarsi of the right front leg are missing. There are further syntypes in the BMNH. Images on OSF. Box F7.

A junior synonym of *Neoconocephalus affinis* (Beauvois, 1805).

aztecus Saussure & Pictet, 1898: 358, 363-364, pl. 17, fig. 13 [*Microcentrum*].

Mexico, Teapa in Tabasco (H. H. Smith). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Orophus aztecus (Saussure & Pictet, 1898).

barellus Pictet, 1888: 11-12, fig. 4 [*Posidippus*].

Cayenne (Bar). Unspecified number of ♂ and ♀.

One ♂ syntype with labels: "Posidippus spec. nov. Brunn. exam." [handwritten on white paper]; "Posidippus Barella, Pict." [handwritten on green paper]; "Lectotype ♂, Posidippus barellus Pictet, 1888, Desig. Emsley, 1969" ["Type" printed and the rest handwritten by Emsley on red card]. The species name label in the insect box has the locality "Cayenne" handwritten in the lower left corner. Specimen set with wings spread; both front legs and the right middle leg are missing and the left middle and hind legs lack the tarsi. Emsley (1970) referred to a male holotype and female allotype in the MHNG, but there was no such designation in the original description and so the specimens are syntypes. The ♀ specimen could not be found in the MHNG collection, and there was no gap in the insect box. Images on OSF. Box B27.

Steirodon barellum (Pictet, 1888).

bariana Pictet, 1888: 10-11, fig. 3 [*Apocerycta*].

Cayenne (Bar). Unspecified number of ♀.

Two ♀ syntypes. A ♀ with labels: "Cayenne, Portal Guyane" [printed on green paper]; "Apocerycta bariana, Pict." [handwritten on green paper]; "Syntypus" [printed

on red card]. Specimen set with wings spread; both antennae, the left front leg, the tibia and tarsi of the right front leg, the tarsi of both middle legs and the last two tarsal segments of the right hind leg are missing, as is most of the femur, the tibia and the tarsi of the left hind leg. A ♀ with labels: "Cayenne" [printed on green paper]; "Apocerycta bariana, Pict." [handwritten on green paper]; "Geneva" [printed on yellowish paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the tarsi of the left front leg, the tibia and tarsi of the right front leg, the last tarsal segment of the left middle leg and the last two tarsal segments of the right middle leg are missing. Images on OSF. Box B34.

Apocerycta bariana Pictet, 1888.

biloba Pictet & Saussure, 1887: 338-339 [*Colpolopha*].

Perou. Unspecified nuber of ♀.

One £ syntype with labels: "Perou, Mr H de Saussure" [handwritten on a strip of white card]; "Colpolopha biloba Sss. et Pict." [handwritten on green paper]; "Colpolopha bilobata Pict. et S., Holotypus, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen lacks both antennae, the left middle leg and the tibiae and tarsi of both hind legs. Images on OSF. Box Z3.

Colpolopha biloba Pictet & Saussure, 1887.

brahmina Pictet & Saussure, 1891: 306-307, fig. 9 [*Gryllacris*].

Indes orientales. Unspecified number of ♀.

One £ syntype with labels: "G. brahmina Pic, Ss." [handwritten on lined white paper]; "16, Ind. orient? Musée" [handwritten on white paper]; "Gryllacris brahmina, ♀ P. et S." [handwritten on yellow paper]; "Holotypus" [printed on red card]. Specimen set with left wings spread and right wings folded; the spread wings are rather frayed, most of both antennae, the last tarsal segment of the left front leg, the tibia and tarsi of the right front leg, the tarsi of the left middle leg, the right middle and hind legs and the tibia and tarsi of the left hind leg are all missing. This species is actually African rather than Indian, and according to the species name label in the insect box this specimen was identified as *G. africana* Brunner von Wattenwyl, 1888 by Griffini (a species currently placed in the genus *Afrogryllacris* Karny). Box N3.

Gryllacris brahmina Pictet & Saussure, 1891.

brevicauda Saussure & Pictet, 1898: 415, 420, pl. 20, fig. 7 [*Gongrocnemis*].

Costa Rica, La Uruca (Biolley). Unspecified number of ♀.

One £ syntype with labels: "La Uruca 107, 1100m, P. Biolley" [handwritten on white paper]; "Costa Rica" [handwritten on green paper]; "Gongrocnemis brevicauda Sauss. + P." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with left wings roughly spread and right wings folded. Images on OSF. Box E20.

Ancistrocercus brevicauda (Saussure & Pictet, 1898).

brevistylus Saussure & Pictet, 1898: 410 [*Lichenochrus*].

Mexico, Cordova (Mus. Genavense). Unspecified number of ♂ and ♀ (the latter only nymphs).

One ♂ syntype with labels: "Potrero, Sumichrast" [handwritten on white paper]; "Lichenochrus brevistylus Sauss et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; most of both antennae and two tarsal segments of the right hind leg are missing. Four ♀ nymphs near this specimen may be those mentioned in the description, and thus syntypes. Box E16.

A junior synonym of *Gongrocnemis munda* Brunner von Wattenwyl, 1895.

brullei Pictet & Saussure, 1892: 22 [*Chloracris*].

Java. Unspecified number of ♂ and ♀.

One ♂ and one ♀ syntype. A ♂ with labels: "Pseudophyllus Brullei, P. & Sauss., ♂ Java" [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded, the antennae and the front and hind legs are missing apart from a detached femur secured on the original pin. The right hind leg is detached and secured on a separate pin. A £ with labels: "Pseudophyllus Brullei P.+ Sauss, ♀"

[handwritten on yellow paper]; "Syntypus" [printed on red paper]. Although this specimen does not have a locality label, the measurements correspond to those given in the original description. Specimen set with wings spread; most of both antennae, the tibia and tarsi of the left middle leg and the last tarsal segment of the right hind leg are missing. Box E3.

Chloracris brullei Pictet & Saussure, 1892.

californicus Pictet, 1888: 64-65, fig. 35 [*Idiostatus*].

Californie. Unspecified number of ♂.

Lectotype ♂ (designated by Rentz, 1973: 52) with labels: "CALIFORNIE, 603 26" [name printed and number handwritten on white paper]; "LECTOTYPE, Idiostatus californicus PICTET, By D.C. RENTZ 1968" [handwritten by Rentz on white card with "Lectotype" and "By" printed in red]. Specimen lacks the right antenna and the tarsi of the right middle leg. A paralectotype ♂ is also present. Images on OSF. Box K10.

Idiostatus californicus Pictet, 1888.

capreolus Pictet, 1888: 69-70, fig. 33 [*Acanthoproctus*].

Afrique méridionale, Cap de Bonne-Espérance. Unspecified number of ♂.

One ♂ and one ♀ syntype. A ♂ with labels: "620 91, Africa mer., Mus. de Calcutta" [handwritten on ruled white card]; "Acanthoproctus capreolus Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen lacks most of both antennae, the left front leg, the tibia and tarsi of the right front leg, the last tarsal segment of the right middle leg and both hind legs. A micro-tube containing dissected parts is secured on the original pin, as are the bracypterous forewings which have been glued onto card. A ♀ with labels: "620 91, Africa mer., Mus. de Calcutta" [handwritten on ruled white card]; "1614" [handwritten on white card]; "1038/ S. Afr." [handwritten on a disc of whitish paper]; "Acanthoproctus capreolus Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen lacks most of both antennae and the last tarsal segment of the left hind leg. Images on OSF. Box M3.

Acanthoproctus vittatus capreolus Pictet, 1888.

cardinalis Pictet & Saussure, 1887: 360-361 [*Tropidacris*].

Guatemala. Unspecified.

One ♀ syntype with labels: "2 14, Guatemala, Mr H. d. Sauss." [handwritten on ruled white paper]; "Tropidacris cardinalis P.-S., Holotypus ♀, C. S. Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread; both antennae, the last tarsal segment of the right front leg and two tarsal segments of the right middle leg are missing. Box Z11.

A junior synonym of *Tropidacris cristata dux* (Drury, 1773).

carinata Pictet, 1888: 46-47 [*Copiophora*].

Haut-Amazone. Unspecified number of ♂.

One ♂ syntype with labels: "Copiophora capito Stål, (carinata Pictet), type, Amazonie" [handwritten on green paper]; "Copiophora capito Stål" [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread; both antennae, the left front leg, the tibia and tarsi of the right front leg and both middle legs are missing, the hind legs are detached and secured on the original pin (one glued to card, the other transfixed through the femur). The head, thorax and abdomen show signs of damage, presumably by museum beetle. Box F1.

A junior synonym of *Copiphora capito* Stål, 1873.

carinifolia Saussure & Pictet, 1898: 457, pl. 22, fig. 20 [*Cycloptera*].

Guiana (Mus. Genavense). Unspecified number of ♂ (almost certainly a single damaged specimen).

Holotype ♂ with labels: "Cycloptera carinifolia Sauss et P." [handwritten on green paper]; "Holotypus" [printed on red card]. There is also a brownish disk of card on which any writing there might have been has faded away. The species name label in the insect box has the locality "Amer. merid.?" handwritten in the lower left corner. Specimen set with wings spread; the antennae, both front legs (apart from a detached femur glued to card and secured on the original pin), the tarsi of the right middle leg and the ends of the femurs, the tibiae and the tarsi of both hind legs are missing. The abdomen has been eviscerated and stuffed. The specimen had lost the hind tibiae before the description. Images on OSF. Box E31.

Paracycloptera carinifolia (Saussure & Pictet, 1898).

carinulatus Saussure & Pictet, 1898: 442, 443-4, pl. 21, fig. 14 [*Scopiorus*].

Mexico (coll. Brunner), Orizaba (H. H. Smith). More than one ♂.

No specimens found in MHNG collections. There is a syntype, erroneously referred to as the holotype on OSF, in the BMNH (images on OSF).

Scopiorinus carinulatus (Saussure & Pictet, 1898).

casamancae Pictet & Saussure, 1892: 23, fig. 13 [*Mataeus*].

Guinea, Casamanca. Unspecified number of ♀.

One ♀ syntype with labels: "Casmana, Mr Ed Sarazin" [handwritten on white paper]; "casamancae" [handwritten on white paper]; "Mataeus latipennis Karsch" [handwritten on pink paper]; "Syntype of M. casamancae Pict. + Saus., 1892, Hollier

2010" [handwritten on red paper]. Specimen set with wings spread; the antennae and all of the legs except the right front leg are lost. The illustration of this species accompanying the original description is of a specimen with folded wings. Box E1.

A junior synonym of *Zabalius apicalis apicalis* (Bolivar, 1886).

cephalotes Saussure & Pictet, 1898: 377, 380, pl. 19, fig. 2 [*Copiophora*].

Brazil, Rio Janeiro. Unspecified number of ♀.

No specimens found in MHNG collections. The whereabouts of the type material is unknown.

Copiphora cephalotes Saussure & Pictet, 1898.

championi Saussure & Pictet, 1898: 445 [*Caloxiphus*].

Guatemala, Panzos in Vera Paz (Champion). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Caloxiphus championi Saussure & Pictet, 1898.

championi Saussure & Pictet, 1898: 357, 360, pl. 16, fig. 30 [*Microcentrum*].

Panama, Bugaba (Champion). Unspecified number of ♂.

No specimens found in MHNG collections.There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Orophus championi (Saussure & Pictet, 1898).

championi Saussure & Pictet, 1898: 370, 371-372, pl. 18, figs 6-9 [*Peucestes*].

Guatemala, Panzos in Vera Paz (Champion, ♂); Costa Rica, Caché (Rogers, ♀). Unspecified number of ♂ and ♀.

The single ♂ specimen in the MHNG collection, from Costa Rica was collected by Biolley and so is not a type. The lectotype of this species, designated by Emsley (1970: 161), is in the BMNH. Images on OSF. Box B26.

Steirodon championi (Saussure & Pictet, 1898).

championi Saussure & Pictet, 1897: 298, pl. 14, figs 20-22 [*Phoberopus*].

Guatemala, Totonicapam 8000 to 10,000 ft., Cerro Zunil 5000 ft. (Champion). More than one ♂.

Lectotype ♂ (designated by Hubbell, 1977: 296) with labels: "Totonicapam, 8-10,000ft., Champion" [printed on white paper]; "Phoberopus championi P. et Sss" [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen lacks the left front leg. Box O9.

Phoberopus championi Saussure & Pictet, 1897.

clarazianus Pictet & Saussure, 1887: 336-337 [*Alcamenes*].

République Argentine (Claraz). Unspecifed number of ♂ and ♀ (colour variation mentioned).

One ♂ and one ♀ syntype. A ♂ with labels: "San José env. Claraz" [hand - written on white paper]; "Alcamenes clarazianus Sss. et Pict." [handwritten on green paper]; "Claraziana S. et P." [handwritten on white paper]; "Alcamenes clarazianus P.

et S., Allotypus ♂, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen lacks about half of the right antenna and two tarsal segments of the left middle leg. A ♀ with labels: "San José env. Claraz" [handwritten on white paper]; "Alcamenes clarazianus Sss. et Pict." [handwritten on green paper]; "Alcamenes clarazianus P. et S., Holotypus ♀, C S Carbonell - 1966" [handwritten by Carbonell on red card]. The original description gives measurements for the ♀ only, which led Carbonell to regard it as the holotype (Carbonell pers. comm.), but male characters are mentioned in the description and there is no type designation, therefore both specimens are syntypes.

Images on OSF. Box Z2.

Alcamenes clarazianus Pictet & Saussure, 1887.

clarazianus Pictet & Saussure, 1887: 370-371 [*Diponthus*].

République Argentine, Entre-Rios, Bahia Blanca, San José. Unspecified number of ♂ and ♀ (colour variation mentioned).

Three ♂ and three ♀ syntypes. A ♂ with labels: "San José, Entre-Rios, env. Claraz" [handwritten on white paper]; "Prionac. clarazianus Pict. et Sss." [handwritten on green paper]; "Diponthus clarazianus P.-S., Hololectotypus [sic] ♂, C S Carbonell. 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread. A ♂ with labels: "San José, env. Claraz" [handwritten on white paper]; "Prionac. clarazianus Pict. et Sss." [handwritten on green paper]; "CSC 1139" [handwritten by Carbonell on a strip of white card]; "Diponthus clarazianus P.-S., Paratypus CSC 1966" [handwritten by Carbonell on red card]. Specimen set with wings folded; the left antenna is missing. A micro-tube containing dissected parts and a label "1139" is secured on the original pin. A ♂ with labels: "Bahia Blanca, env. G Claraz" [handwritten on white paper]; "Diponthus clarazianus ♂ P. et S." [handwritten on green paper]; "Prionac. clarazianus Pict. et Sss." [handwritten on green paper]; "CSC 1141" [handwritten by Carbonell on a strip of white card]; "Diponthus clarazianus P.-S., Paratypus CSC - 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread; the left front leg is missing. A micro-tube containing dissected parts and a label "1141" is secured on the original pin. A ♀ with labels: "Colonie Suisse de San José, Entre-Rios, env. Claraz" [handwritten on white paper]; "Prionac. clarazianus Pict. et Saus." [handwritten on green paper]; "Diponthus clarazianus ♀ P. et S." [handwritten on green paper]; "Diponthus clarazianus P.-S., Allolectotypus [sic] ♀, C S Carbonell 1966" [handwritten by Carbonell on red card]. Specimen set with left wings spread and right wings folded. A ♀ with labels: "San José, Entre-Rios, env. Claraz" [handwritten on white paper]; "Prionac. clarazianus Pict. et Sss." [handwritten on green paper]; "Diponthus clarazianus P.-S., Paratypus CSC - 1966" [handwritten by Carbonell on red card]. Specimen set with wings folded; the left antenna, the last tarsal segment of the left front and middle legs, and the tarsi of both hind legs are missing. A ♀ with labels: "Bahia Blanca, env. G Claraz" [handwritten on white paper]; "Prionac. clarazianus Pict. et Saus." [handwritten on green paper]; "Diponthus clarazianus P.-S., Paratypus CSC - 1966" [handwritten by Carbonell on red card]. Specimen set with wings folded; both antennae are missing. The lectotype does not seem to have been officially designated. Images on OSF. Box Z15.

Diponthus clarazianus Pictet & Saussure, 1887.

comanchus Saussure & Pictet, 1897: 287, 290 [*Stenopelmatus*].

Northern Mexico, Durango (Höge). Unspecified number of ♂ and ♂.

No specimens found in MHNG collections. The type material is in the BMNH according to their database.

A junior synonym of *Stenopelmatus fuscus* Haldeman, 1852.

consobrinus Saussure & Pictet, 1898: 383, 384, pl. 19, figs 6-7 [*Eriolus*].

Guatemala, Lanquin in Vera Paz, Capetillo (Champion); Panama, Volcan de Chiriqui (Champion). Unspecified number of ♂ and ♀ (size variation mentioned).

Three ♀ syntypes. A ♀ with labels: "V. de Chiriqui, below 1,000 ft., Champion" [printed on white card]; "Eriolus consobrinus S. et P." [handwritten on green paper]; "Musée de Genève, No" [printed on white card with printed border]; "Eriolus consobrinus Sauss." [handwritten on white card]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the left antenna, the tarsi of the right front and middle legs and the last tarsal segment of the left middle leg are lost. A ♀ with labels: "V. de Chiriqui, 25-4000 ft., Champion" [printed on white card]; "Eriolus consobrinus S et P" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the right antenna is missing and the abdomen is twisted so that the ovipositor points down and to the left. A ♀ with labels: "V. de Chiriqui, 25-4000 ft., Champion" [printed on white card]; "Eriolus consobrinus S et P" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the right antenna, both front legs and the tibia and tarsi of the right hind leg are lost. OSF states that the lectotype is in the BMNH, although it does not seem to have been formally designated. There are further syntypes in the BMNH (images on OSF). Box F2.

Erioloides consobrinus (Saussure & Pictet, 1898).

coriacea Pictet, 1888: 9-10, fig. 2 [*Prosagoga*].

Guyane. Unspecified number of ♂.

One ♂ syntype with labels: "Cayenne, Portal Guyane" [printed on green paper]; "Prosagoga coriacea, Pict." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread; both antennae, the tarsi of the left front leg, the last tarsal segment of the left middle leg and the last tarsal segment of the right hind leg are missing. Part of the terminalia is glued to a card secured on the original pin. Images on OSF. Box B33.

Itarissa coriacea (Pictet, 1888).

crenata Saussure & Pictet, 1897: 323, 324 [*Ectemna*].

Mexico, Cordova (Saussure). One ♀.

Holotype £ with labels: "Ectemna carinata Br. var." [handwritten on white card with printed black border]; "Ectemna crenata Sauss." [handwritten on green paper]; "Holotypus Ectemna crenata Sauss." [handwritten on red card with "Holotypus" printed]. The species name label in the insect box has the locality "Mexique" handwritten in the lower left corner. Specimen set with left wings spread and right wings folded; most of both antennae is missing, the left front and middle legs lack two tarsal segments, the right middle leg lacks the tarsi and the right hind leg is missing. Images on OSF. Box B23.

Ectemna crenata Saussure & Pictet, 1897.

cribrosum Saussure & Pictet, 1898: 358, 362 [*Microcentrum*].

Mexico, Teapa in Tabasco (H. H. Smith). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Orophus cribrosus (Saussure & Pictet, 1898).

cultricornis Pictet, 1888: 47-48, fig. 23 [*Copiophora*].

Amérique centrale. Unspecified number of ♂ and ♀.

Three ♀ specimens. A ♀ with labels: "V. de Chiriqui, 2-3000 ft., Champion" [printed on white card]; "cultricollis [sic]" [handwritten on white paper]; "cultricornis Pict., cultricollis?" [handwritten on green paper]; "Possible syntype of C. cultricornis Pictet, 1888? Hollier 2010" [handwritten on red paper]. Specimen set with wings folded. A £ with labels: "V. de Chiriqui, 2-3000 ft., Champion" [printed on white card]; "Copiophora cultricornis Pict." [handwritten on green paper]; "Possible syntype of C. cultricornis Pictet, 1888? Hollier 2010" [handwritten on red paper]. Specimen set with wings folded; most of the left antenna is lost. A ♀ with labels: "Coll. G. et S., Volc. Chiriqui, G.C. Champion" [printed on white paper]; "Copiophora cultricornis Pict." [handwritten on green paper]; "Possible syntype of C. cultricornis Pictet, 1888? Hollier 2010" [handwritten on red paper]. Specimen set with wings spread; most of both antennae, the right front and middle legs and both hind legs are missing. The locality labels suggest that these specimens arrived in the MHNG collection when Saussure and Pictet were preparing the first Orthoptera volume of the *Biologia Centrali-Americana* (Saussure & Pictet 1898), meaning that they probably arrived after the publication of the description. This impression is reinforced by the fact that the locality given in the description is only "l'Amérique centrale" rather than something more specific. However, in the BCA (Saussure & Pictet, 1898) the only localities mentioned are Chiriqui and Buguba in Panama, and Redtenbacher (1891: 342) refers to specimens of this species from Chiriqui in the collection of Brunner von Wattenwyl, showing that Champion's material (it being unlikely that any other collector would have visited this particular site at the time) was in Europe at around the time of publication. The specimens in the MHNG collection are therefore possibly syntypes; if not, the where-abouts of the type material is unknown. Images on OSF. Box F1.

Copiphora cultricollis Pictet, 1888.

cyclops Saussure & Pictet, 1897: 305, 308, pl. 15, fig. 9 [*Gryllacris*].

Panama, Chiriqui (Champion). Unspecified number of ♀.

No specimens found in MHNG collections. The type material is in the BMNH according to their database.

Brachybaenus cyclops (Saussure & Pictet, 1897).

denticauda Saussure & Pictet, 1897: 341, 345, pl 16, figs 15-16 [*Anaulacomera*].

Mexico, Temax in N. Yucatan (Gaumer). Unspecified number of ♂ and ♀ (variation in femur mentioned).

Specimen(s) missing. There is a ♀ syntype, erroneously refered to as the holotype on OSF, in the BMNH (images on OSF). Box B31.

Anaulocomera denticauda Saussure & Pictet, 1897.

dentipes Saussure & Pictet, 1898: 414, 415-416 [*Gongrocnemis*].

Costa Rica, Caché (Rogers). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Clepsydronotus dentipes (Saussure & Pictet, 1898).

diadematus Saussure & Pictet, 1898: 385-6; pl. 19, figs. 11 & 12 [*Basileus*].

Guiana, Cayenne (Portal). More than one ♀ (size variation mentioned).

Three £ syntypes. A £ with labels: "CAYENNE" [printed on a strip of green paper]; "Basileus diadematus, Sss & P." [handwritten on green paper]; "Holotypus" [printed on red card]; "Probably a syntype, Hollier 2010" [handwritten on red paper]. Specimen set with wings folded; most of the left antenna and the entire right antenna are lost. A ♀ with labels: "Cayenne, Portal Guyane" [printed on green paper]; "Basileus diadematus, S. & P." [handwritten on green paper]; "Probably a syntype, Hollier 2010" [handwritten on red paper]. Specimen set with wings spread, most of the left antenna and the entire right antenna are lost, as are the tarsi of the right middle leg. A ♀ with labels: "Basileus diadematus, S. & P." [handwritten on green paper]; "Probably a syntype, Hollier 2010" [handwritten on red paper]. Specimen set with wings folded, the tip of the left antenna and the entire right antenna, the tarsi of the right middle leg and the last tarsal segment of the left hind leg are missing. Images on OSF. Box F3.

Vestria diademata (Saussure & Pictet, 1898).

dumicola Saussure & Pictet, 1897: 323 [*Ectemna*].

Panama, Bugaba (Champion). Unspecified number of ♂ and ♀.

Two ♀ syntypes. A ♀ with labels: "Bugaba, 800-1,000 ft., Champion" [printed on white paper]; "Ectemna dumicola Sss" [handwritten on green paper]; "Geneva" [printed on a strip of yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae is missing, the left middle leg lacks the last tarsal segment and the right hind leg is lost. A ♀ with labels: "Bugaba, 800-1,000 ft., Champion" [printed on white paper]; "Ectemna dumicola Sss" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the ends of the antennae are lost as are the tarsi of both front legs, both middle legs and the tarsi of both hind legs. Images on OSF. There are further syntypes in the BMNH according to their database. Box B23.

Ectemna dumicola Saussure & Pictet, 1897.

elliptifolia Pictet & Saussure, 1892: 18, fig. 11 [*Microprion*].

Java. Unspecified number of ♀.

One ♀ syntype with labels: "Microprion ceylonicus Brunner" [handwritten on yellow paper]; "Microprion elliptifolia P. & S., det. C. de Jong 1938, TYPE" [determination handwritten on white card with de Jong's name, date and "TYPE" printed]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Java" handwritten in the lower left corner. Specimen set with left wings spread and right wings folded; the antennae and all legs are lost. The left hind wing is

detached and glued to a piece of card pinned into the insect box next to the specimen. A second ♀ with labels "Microprion ceylonicus Brunner" [handwritten on yellow paper]; "Microprion elliptifolia P. & S., det. C. de Jong 1938" [determination handwritten on white card with de Jong's name and date printed] may be a second syntype. Images on OSF. Box E8.

Phyllomimus elliptifolius (Pictet & Saussure, 1892).

e***phippium*** Pictet & Saussure, 1887: 332-333 [*Orestera*].

Perou. Unspecified number of ♂.

One ♂ syntype with labels: "Perou, Mr H de S." [handwritten on white paper]; "Orestera ephippium, ♂ S. et P., Perou M. H. de S." [handwritten on green paper]; "Orestera ephippum P.-S., Holotypus, C S Carbonell 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread; most of the left antenna, the tarsi of the right front leg, the last tarsal segment of the left middle leg and the tarsi of the right middle leg are missing. Images on OSF. Box Z1.

Hippacris ephippium (Pictet & Saussure, 1887).

excisum Pictet, 1888: 26-27, fig. 9 [*Typophyllum*].

Cayenne (Bar). More than one ♂.

There are no specimens standing under this name in the MHNG even though Vignon (1931) states that he saw more than one ♂ specimen (only ♂ characters were mentioned in the original description). It is probable that the syntypes are among the specimens of *Typophyllum trapeziforme* (Stoll, 1787) in the MHNG collection (box E30), which are also from Cayenne (the type locality of *T. excisum*), but it is not possible to identify them. The specimen in the Muséum National d'histoire naturelle (MNHN) in Paris referred to on OSF is that mentioned by Vignon (1931: 122) and not a type.

A junior synonym of *Typophyllum trapeziforme* (Stoll, 1787).

fagifolia Saussure & Pictet, 1898: 455, 456, pl. 22, fig. 18 [*Chlorophylla*].

Ecuador. More than one ♀ (colour variation mentioned).

One ♀ syntype with labels: "Ecuador, 6630, 1" [locality handwritten, numerals printed on white card]; "Chlorophylla fagifolia Sauss + P. var." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; most of the left antenna and the entire right antenna are missing, as are both front legs, the tarsi of the left middle leg and the tibia and tarsi of the right middle leg. The thorax is badly damaged, and the head and prothorax is separated from the rest of the body, the whole being supported on a piece of cork secured on the original pin. Images on OSF. Box E29b.

A junior synonym of *Cycloptera speculata* (Burmeister, 1838).

falcatus Saussure & Pictet, 1898: 383, 384, pl. 19, fig. 8 [*Eriolus*].

Guatemala, Lanquin in Vera Paz (Champion). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Eriolus falcatus Saussure & Pictet, 1898.

fasciculata Pictet & Saussure, 1891: 310-311, fig. 12 [*Gryllacris*].

Iles de la Sonde. Unspecified number of ♀ (hind wings frayed, probably only one).

One ♀ syntype with labels: "Lahat, Sumatra, 11 – 18" [handwritten on white card]; "Gryllacris fasciculata, ♀ P. et Sss." [handwritten on yellow paper]; "G. fasciculata Pic. et Ss. [handwritten on lined white paper]; "Musée de Genève, No 70" [number handwritten on printed white card]; "Pict. Sss., Type" [names written and "Type" printed on pink card with black printed margin]. Specimen set with wings spread; both hind wings, particularly the left, are frayed. Most of both antennae, the left front leg and the last tarsal segment of the left hind leg are missing. Box N4.

Erythrogryllacris fasciculata (Pictet & Saussure, 1891).

femoratus Pictet & Saussure, 1891: 299-300 [*Onosandrus*].

Les Indes orientales. Unspecified number of ♀.

One ♀ syntype with labels: "Promont. B. Sper" [handwritten on a strip of white paper]; "Onosandrus sp.?" [handwritten on pink card]; "Musée de Genève, No 107" [number handwritten on printed white card]; "Onosandrus femoratus Pict. et Sss." [handwritten on yellow paper]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Indes orient." handwritten in the lower left corner. The specimen is in poor condition, having lost the antennae and all of the legs except the right hind femur and tibia, and part of a leg glued to the left side of the thorax. There are holes in the top and bottom of the thorax left by a previous pin. The current generic placement was questioned by Johns (1997: 133). It is not clear whether the specimen is from Asia, as is stated in the description and on the species name label in the insect box, or from Southern Africa as the label on the specimen pin indicates. Box O5.

Paterdecolyus femoratus (Pictet & Saussure, 1891).

fissa Saussure & Pictet, 1898: 414, 417, pl. 20, fig. 4 [*Gongrocnemis*].

Guatemala (Oltramare, Mus. Genavense). Unspecified number of ♂.

No specimens found in MHNG collections. Although the original description indicates that the material is in the MHNG, there is a ♂ from the type series, stated to be the holotype on OSF, in the BMNH (images on OSF).

Gongrocnemis fissa Saussure & Pictet, 1898.

flavifolium Saussure & Pictet, 1898: 455, pl. 22, fig. 6 [*Typophyllum*].

Venezuela (Mus. Genavense). Unspecified number of ♀.

One ♀ syntype with labels: "Venezuela" [handwritten on a strip of yellowed paper]; "Typophyllum flavifolia S. P." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with left wings spread and right wings folded; most of both antennae, the left front leg and two tarsal segments of the right hind leg are lost. Images on OSF. Box E30.

Typophyllum flavifolium Saussure & Pictet, 1898.

forceps Saussure & Pictet, 1897: 327, pl. 15, figs. 24-27 [*Chloroscirtus*].

Guatemala, Dueñas (Champion). One damaged ♂.

No specimens found in MHNG collections. The holotype is in the BMNH (images on OSF).

Chloroscirtus forceps Saussure & Pictet, 1897.

foreli Saussure & Pictet, 1898: 346, 348 [*Ctenophlebia*].

Colombia, Santa Marta (Dr. A. Forel). Unspecified number of ♂.

One ♂ syntype with labels; "St Martha, Colombie, Forel, 623 3" [handwritten on white paper]; "Ctenophlebia Foreli Sauss ♂ type!" [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread, but the left forewing is folded back having been repaired with glue; most of both antennae and the tarsi of the left hind leg are missing. Images on OSF. Box B32.

Viadana foreli (Saussure & Pictet, 1898).

foreli Pictet & Saussure, 1891: 294-5, fig. 1 [*Pamphagus*].

Gabès (Dr. A. Forel). Unspecified number of ♂.

One ♂ syntype with labels: "620 84, Gabès, Tunisie, Mr A. Forel" [handwritten on ruled white card]; "Gabès, 1-7 IV" [handwritten on white card]; "Pamphagus forelii [sic] Sss., Gabès, M. H. S," [handwritten on white paper]; "Pamph. Foreli Sauss." [handwritten on pink paper]; "Holotypus" [printed on red card]. Specimen lacks the right antenna and the left middle leg. Box Y5.

Paracinipe foreli (Pictet & Saussure, 1891).

forreriana Saussure & Pictet, 1897: 301, 302-303, pl. 15, fig. 1 [*Hemiudeopsylla*].

Mexico, Ciudad in Durango 8100 ft. (Forrer). Unspecified number of ♂ and ♀.

One ♂ and one ♀ syntype. A ♂ with labels: "172" [handwritten on white paper]; "Ciudad, Mex., 8100 ft., Forrer" [printed on white paper]; "Schoenobates Forreri P. et Sss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen lacks most of the left antenna and the entire right antenna and the left hind leg. The right hind leg is detached and secured on a separate pin. A ♀ with labels: "Ciudad, Mex., 8100 ft., Forrer" [printed on white paper]; "Hemiudeopsylla Forreriana P. + Saus." [handwritten on green paper]; "Ceuthophilus (Hemiudeopsylla) genicularis S. & P. juv., det. T.H. Hubbell, 1960" [designation and last numeral of date handwritten on printed white card]; "Syntypus" [printed on red paper]. Specimen lacks most of both antennae, the right front and middle legs and the left hind leg. The right hind leg is detached and secured through the femur on the original pin. There are further syntypes in the BMNH. Box O9.

A junior synonym of *Ceuthophilus genicularis* (Saussure & Pictet, 1897).

fraternus Saussure & Pictet, 1898: 431, 433 [*Cocconotus*].

Panama, Volcan de Chiriqui (Champion). Unspecified number of ♂ and ♀.

Two ♀ syntypes. A ♀ with labels: "Coll. G. et S., Volc. Chiriqui, G.C. Champion" [printed on white card]; "Cocconotus fraternus, ♀ S – P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; most of the left antenna and the last segment of the left hind leg are lost. The abdomen has shrunk laterally. A ♀ with labels: "Coll. G. et S., Volc. Chiriqui, G.C. Champion"

[printed on white card]; "Cocconotus fraternus, ♀ S et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread, those on the left being considerably tattered; much of the right antenna is missing and the abdomen has shrivelled laterally. There is also a possible ♂ syntype placed in the collection under the unpublished name "Cocconotus forceps Sauss. et Pict." This bears the labels: "Coll. G. et S., Volc. Chiriqui, G.C. Champion" [printed on white card]; "Cocconotus forceps, S, & P." [handwritten on green paper]; "Syntype of C. fraternus Sauss. & Pict. 1898?, Hollier 2010" [handwritten on red paper]. Specimen set with wings spread; most of both antennae, the left front leg and the tarsi of the right hind leg are missing. The left hind leg is detached and secured through the femur on the original pin. There are further syntypes in the BMNH (images on OSF). Box E25.

Docidocerus fraternus (Saussure & Pictet, 1898).

frutetorum Saussure & Pictet ,1898: 365 [*Ischyra*].

Guatemala (Mus. Genavense). Unspecified number of ♂.

One ♂ syntype with labels: "Mr Oltram. 51, Guatemala 603" [printed on white paper]; "Ischyra frutetorum Sss. et P." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread; most of both antennae, the tarsi of both front legs, the entire left middle leg and the last tarsal segment of both hind legs are lost. Images on OSF. Box B36.

Ischyra frutetorum Saussure & Pictet, 1898.

furcatum Saussure & Pictet, 1898: 424, 425-426, pl. 20, figs 16-19 [*Idiarthron*].

Costa Rica (Biolley). More than one ♂ (variation of the cerci mentioned) and an unspecified number of ♀.

Five ♂ and three ♀ syntypes. A ♂ with labels: "COSTA RICA, P. BIOLLEY" [printed on green paper]; "Idiarthron furcatum Sauss + P." [handwritten on green paper]; "Lectotypus, Idiarthron furcatum S. & P." [handwritten on red card with "Lectotypus" printed]. Specimen set with right wings spread and left wings folded; most of both antennae and the left middle leg is lost. A ♂ with labels: "COSTA RICA, P. BIOLLEY" [printed on green paper]; "Idiarthron furcatum Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the left antenna, the last tarsal segment of the right front leg and the left middle leg are missing. A ♂ with labels: "COSTA RICA, P. BIOLLEY" [printed on green paper]; "Idiarthron furcatum Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A ♂ with labels: "COSTA RICA, P. BIOLLEY" [printed on green paper]; "Idiarthron furcatuum, Sauss & P., var.lamina supraanali vari" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the right antenna, the last tarsal segment of the right front leg and the last tarsal segment of the right hind leg are missing. A ♂ with labels: "339, El Campejal, 1000m, P. Biolley" [handwritten on white paper]; "Idiarthron furcatum Sss. et Pt." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A ♀ with labels: "COSTA RICA, P. BIOLLEY" [printed on green paper]; "Idiarthron furcatum Sauss & P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with

wings folded; most of the right antenna and the claw of the right middle leg are missing. A ♀ with labels: "339." [handwritten on a square of white paper]; "Idiarthron furcatum Sss. et Pt." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the right antenna has been repaired with glue. A ♀ with labels: "COSTA RICA, P. BIOLLEY" [printed on green paper]; "Idiarthron furcatum Sauss & P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae and two tarsal segments of the left front leg are missing. A further three ♂ and one ♀ with a locality "Amer. cent." may also be syntypes. There are further syntypes in the BMNH. Images on OSF. Box E22.

Idiarthron furcatum Saussure & Pictet, 1898.

gaumeri Saussure & Pictet, 1898: 421, 422, pl. 20, fig. 11 [*Anchiptolis*].

Mexico, Temax in North Yucatan (Gaumer). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Gongrocnemis gaumeri (Saussure & Pictet, 1898).

genicularis Saussure & Pictet 1897: 301-302 [*Hemiudeopsylla*].

Mexico, Cuidad in Durango 8100 ft. (Forrer). Unspecified number of ♂.

Although OSF states that the specimen in the BMNH is the holotype, the MHNG collections contain a single hind femur labelled "Hemiudeopsylla geniculatus P. et Ss, Fimur! [sic]" [handwritten on green paper], the label being apparently contemporaneous with the name labels on the other specimens in the insect box. It is not clear if this is part of the BMNH specimen or part of a second syntype. Box O9.

Ceuthophilus genicularis (Saussure & Pictet 1897).

genicularis Pictet & Saussure, 1892: 24, fig. 16 [*Phyllozelus*].

Patria? Unspecified number of ♀.

One ♀ syntype with labels: "Phyllozelus genicularis P. et Sauss." [handwritten on yellow paper]; "Oviscapte large et court" [handwritten on white paper]; "Phyl - lozelus genicularis P. & S., det. C. de Jong 1938, Lectotype" [determination and "Lectotype" handwritten on white printed card]. The species name label in the insect box has the locality "Asia merid?" handwritten in the lower left corner. Specimen set with wings spread, the wings being rather tattered; the left antenna, two tarsal segments of the left front leg, the right front leg, two tarsal segments of both middle legs, the last tarsal segment of the left hind leg and the right hind leg are missing. The abdomen is much damaged, and has lost the end, which might explain why the specimen is referred to as ♂ on OSF. No formal lectotype designation appears to have been published by de Jong. Images on OSF. Box E8.

Phyllozelus genicularis Pictet & Saussure, 1892.

godeffroyi Pictet, 1888: 50-52, fig. 29 [*Agraecia*].

Nouvelle Irlande. Unspecified number of ♂ and ♀.

Two ♂ syntypes. A ♂ with labels: "603 34, New Irland" [handwritten on whitish paper]; "21" [handwritten on a square of white paper]; "Salomona godeffroyi,

type! Pict." [handwritten on lilac paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the left and the entire right antenna are missing, the left middle leg lacks the tarsi, the left hind leg lacks the tibia and tarsi and the right hind leg lacks the last tarsal segment. A ♂ with labels: "603 34, New Irland (21)" [handwritten on whitish paper]; "Salomona godeffroyi, type! Pict." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the right antenna is missing, as are all three left legs and the last tarsal segment of the right middle leg. There is also a ♀ with labels: "603 34, Cape York, N. Australia" [handwritten on whitish paper]; "15" [handwritten on white paper]; "Salomona goedeffroyi Pict." [handwritten on lilac paper]; "Syntype of S. godeffroyi Pictet?, Hollier 2010" [typewritten on white card]. Specimen set with wings folded; the antennae, right middle leg and the tibia and tarsi of the left hind leg are lost. The right front leg and left middle leg are detached and secured on the original pin. The abdomen has been eviscerated and stuffed, presumably at the time of capture. The locality label suggests that this is not part of the type series, but the material was acquired at the same time as the syntypes. The collection also contains two more ♀ and two juveniles which may belong to the type series. Part of the type series of S. sigma Redtenbacher, 1891 is stated to be in the MHNG in the original description, but no specimens are labelled as such (the latter species having being placed in synonymy with *S. godefrroyi*). Images on OSF. Box F19.

Salomona godeffroyi (Pictet, 1888).

goeldianus Saussure & Pictet, 1897: 295 [*Pherterus*].

Brazil, Rio Janeiro (Göldi), Santa Catharina. More than one ♂ and ♀ (size variation mentioned).

Three ♂ and three ♀ syntypes. A ♂ with labels: "R. JANEIRO, ERNI." [printed on green paper]; "Pherterus göldianus P. & Sss" [handwritten on green paper]; "Lectotypus, should be designated, TH Hubbell" [handwritten on red card with "Lectotypus" printed]. Specimen lacks most of both antennae and the tarsi of the right middle leg. A ♂ with labels: "R. JANEIRO, ERNI." [printed on green paper]; "Pherterus göldianus P. & Sss" [handwritten on green paper]; "# 1B Paratypus, Pherterus goeldianus, S & P THH" [handwritten on red card with "Paratypus" printed]. Specimen lacks most of both antennae and two tarsal segments of the right hind leg. A ♂ with labels: "R. JANEIRO, Mr. Hy de Sauss." [printed on green paper]; "Pherterus göldianus P. & Sss" [handwritten on green paper]; "# 1A Paratypus, Pherterus goeldianus, S & P THH" [handwritten on red card with "Paratypus" printed]. Specimen lacks most of both antennae, the last tarsal segment of the left front leg, the tibia and tarsi of the right front leg, most of the tibia and the tarsi of the right middle leg and the last tarsal segment of the left hind leg. A ♀ with labels: "R. JANEIRO, ERNI." [printed on green paper]; "Pherterus göldianus P. & Sss" [handwritten on green paper]; "Allotypus, Pherterus goeldianus, P. & S. THH" [handwritten on red card with "Allotypus" printed]. Specimen lacks most of the right antenna. A ♀ with labels: "R. JANEIRO, ERNI." [printed on green paper]; "Pherterus göldianus P. & Sss" [handwritten on green paper]; "Paratypus, # 2A (Not) Pherterus goeldianus P. & S., ad. ♀ THH" [handwritten on red card with "Paratypus" printed]. Specimen lacks the tips of

the antennae. A ♀ with labels: "R. JANEIRO, ERNI." [printed on green paper]; "Pherterus göldianus P. & Sss" [handwritten on green paper]; "Paratypus, # 2B (Not) Pherterus goeldianus P. & S., THH" [handwritten on red card with "Paratypus" printed]. Specimen lacks most of both antennae. No formal lectotype designation appears to have been published. Box O4.

Lutosa goeldianus (Saussure & Pictet, 1897).

grandiocellata Pictet, 1888: 37, fig. 20 [*Tanusia*].

Guyane? (Ancienne collection Jurine). Unspecified number of ♂, but the provenance strongly suggests a single specimen.

One ♀ with labels: "Tanusia grandiocelata Pic." [handwritten on white paper]; "Tanusia colorata Serv." [handwritten on green paper]; "11 (Vignon)" [handwritten on white paper]; "Holotypus" [printed on red card]. The species name label for *T. colorata* Serville in the insect box (under which the specimen was placed) has the locality "Brasilia" written in the lower left corner. Specimen set with left forewing spread, much of the thorax and the right wings are lost. All legs except the femur of the right front leg are missing; the head and the left hind wing are detached and secured on separate pins. The abdomen shows signs of damage, presumably by museum beetle. It is by no means clear if this is really part of the type series, given that the sex is not that given in the description. Box E29.

A junior synonym of *Tanusia colorata* (Serville, 1838).

grioleti Pictet & Saussure, 1892: 20, fig. 15 [*Tympanoptera*].

Insulae Molucca (Dom. Griolet). Unspecified number of ♀.

Two ♀ syntypes. A ♀ with labels: "Tympanoptera Grioleti P. & Ss." [handwritten on white paper]; "Oxyscelus grioleti P. + Sauss." [handwritten on yellow paper]; "Holotypus" [printed on red card]; "Probably a syntype! Hollier 2010" [handwritten on red paper]. The species name label in the insect box has the locality "Ins. Asiae merid." handwritten in the lower left corner. Specimen set with wings folded; the antennae, right front and middle legs and the last tarsal segment of the left middle and hind legs are lost. A ♀ with labels: "Oxyscelus grioleti P. + Sauss." [handwritten on yellow paper]; "Syntype of T. grioleti Pict. & Sauss. 1892?, Hollier 2010" [handwritten on red paper]. Specimen set with right wings spread and left wings folded, the entire left antenna and most of the right antenna are missing, as is the left middle leg. The left hind leg is detached and secured through the femur on the original pin. A third ♀ without locality label may also be a syntype. Images on OSF. Box E9.

Tympanoptera grioleti Pictet & Saussure, 1892.

guatemalae Saussure & Pictet, 1897: 336-337, pl. 16, fig. 3 [*Amblycorypha*].

Guatemala (Mus. Genavense). Unspecified number of ♂.

One ♂ syntype with labels: "Guatemala, H d. Sauss" [handwritten on green paper]; "Amblycorypha Guatemalae ♂ S. et P." [handwritten on white paper]; "Holotypus" [printed on red card]. Specimen set with wings spread; both antennae, both front legs, the right middle leg, the tarsi of the right hind leg and the last tarsal segment of the left hind leg are missing. Images on OSF. Box B28.

Amblycorypha guatemalae Saussure & Pictet, 1897.

hispida Pictet, 1888: 20-22, fig. 5 [*Echimacris*].

Haut-Amazone. Unspecified number of ♀.

One ♀ syntype with labels: "Haut Amazone" [handwritten on green paper]; "Echimacris hispida Pictet" [handwritten on green paper]; "Holotypus" [printed on red card]. The specimen lacks the right antenna and one middle leg, the front legs and other middle leg are detached, as is one of the palps. Images on OSF. Box E10.

A junior synonym of *Choeroparnops tuberculatus* (Walker, 1870).

hoegei Saussure & Pictet, 1897: 334, pl. 16, fig. 1 [*Phrixa*].

Mexico, Cordova (Höge). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Phrixa hoegei Saussure & Pictet, 1897.

hoegei Saussure & Pictet, 1898: 450, pl. 22, fig. 1 [*Tanusia*].

Mexico, Cordova (Höge). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Anommatoptera hoegi (Saussure & Pictet, 1898).

humbertiana Pictet & Saussure, 1892: 24-25, fig. 18 [*Scutotribonia*].

Ceylon (Al. Humbert). Unspecified number of ♀.

Two ♀ syntypes. A ♀ with labels: "358" [handwritten on a strip of white paper]; "Ceylan, Humbert" [handwritten on white paper]; "Scutotribonia humbertiana P. + Sauss." [handwritten on yellow paper]; "Scutotribonia humbertiana P. & S., det. C. de Jong 1938, LECTOTYPE" [determination and "LECTO" handwritten on white card with de Jong's name, date and "TYPE" printed]; "Syntypus" [printed on red paper]. Specimen set with left forewing spread and right wings folded; most of both antennae and the last tarsal segment of the right front leg are missing. A ♀ with labels: "Scutotribonia Humbertianus P. + Ss." [handwritten on white paper]; "Scutotribonia humbertiana P. + Sauss." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae and the left front leg are lost. No formal lectotype designation appears to have been published by de Jong. Box E7.

A junior synonym of *Zumala cingalensis*. Walker, 1869.

hybridus Pictet, 1888: 67-68, fig. 22 [*Aprosphlyus*].

Afrique méridionale, Angra. Unspecified number of ♀.

One ♀ syntype with labels: "ANGRA" [printed on pink paper]; "Aprosphylus hybrida Pict." [handwritten on pink paper]; "Holotype ♀, Aprosphylus hybrida Pictet, Det. D.C. Rentz 1980" [handwritten on white card with "Det. D.C. Rentz" printed]. Specimen set with left wings spread and right wings folded; the antennae and all legs except the right hind leg are lost. Images on OSF. Box K10.

Aprosphylus hybridus Pictet, 1888.

ibex Pictet, 1888: 72-73, fig. 31 [*Acanthoproctus*].

Afrique méridionale. Unspecified number of ♀.

One ♀ syntype with labels: "620 74, Transvaal, Africa mer., Mr. Péringuey" [handwritten on lined white card]; "TRANSVAAL, Peringuey" [locality printed and name handwritten on white paper]; "Acanthoproctus ibex Pict." [handwritten on pink paper]; "Holotypus" [printed on red card]. Specimen lacks both antennae and the tarsi of both front legs and the right middle leg. Images on OSF. Box M3.

A junior synonym of *Acanthoproctus diadematus* (Stål, 1858).

icterus Pictet & Saussure, 1887: 353 [*Rhomalea*].

République Argentine; Equateur, Quito. More than one ♀.

Lectotype ♀ (designated by Roberts & Carbonell, 1982: 55) with labels: "Quito, M H de Saussure" [handwritten on white paper]; "Rhomalea icterus P. et S." [handwritten on green paper]; "Rhomalea icterus Sss et Pict." [handwritten on green paper]; "Rhomalea icterus P.-S., Hololectotypus [sic] ♀, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread. A ♀ paralectotype is also present. Images on OSF. Box Z8.

Chromacris icterus (Pictet & Saussure, 1887).

iheringi Pictet & Saussure, 1887: 357 [*Zoniopoda*].

Brèsil Méridionale (Ihering). Unspecifed number of ♂ and ♀.

Lectotype ♂ (designated by Carbonell, 2007: 24) with labels: "Brésil, Rio Grande da Sul, Dr Ihering, 614. 46." [printed on white paper]; "Zoniopoda Iheringi Pict." [handwritten on green paper]; "Zoniopoda iheringi P.-S. ♂, Hololectotypus [sic], C S Carbonell 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread. A micro-tube containing dissected parts is secured to the original pin. Four other ♂ and five ♀ paralectotypes are also present. Images on OSF. Box Z9.

Chromacris iheringi (Pictet & Saussure, 1887).

imbecilis Pictet & Saussure, 1891: 312-313 [*Gryllacris*].

Indes orientales. Unspecified number of ♂.

Holotype ♂ with labels: "Sibs., S. E. P." [printed on white paper]; "Gryllacris imbecilis, ♂ P. et S." [handwritten on yellow paper]; "Gryllacris imbecilis, ♂ P. et S." [handwritten on white paper]; "Gryllacris sp. n. vicina Gr. debilis Br." [handwritten, the first word in black and the rest in red ink, on a strip of squared white paper]; "Pict. Sss., Type" [names written and "Type" printed on pink card with black printed margin]; "Holotypus" [printed on red card]. Specimen set with right wings spread and left wings folded; the forewings are missing, as is most of the right hind wing. Most of both antennae, the tibia and tarsi of the left front leg, the right front and middle legs, the left middle leg, the tarsi of the left hind leg and the tibia and tarsi of the right hind leg have been lost. Box N3.

A junior synonym of *Phryganogryllacris nivea* (Brunner von Wattenwyl, 1888).

imperialis Pictet & Saussure, 1887: 361 [*Tropidacris*].

Amérique central; Guatemala. Unspecifed.

One ♀ syntype with labels: "Guatemala, [illegible words]" [printed on card (now discoloured)]; "Tropidacris imperialis P.-S., Holotypus ♀, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread; the last tarsal segment of the left front leg and the last tarsal segment of the left hind leg are missing. Box Z11.

A junior synonym of *Tropidacris cristata dux* (Drury, 1773).

inca Saussure & Pictet, 1898: 432, 436 [*Cocconotus*].

Peru. Unspecified number of ♀.

One ♀ syntype with labels: "Pérou, Mr Hy de Saussure" [handwritten on a strip of white paper]; "Cocconotus inca Sauss." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with left wings spread and right wings folded; most of both antennae and the last tarsal segment of the left hind leg are missing. The right middle and left hind legs are detached and secured through the femur on the original pin. Images on OSF. Box E25.

Incanotus inca (Saussure & Pictet, 1898).

inermis Saussure & Pictet, 1898: 386, 387-388, pl. 19, fig. 17 [*Pyrgocorypha*].

Costa Rica, San José (Biolley). Unspecified number of ♂.

One ♂ syntype with labels: "San José, 1135m" [handwritten on whitish paper]; "Pyrgocorypha inermis S. P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae are lost. Images on OSF. Box F4.

A junior synonym of *Pyrgocorypha hamata* (Scudder, 1878).

infirmus Saussure & Pictet, 1898: 401, 402-403, pl. 19, figs 30-32 [*Thydrus*].

Guatemala, San Gerónimo (Champion); Guiana, Cayenne (Prudhomme). More than one ♀.

One ♀ syntype with labels: "CAYENNE" [printed on a strip of green paper]; "Thydrus infirmus Sauss & Pict." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded: most of the left antenna and two tarsal segments of the left hind leg are lost. There are further syntypes in the BMNH (images on OSF). Box F24.

A junior synonym of *Phlugis chrysopa* Bolívar, 1888.

javana Pictet & Saussure, 1892: 16 [*Mioacris*].

Java. Unspecified number of ♂ and ♀.

One ♂ and one ♀ syntype. A ♂ with labels: "Mioacris javana Pict. et Sss." [handwritten on white paper]; "Chlorotribonia brevifolia de Haan" [handwritten on yellow paper]; "Mioacris javana P.+S., det. C. de Jong 1938, LECTOTYPE ♂" [determination and "LECTO" handwritten on white card with de Jong's name, date and "TYPE" printed]; "Syntypus" [printed on red paper]. The species name label in the insect box has the locality "Java" handwritten in the lower right corner. Specimen set with left wings spread and right wings roughly folded; both antennae are lost, as are the last tarsal segements of the front left and right hind legs. A ♀ with labels: "Java,

601 39" [last number hand written, the rest printed on white paper]; "Chlorotribonia brevifolia de Haan" [handwritten on yellow paper]; "Mioacris javana P.+S., det. C. de Jong 1938, LECTOTYPE ♀" [determination and "LECTO" handwritten on white card with de Jong's name, date and "TYPE" printed]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; most of the left and the entire right antenna are missing, as are the left middle leg, the tibia and tarsi of the right middle leg and the right hind leg. The abdomen has shrunk and there are signs of damage, presumably by museum beetle. Although the species is mentioned by de Jong (1938: 31) he did not formally designate a lectotype. Images on OSF. Box E7.

Mioacris javana Pictet & Saussure, 1892.

kanguroo Pictet, 1888: 14-15, fig. 38 [*Macroscirtus*].

Gabon. Unspecified number of ♂.

Two ♂ syntypes. A ♂ with labels: "Gabon, Afrique occ., M. Ed. Sarasin" [handwritten on ruled white card]; "Gabon, M.Ed Sarazin" [handwritten on white paper]; "Genus novum, Mecopodidarum, Br. d." [handwritten on greyish paper]; "Macroscirtus kanguroo Pictet" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the right forewing is detached and secured on separate pin, both front legs are detached and secured on a separate pin, and the ends of the antennae, the left middle leg and the last tarsal segment of both hind legs are missing. A ♂ with labels: "Gabon, Afrique occ., M. Ed. Sarasin" [handwritten on ruled white card]; "Confluans de l'O-gowi Gabon, M.Ed Sarazin, 78" [handwritten on white paper]; "Macroscirtus kanguroo Pictet" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the left antenna and both front legs are missing, the left middle and hind legs lack the tarsi, the right hind leg lacks part of the tibia and the tarsi. According to OSF there is a ♀ syntype in the Museo Nacional de Ciencias Naturales (MNMS) in Madrid, but the original description only treats the ♂, and the Madrid specimen is labelled "Macroscirtus kangaroo var Joannis Bol." in Bolivar's handwriting, this is not a syntype of M. kangaroo Pictet. Images on OSF. Box D8.

Euthypoda kanguroo (Pictet, 1888).

latifolia Pictet, 1888: 43-44, fig.14 [*Chlorophylla*].

Cayenne (Bar). Unspecified number of ♂.

One ♂ syntype with labels: "Cayenne, Portal Guyane" [printed on green paper]; "Chlorophylla latifolia Pic." [handwritten on white paper]; "Chlorophylla latifolia Pict." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread; most of both antennae, the left front leg, the tarsi of the right front leg, both middle legs and two tarsal segments from each of the hind legs are missing. Images on OSF. Box E29b.

A junior synonym of *Cycloptera speculata* (Burmeister, 1838).

latipennis Saussure & Pictet, 1897: 322 [*Amaura*].

Mexico, Ventanas (Forrer). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Ligocatinus latipennis (Saussure & Pictet, 1897).

latipennis Pictet & Saussure, 1891: 311-312, fig. 13 [*Gryllacris*].

Java. Unspecified number of ♀.

One ♀ syntype with labels: "Gr. latipennis" [handwritten on a strip of white card]; "Musée de Genève, No 29" [number handwritten on printed white card]; "Gryllacris latipennis, ♀ P. et S." [handwritten on yellow paper]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Iles de la Sonde" handwritten in the lower right corner. Specimen set with wings spread; most of both antennae and the left front leg are missing. Box N2.

A junior synonym of *Capnogryllacris signatifrons* (Serville, 1838).

latipennis Pictet & Saussure, 1892: 15, figs 6-7 [*Onomarcus*].

China. Unspecified number of ♂ and ♀.

One ♂ syntype with labels: "CHINE A.NAV., 601/94" [text printed, numerals handwritten on white paper]; "Onomarchus leuconotus Serv." [handwritten on yellow paper]; "Onomarchus leuconotus Serv. ♂, det. C. de Jong 1938" [determination handwritten on white card with de Jong's name and date printed]; "Syntype of O. latipennis Pict. & Saus. 1892, Hollier 2010" [handwritten on red paper]. Specimen set with right wings spread and left wings folded; both of most antennae and the last tarsal segment of the left middle leg are lost. No ♀ syntypes could be located in the MHNG collection. Box E5.

A junior synonym of *Onomarchus leuconotus* (Serville, 1838).

latipennis Saussure & Pictet, 1898: 370, 371, pl. 18, fig. 2 [*Peucestes*].

Mexico (Mus. Genavense); Colombia. More than one ♀.

One ♀ syntype with labels: "Peucestes latipennis Sauss." [handwritten on green paper]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Amér. Cent." handwritten in the lower left corner. Specimen set with left wings spread and right wings folded; the antennae, the tarsi of the left front leg, the right front leg, left middle leg, the tarsi of the right middle leg, two tarsal segments of the left hind leg and the claw of the right hind leg are missing. The abdomen has been eviscerated and stuffed, presumably at the time of capture. Images on OSF. Box B26.

Steirodon latipennis (Saussure & Pictet, 1898).

latipennis Pictet & Saussure, 1887: 351 [*Rhomalea*].

Brésil. One ♂.

Holotype ♂ with labels: "477/56" [handwritten on disc of white card]; "Rhomalia [sic] latipennis Saus. Pict." [handwritten on green paper]; "Rhomalea latipennis, P. et S., type" [handwritten on green paper]; "CSC 1134" [handwritten by Carbonell on a strip of white card]; "Rhomalea latipennis P.-S., Holotypus- 1134, CSC - 1966" [handwritten by Carbonell on red card]. The species name label in the insect box has the locality "Brésil" handwritten in the lower left corner. Specimen set with

right wings spread and left wings folded; both antennae, the right front leg and the last tarsal segment of the left hind leg are missing. A micro-tube containing dissected parts and a label "CSC 1134" is secured on a separate pin with the label "Rhomalea latipennis P.-S., Holotypus, Genitalia No. 1134, C S Carbonell" handwritten by Carbonell on red card. Images on OSF. Box Z6.

A junior synonym of *Chromacris nuptialis* (Gerstaecker, 1873).

laurifolia Pictet, 1888: 34-35, fig. 15 [*Ommatoptera*].

Brésil (Ancienne collection Jurine). One damaged ♀.

Holotype ♀ with labels: "Ommatoptera laurifolia Pic." [handwritten on white paper]; "Ommatoptera laurifolia ♀ Pict." [handwritten on green paper]; "Tanusia laurifolia Pict." [handwritten on green paper]; "12 (Vignon)" [handwritten on white paper]; "Holotypus" [printed on red card]. Specimen set with wings spread, the hind wings are rather tattered; the right antenna, the right front leg, the tarsi of the left middle leg and both hind legs are lost. Images on OSF. Box E29.

Ommatoptera laurifolia Pictet, 1888.

licornis Pictet, 1888: 45-46, fig. 24 [*Copiophora*].

Haute-Amazone. Unspecified number of ♀.

There are no specimens standing under this name in the MHNG. It is possible that the ♀ type(s) are among the specimens of *Copiophora longicauda* Serville, 1838 in Box F1.

A junior synonym of *Copiphora longicauda* Serville, 1838.

longicauda Pictet & Saussure, 1891: 317-318, fig. 17 [*Eremus*].

Indes orientales, côte de Malabar. Unspecified number of ♂ and ♀.

One ♂ and one ♀ syntype. A ♂ with labels: "Malabar Coast, Atzenwyler [?]" [handwritten on yellow paper]; "Eremus longicauda P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. The specimen has lost both antennae and all of the legs except for the left hind femur. A ♀ with labels: "Malabar Coast, Atzenwyl. [?]" [handwritten on yellow paper]; "Eremus longicauda Pict. et Ss." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. The specimen has lost both antennae and all of the legs except for the left hind femur. Box N6.

Eremus longicauda Pictet & Saussure, 1891.

longipennis Pictet & Saussure, 1891: 314-315, fig. 15 [*Gryllacris*].

Amérique. Unspecified number of ♂.

No specimens found in the MHNG collections. OSF states that the holotype is in the BMNH, but this may be a specimen collected by Champion for the BCA (see Saussure & Pictet 1897: 307) and not a specimen available to Pictet in 1891. Griffini (1909) did not mention this species in the MHNG collections.

Abelona longipennis (Pictet & Saussure, 1891).

longispina Pictet & Saussure, 1887: 345-346 [*Elaeochlora*].

Andes de la Nouvelle Grenade. Unspecified number of ♂ and ♀.

Possible ♀ syntype with labels: "Pérou" [handwritten on white paper]; "Elaeoch. longispina Sss. et Pict." [handwritten on green paper]; "Possible syntype? Hollier 2010" [handwritten on red paper]. The species name label in the insect box has the locality "Andes du Pérou" handwritten in the lower left corner. Specimen lacks the tarsi of right front leg. Roberts & Carbonell (1992: 91) state that the types could not be found, assuming that when the original description gave the type locality this meant Colombia or Venezuela (Carbonell in litt.). It is possible however, that "Nouvelle Grenade" was less precisely defined by Pictet & Saussure at the time of the description than it was by Roberts & Carbonell and that this Andean specimen is a syntype. Images on OSF. Box Z4.

Elaeochlora longispina Pictet & Saussure, 1887 (nomen dubium on OSF).

loricatus Pictet, 1888: 6-7, fig. 1 [*Stilpnothorax*].

Afrique méridionale (Péringuey, Mus. du Cap). Unspecified number of ♀.

One possible ♀ syntype with labels: "Africa" [handwritten on pink paper]; "Pomatonota dregii Burm. (= Stilpnothorax loricata Pict.)" [handwritten on pink paper]; "Possible syntype of Stilpnothorax laricatus Pictet, 1888? Hollier 2010" [handwritten on red paper]. Specimen set with wings folded; the ends of the antennae are missing. According to OSF there is a specimen (referred to as the holotype) in the Iziko Museum, Cape Town (SAMC). Unlike the specimen now in the MHNG, the illustration accompanying the original description is of a specimen with the wings spread. Box D1.

A junior synonym of *Pomatonota dregii* Burmeister, 1838.

lunatum Pictet, 1888: 27-28, fig. 12 [*Typophyllum*].

Perou, Mayobambo. Unspecified number of ♀.

One ♀ syntype with labels: "Mayobambo, Pérou, M. H. de Saussure" [handwritten on white paper]; "Typophyllum lunatum Pict." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread, the hind wings being very tattered; most of both antennae and the left hind leg are lost. Images on OSF. Box E30.

Typophyllum lunatum Pictet, 1888.

macilentus Pictet & Saussure, 1891: 313-314, fig. 14 [*Gryllacris*].

Java. More than one ♀ (variation in number of spines on femur mentioned).

Seven ♀ syntypes. A ♀ with labels: "Java" [printed on yellow paper]; "Gryllacris macilenta, ♀ P. et S." [handwritten on yellow paper]; "Musée de Genève, No 52" [number handwritten on printed white card]; "G. macilentus Pic. + Ss." [handwritten on lined white paper]; "Lectotypus, Gryllacris macilentus, THH P. & S." [handwritten by Hubbell on red card with "Lectotypus" printed]. Specimen set with right wings spread and left wings folded; most of both antennae, the left front leg and two tarsal segments of the left middle leg are missing. A ♀ with labels: "Gryllacris macilenta, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread. A ♀ with labels: "Java" [printed on yellow paper]; "Gryllacris macilenta, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed

on red paper]. Specimen set with wings folded; most of the right antenna and the entire left antenna are missing, as is the right front leg. A ♀ with labels: "Java" [printed on yellow paper]; "Gryllacris macilenta, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the right front leg is missing. A ♀ with labels: "Java" [printed on yellow paper]; "Gryllacris macilenta, ♀ P. et S." [handwritten on yellow paper]; "Musée de Genève, No 53" [number handwritten on printed white card]; "p. 81 – vic. thysanoides, H aw [?]" [handwritten in pencil on white paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; most of both antennae are missing. A ♀ with labels: "Gryllacris macilenta, ♀ P. et S." [handwritten on yellow paper]; "Musée de Genève, No 54" [number handwritten on printed white card]; "Syntypus" [printed on red paper]. Specimen set with wings spread; most of both antennae is lost, and the head of a second pin projects from the pronotum. A ♀ with labels: "Gryllacris macilenta, ♀ P. et S." [handwritten on yellow paper]; "G. macilentus" [handwritten on white paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; most of the antennae, the left front leg and the tarsi of the left hind leg are lost. The specimen is somewhat distorted, and seems to be teneral. The species name label in the insect box has the locality "Java" handwritten in the lower left hand corner. No formal designation of a lectotype appears to have been published by Hubbell. Box N3.

Ascarogryllacris macilenta (Pictet & Saussure, 1891).

maculifolia Pictet & Saussure, 1892: 21, fig. 19 [*Aprion*].

Sumatra. Unspecified number of ♀.

Two ♀ syntypes. A ♀ with labels: "maculifolia" [handwritten on white paper]; "Aprion maculifo-, lius P. + Sauss." [handwritten on yellow paper]; "Morismus ♀, oleifolius Fab., det. C. de Jong 1938" [determination handwritten on white printed card]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; the tarsi of the right middle leg are lost. A ♀ with labels: "Toerongie [?], Sumatra VI" [handwritten on white paper]; "Aprion maculifolius P. et Sss." [handwritten in pencil on white paper]; "Aprion maculifolia P. & Sauss." and "LECTOTYPE by C. de Jong" [handwritten, apart from printed word "TYPE", on white card, the two labels being glued together]; "Morsimus ♀, oleifolius Fabr., det. C. de Jong 1938" [determination handwritten on printed white card]. Specimen set with wings folded; most of the left antenna is missing. No formal lectotype designation or placement of the species in synonymy appears to have been published by de Jong. Box E10.

Paramorsimus maculifolius (Pictet & Saussure, 1892).

mancus Pictet & Saussure, 1887: 342-343 [*Draconata*].

Colombie. Unspecified number of ♂.

One ♂ syntype with labels: "Colombie, 603 28" [country printed, numerals handwritten on white paper]; "Draconata mancus, ♂ S. et P., Colombia Mr. H. d. Sss." [handwritten on green paper]; "Draconata mancus Sss. et P." [handwritten on green paper]; "Draconata mancus P. et S. ♂, Holotypus, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen has lost the tip of the left antenna and the last tarsal segment of the left hind leg. Images on OSF. Box Z4.

Draconata mancus Pictet & Saussure, 1887.

mandarinus Pictet & Saussure, 1892: 16 [*Onomarcus*].

Tonkin. Unspecified number of ♀.

No specimens found in the MHNG collections. De Jong (1938: 22) was unable to locate the types.

A junior synonym of *Onomarchus uninotatus* (Serville, 1838).

manillensis Pictet, 1888: 7-9 [*Elbenia*].

Philippines, Manille. Unspecified number of ♀.

No specimens found in the MHNG collections. The whereabouts of the type is unknown.

Elbenia manillensis Pictet, 1888.

maori Pictet & Saussure, 1891: 296-297, fig. 2 [*Deinacrida*].

Nouvelle Zélande. Unspecified number of ♂ and ♀ (colour variations mentioned).

Thirty eight ♂ and thirty nine ♀ syntypes, almost all with labels: "Nov. Zealand, 619 41" [printed on bluish paper]; "Deinacrida maori Pict. et Sauss." [handwritten on lilac paper]. Some specimens have the additional label: "Weta [sex], Mt. Cook Hermitage, 3.iv.89. H. Suter" [handwritten on white paper]. A ♀ specimen has the additional labels: "maori P. et S." [handwritten on white paper]; "Lectotypus, maori Pictet & Sauss., P. M. Johns vii.90" ["lectoypus" printed, the rest handwritten by Johns on red card]. This specimen lacks the ends of the antennae and the tibia and tarsi of the left front leg. According to OSF there are further syntypes in the Staatliches Museum für Naturkunde (SMNS) in Stuttgart, the Martin Luther Universität in Halle (MLUH), the Museo Regionale di Scienze Naturali (MRSN) in Turin and the Zoologisch Museum, Universiteit Amsterdam (ZMAN). Johns (1997) did not formally designate a lectotype. Boxes O3 and Doubles 55.

Hemideina maori (Pictet & Saussure, 1891).

maori Pictet & Saussure, 1891: 300-301, fig. 4 [*Onosandrus*].

Nouvelle Zélande. Unspecified number of ♂ and ♀.

Two ♂ and two ♀ syntypes. A ♂ with labels: "White horse hill" [handwritten on a strip of white paper]; "Nov. Zealand" [printed on blueish paper]; "Onosandrus maori Pict. et Sauss." [handwritten on lilac paper]; "Lectotypus, should be designated, T H Hubbell" ["Lectotypus" printed, the rest handwritten by Hubbell on red card]; "Lectotypus, Onosandrus maori P. & S., P.M. Johns vii.90" ["Lectotypus" printed, the rest handwritten by Johns on red card]. Specimen lacks the end of the left antenna, the entire right antenna and the tarsi of the right hind leg. A ♂ with labels: "White horse hill" [handwritten on a strip of white paper]; "Nov. Zealand" [printed on blueish paper]; "Onosandrus maori Pict. et Sauss." [handwritten on lilac paper]; "Syntypus" [printed on red paper]. Specimen lacks both antennae. A ♀ with labels: "White horse hill" [handwritten on a strip of white paper]; "Nov. Zealand" [printed on blueish paper]; "Onosandrus maori" [handwritten on white paper]; "Onosandrus maori Pict. et Sauss." [handwritten on lilac paper]; "Allotypoid, should be designated, T H Hubbell" ["allotypoid" printed, the rest handwritten by Hubbell on red card]. Specimen lacks

both antennae, the tibia and tarsi of the left front leg and the entire left middle leg. A ♀ with labels: "White horse hill" [handwritten on a strip of white paper]; "Nov. Zealand" [printed on blueish paper]; "Onosandrus maori Pict. et Sauss." [handwritten on lilac paper]; "Syntypus" [printed on red paper]. Specimen lacks most of the left antenna and the tarsi of the right hind leg. An immature ♀ with the same data labels may also be considered a syntype. No formal lectotype designation was published by Johns (1997). Box O5.

A junior synonym of *Hemiandrus maculifrons* (Walker, 1869).

marmorata Saussure & Pictet, 1898: 452, 453-454, pl. 22, figs 10-11 [*Mimetica*].

Costa Rica, Caché (Rogers); Panama, Tolé (Champion). More than one ♀.

One ♀ syntype with labels: "Cache, Costa Rica, H. Rogers" [printed on white card]; "17 (Vignon)" [handwritten on a square of white paper]; "Mimetica marmorata Sauss + Pict." [handwritten on green paper]; "Holotypus" [printed on red card]; "A syntype!, Hollier, 2010" [handwritten on red paper]. Specimen set with wings spread, the right forewing is detached, glued to card and secured on a separate pin, the hind wings are rather ragged; the end of the left antenna, most of the right antenna and the last tarsal segment of the right middle leg are missing. The left hind leg is detached, but held in place amongst the other legs. There is at least one syntype in the BMNH according to their database. Images on OSF. Box E29b.

A junior synonym of *Mimetica incisa* (Stål, 1875).

martinicum Saussure & Pictet, 1898: 357, 359-60 [*Microcentrum*].

Antilles, Martinique. Unspecified number of ♂ and ♀.

One ♂ syntype with labels: "Martinique" [handwritten on white paper]; "Microcentrum martinica Sss. et P." [handwritten on green paper]; "Geneva" [printed on a strip of yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the ends of the antennae and the last tarsal segment of each of the middle and hind legs are missing. A ♀ specimen without a locality label has also been labelled as a syntype, but wing is considerably larger than the measurement given in the original description so this is doubtful. Images on OSF. Box B35.

Orophus martinicus (Saussure & Pictet, 1898).

maya Saussure & Pictet, 1897: 334, 335, pl. 16, fig. 2 [*Phrixa*].

Mexico, Valladolid in Yucatan (Gaumer). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Phrixa maya Saussure & Pictet, 1897.

mexicana Saussure & Pictet, 1897: 303-304, pl. 15, figs 2-3 [*Argyrtes*].

Mexico, Amula in Guerrero 6000 ft. (H. H. Smith). Unspecified number of ♂.

No specimens found in MHNG collections. The type material is in the BMNH according to their database.

Argyrtes mexicana Saussure & Pictet, 1897.

mexicana Saussure & Pictet, 1897: 323, 324, pl. 15, figs 28-29 [*Ectemna*].

Mexico, Teapa in Tabasco (H. H. Smith). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Ectemna mexicana Saussure & Pictet, 1897.

mexicanus Saussure & Pictet, 1898: 401, 402 [*Thydrus*].

Mexico, Chilpancingo in Guerrero, Atoyac in Vera Cruz, Teapa in Tabasco (H. H. Smith); Guatemala, San Gerónimo, Zapote (Champion); Panama, Bugaba (Champion). Unspecified number of ♂ and ♀.

Four ♂ and three ♀ syntypes. A ♂ with labels: "Teapa. Tabasco. Feb. H.H.S." [printed on white card]; "Thydrus mexicanus S et Pt" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae, the tibia and tarsi of the right front leg and the right middle leg are missing. A ♂ with labels: "Teapa. Tabasco. Feb. H.H.S." [printed on white card]; "Thydrus mexicanus S et Pt" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae, the left front leg and the last tarsal segment of the left middle leg are lost. A ♂ with labels: "Atoyac, Vera Cruz. April H.H.S." [printed on white card]; "Thydrus mexicanus S et P" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the left antenna and the entire right antenna are lost. A ♂ with labels: "S. Geronimo, Guatemala. Champion" [printed on white card]; "Thydrus mexicanus S et Pt" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae, the right front leg, the left hind leg and two tarsal segments of the right hind leg are missing. The tarsi of the left middle leg are detached and stuck to the original pin by verdigris. The specimen is splitting where the pin has been inserted, the head and prothorax being depalced, while the abdomen is shrivelled. A ♀ with labels: "Zapote, Guatemala, G.C. Champion." [printed on white card]; "Thydrus mexicanus S et Pt" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae is lost. A ♀ with labels: "Chilpancingo, Guerrero, 4600 ft., June. H.H. Smith." [printed on white card]; "Thydrus mexicanus S et Pt" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right forewing spread and other wings folded; most of both antennae and the right hind leg are missing. A ♀ with labels: "Chilpancingo, Guerrero, 4600 ft., June. H.H. Smith." [printed on white card]; "Thydrus mexicanus S et Pt" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae and the right middle leg are lost. The left middle leg has been glued to the end of the left hind femur, the left hind tibia being flexed against the femur. The left forewing is detached and secured on the original pin. There are further syntypes are in the BMNH (images on OSF). Box F24.

A junior synonym of *Phlugis chrysopa* Bolívar, 1888.

monoceros Saussure & Pictet, 1898: 376, 378 [*Copiophora*].

Guatemala, Teleman in Vera Paz (Champion). Unspecified number of ♀.

No specimens found in MHNG collections. There is a £ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Copiphora monoceros Saussure & Pictet, 1898.

montana Saussure & Pictet, 1898: 405-406, pl. 20, fig. 1 [*Championica*].

Panama, Volcan de Chiriqui 2500 to 4000 ft. (Champion). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Championica montana Saussure & Pictet, 1898.

montanus Pictet & Saussure, 1891: 302-303, fig. 5 [*Pharmacus*].

Nouvelle Zélande, Mt. Cook, 7000 ft. (Maoring). Unspecified number of ♂.

Fragments of the ♂ holotype on two pins. One with several antennal fragments glued to white card with the label: "Fühler Fragmente der Heuschrecke von Umgeb. des Mt. Cook, über 7000' die im Sammelglas herumlagen" [handwritten on white paper]. One with several leg fragments glued to white card and the label: "Pharmacus montanus, ♂ Sss. et Pict." [handwritten on lilac paper]. There is a label: "Révision: Dr. A. M. Richards, 1969 Typus" [typewritten on white card, with "Typus" printed on red card and glued on] pinned into the insect box. Some of the specimens that were used for the redescription of this species by Richards (1972) are deposited in the MHNG collection in alcohol. Box O7.

Pharmacus montanus Pictet & Saussure, 1891.

mortuifolia Pictet, 1888: 30-32, fig.13 [*Mimetica*].

Amérique centrale. More than one ♂ and more than one ♀ (size variations mentioned).

One ♀ syntype with labels: "Guatemala, M Oltram., 603 51" [printed on white card]; "Mimetica mortuifolia, ♀ Pict." [handwritten on green paper]; "Pictet 1888. pl. I, fig. 13, Elytra gauche vu par Dessous." [handwritten on white paper]; "M. Picteti, Kirby 1906, n.n." [handwritten on whitish paper]; "Type" [printed on pink card with printed margin]; "Holotypus" [printed on red card]; "Syntype! Description mentions both sexes. Hollier 2010" [handwritten on red paper]. Specimen set with wings spread; the head, right front leg, both middle legs and the left hind leg are missing. The right hind leg is detached and secured on a separate pin. The prothorax is hollowed out, and has a hole left by a previous pin.

Two other ♀ placed in the collection under this name, collected by Biolley, could also be syntypes. One has labels: "Mimetica, San Jose 1161m, P. Biolley, 320" [handwritten on white paper, the final number being in a different handwriting and circled]; "Mimetica mortuifolia Pictet" [handwritten on green paper]; "Syntypus? Hollier 2010" [handwritten on red paper]. This specimen is set with the left forewing spread and the other wings folded; it lacks the abdomen and all legs except right front leg which is detached and secured on the original pin. The other has labels: "Mimetica, La Laguna 1000m, Camono del Carrillo, 321, P. Biolley" [handwritten on white paper, the final number being in a different handwriting and circled]; "Mimetica mortuifolia Pict." [handwritten on green paper]; "16 (Vignon)" [handwritten on white paper]; "Syntypus? Hollier 2010" [handwritten on red paper]. This specimen has the left wings spread but the right wings and most of the thorax are missing; the middle and hind legs are missing and the abdomen and part of the thorax are detached and secured on a

separate pin. The collection also contains a ♂ with no locality label. Although Vignon (1931: 153) considered the first of these specimens to be the holotype, the original description indicates that Pictet studied both sexes and more than one ♀. Images on OSF. Box E29b.

Mimetica moruifolia Pictet, 1888.

mucronatus Saussure & Pictet, 1898: 442, 443, pl. 21, fig. 15 [*Scopiorus*].

Costa Rica, Azhar de cartago (Biolley). Unspecified number of ♂.

One ♂ syntype with labels: "19, Azahar de Cartago, 1500m, Museo nacional" [handwritten in pencil on whitish paper]; "COSTA RICA" [printed on green paper]; "Scopiorus mucronatus S. et P." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with right wings spread and left wings roughly folded; most of both antennae and the left hind leg are lost. Images on OSF. Box E27.

Scopiorinus mucronatus (Saussure & Pictet, 1898).

mutabilis Pictet & Saussure, 1891: 307-309, fig. 10 [*Gryllacris*].

Java. More than one ♂ and unspecified number of ♀ (♂ colour variation mentioned).

Four ♂ and five ♀ syntypes. A ♂ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "G. mutabilis, Pict et Ss." [handwritten on lined white paper]; "Gryllacris mutabilis, ♂ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of the left antenna is missing, the right has been repaired with glue. A ♂ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "Gryllacris mutabilis, ♂ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A ♂ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "Gryllacris mutabilis, ♂ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; the ends of the antennae are missing. A ♂ with labels: "Java" [printed on ruled white card]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae is missing. A ♀ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "Gryllacris mutabilis, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; most of the left antenna and the entire right antenna are missing. A ♀ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "G. mutabilis, Pic et Ss." [handwritten on lined white paper]; "Gryllacris mutabilis, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; the ends of the antennae are missing. A ♀ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "Gryllacris mutabilis, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; the ends of the antennae are missing. A ♀ with labels: "Java, Fruhstorfer" [printed on white card]; "d." [handwritten on a square of white paper]; "Gryllacris mutabilis, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the tarsi of the left hind leg are missing. A ♀ with labels: "Java, Fruhstorfer" [printed on white card]; "Gryllacris mutabilis, ♀ P. et S." [handwritten on

yellow paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A further ♂ specimen with labels "Java, Mr Wickler, 23.II.76" and "Gryllacris mutabilis P. et S., = podocausta" [both handwritten on yellow paper] may also be a syntype, but the name label on this specimen appears to have been written after the others. Box N1.

Caustogryllacris podocausta mutabilis (Pictet & Saussure, 1891).

mutabilis pallidior Pictet & Saussure, 1891: 307-309 [*Gryllacris*].

Java. Unspecified.

One ♂ and one ♀ syntype. A ♂ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "Gryllacris mutabilis, ♂ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; the ends of the antennae are missing. A ♀ with labels: "Java, Fruhstorfer" [handwritten on white paper]; "Gryllacris mutabilis, ♀ P. et S." [handwritten on yellow paper]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; the ends of the antennae are missing. Box N1.

Caustogryllacris podocausta pallidior (Pictet & Saussure, 1891).

myrtifolium Saussure & Pictet, 1898: 357, 359 [*Microcentrum*].

Brazil (Mus. Genavense). Unspecified number of ♂ and ♀.

One ♂ and one ♀ syntype. A ♂ with labels: "Brésil, 623. 19." [handwritten on white paper]; "Microcentrum myrtifolia Sss." [handwritten on green paper]; "Lectotypus, Microcentrum myrtifolium Ss., should be des." [handwritten on red card with "Lectotypus" printed]. Specimen set with wings spread; the antennae, the tarsi of the right front leg, two tarsal segments of the left front leg, the right middle leg, the last tarsal segment of the left middle leg and two tarsal segments of both hind legs are lost. A ♀ with labels: "Brésil, 623" [handwritten on white paper]; "Microcentrum myrtifolia Sss." [handwritten on green paper]; "Geneva" [printed on a strip of yellow paper]; "Allotypoid, Microcentrum myrtifolium Ss., should be designated" [handwritten on red card with "Allotypoid" printed]. Specimen set with wings spread, the hind wings being rather ragged; the ends of both antennae, two tarsal segments of the left hind leg and the last tarsal segment of the right hind leg are missing. Images on OSF. Box B36.

Microcentrum myrtifolium Saussure & Pictet, 1898.

nasicornis Pictet, 1888: 54-55, fig. 26 [*Macroxiphus*].

Java. Unspecified number of ♀.

One ♀ syntype with labels: "Java, f5-" [handwritten on white paper]; "19" [handwritten on a square of white paper]; "nasicornis, ♀ Sss." [handwritten on white paper]; "Macroxiphus sumatranus de Haan" [handwritten on yellow paper]; "Holotype of Macroxiphus nasicornis PICTET 1888, det. S. Ingrisch, 1998" [printed on white card]. Specimen set with wings spread. The lectotype does not seem to have been formally designated. Images on OSF. Box F17.

Macroxiphus nasicornis Pictet, 1888.

nigrifrons Saussure & Pictet, 1898: 410-411 [*Lichenochrus*].

Mexico, Orizaba (Mus. Genavense). One ♂ nymph.

Holotype ♂ with labels: "Orizaba, Sumichrast" [handwritten on white paper]; "Lichenochrus nigrifrons Sauss et P." [handwritten on green paper]; "Holotypus" [printed on red card]. Immature specimen; most of both antennae and the tarsi of the left middle and hind legs are missing. The right front leg is detatched and secured through the femur on the original pin. Box E16.

A junior synonym of *Gongrocnemis munda* Brunner von Wattenwyl, 1895.

oceanica Pictet & Saussure, 1892: 20, fig. 12 [*Tympanoptera*].

Insulae Fidgii. Unspecified number of ♂.

One ♂ syntype with labels: "oceanica" [handwritten on white paper]; "Aprion oceanicus P. & Sauss." [handwritten on lilac paper]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Ins. Viti" handwritten in the lower left corner. Specimen set with right wings spread and left wings folded; the antennae, left hind leg and the tarsi of the right hind leg are lost. The right middle leg is detached and glued to a piece of card on the original pin. Images on OSF. Box E8.

Acauloplacella oceanica (Pictet & Saussure, 1892).

ochracea Saussure & Pictet, 1898: 450, pl. 22, fig. 2 [*Tanusia*].

Guatemala, San Juan in Vera Paz (Champion). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Anommatoptera ochracea (Saussure & Pictet, 1898).

ocularis Saussure & Pictet, 1898: 354-355 [*Turpilia*].

Mexico, Teapa in Tabasco (H. H. Smith). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Montezumina ocularis (Saussure & Pictet, 1898).

oculatum Pictet & Saussure, 1892: 21 [*Aprion*].

Ceylon (Al. Humbert). Unspecified number of ♂ and ♀.

One ♂ and one ♀ syntype. A ♂ with labels: "Trincom., Ceylan" [printed on white paper]; "oculatum" [handwritten on white paper]; "Aprion oculatus P. + Sauss." [handwritten on yellow paper]; "Aprion oculatum P. & Sauss." and "LECTOTYPE by C. de Jong" [handwritten, apart from printed word "TYPE", on white card, the two labels being glued together]; "Morsimus ♀ [sic], oleifolius Fabr., det. C. de Jong 1938" [determination handwritten on printed white card]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; both antennae and all legs except the right front leg are missing. A ♀ with labels: "Ceylan, Mr. H. Saussure" [handwritten on whitepaper]; "Aprion oculatum P. & Ss., Ceylan" [handwritten on white paper]; "Aprion oculatus P. + Sauss." [handwritten on yellow paper]; "Aprion oculatum P. & Sauss." and "LECTOTYPE by C. de Jong" [handwritten, apart from printed word "TYPE", on white card, the two labels being glued together]; "Morsimus ♀, oleifolius Fabr., det. C. de Jong 1938" [determination handwritten on printed white card]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right

wings folded; the antennae and right front leg are lost, the left hind leg lacks the tarsi. No formal lectotype designation appears to have been published by de Jong. Images on OSF. Box E10.

A junior synonym of *Paramorsimus oleifolius* (Fabricius, 1793).

oridiops Saussure & Pictet, 1898: 354, 355 [*Turpilia*].

Mexico, Acapulco in Guerrero (H. H. Smith). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Montezumina oridiops (Saussure & Pictet, 1898).

ovalifolia Saussure & Pictet, 1898: 368, 369 [*Stilpnochlora*].

Brazil (Mus. Genavense). Unspecified number of ♀.

Holotype ♀ with labels: "Brésil, 623. 19." [handwritten on white card]; "Stilpnochlora ovalifolia, ♀ Sauss." [handwritten on green paper]; "Identified as Type, Emsley 1969" [handwritten in pencil on white card]; "HoloTYPE ♀, Stilpnochlora ovalifolia., Saussure & Pictet 1898." [handwritten on red card with "TYPE" printed]. Specimen set with wings folded; the antennae, the tarsi of the right front leg and left middle leg, two tarsal segments of the right middle leg and two last tarsal segments of the left hind leg are lost. Images on OSF. Box B25.

Stilpnochlora ovalifolia Saussure & Pictet, 1898.

parvispina Pictet & Saussure, 1887: 344-345 [*Elaeochlora*].

Brésil. One ♂ (hind legs do not belong to specimen).

Holotype ♂ with labels: "Brasil" [handwritten on a strip of white paper]; "CSC 1135" [handwritten by Carbonell on a strip of white card]; "Elaeochlora parvispina Sss. et Pict." [handwritten on green paper]; "Elaeochlora parvispina P.-S., Holotypus, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen lacks both antennae, the claw of the right front leg, the left middle leg, the tarsi of the right middle leg and both hind legs. A micro-tube containing dissected parts and a label "CSC 1135" is secured on the original pin. A pair of hind legs is secured on a separate pin with the label "These hind legs were pinned together with the type of Elaeochlora parvispina P.-S., and are the ones described by the authors as belonging to the insect. They are instead from a specimen of the genus Phaeoparia, probably Ph. lineaalba Linn. C S Carbonell, 1966." Images on OSF. Box Z4.

A junior synonym of *Agriacris auripennis* (Walker, 1870).

patagona Pictet & Saussure, 1887: 355-356 [*Clarazella*].

République Argentine, Bahia Blanca sur les confins de la Patagonie (Claraz). Unspecified number of ♀.

One ♀ syntype with labels: "Bahia Blanca, envoi G. Claraz" [handwritten on white paper]; "Zoniopoda patagona Pict. et Sauss." [handwritten on green paper]; "24 Gen. nov. divisionis II Stål vic. Zoniopoda Stå l. (je posside la même genre mais l'esp. diff.) Brunn." [handwritten on white paper]; "Clarazella patagona P.S., Holotypus, C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen set with wings

spread; both antennae and the tarsi of both hind legs are missing. Images on OSF. Box Z9.

Clarazella patagona Pictet & Saussure, 1887.

peringueyi Pictet, 1888: 74-75, fig. 30 [*Hemihetrodes*].

Afrique méridionale (Peringuey). Unspecifed number of ♀.

Two ♀ syntypes. A ♀ with labels: "Hemihetrodes peringueyi, ♀ Pict., Cap." [handwritten on white paper]; "620 74 Transvaal, Africa mer. Mr. Péringuey" [handwritten on ruled white card]; "Hemihetrodes peringueyi Pictet" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen lacks most of both antennae, the tibia and tarsi of the right front leg, the right middle leg and the last tarsal segment of the left middle and hind legs. A ♀ with labels: "TRANSVAAL, Peringuey" [locality printed and name handwritten on white paper]; "620 74 Transvaal, Africa mer. Mr. Péringuey" [handwritten on ruled white card]; "Hemihetrodes peringueyi Pictet" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen lacks most of the right antenna and all of the left antenna, the last tarsal segment of the right front and left middle legs, two tarsal segments of the right middle and left hind legs, and the tarsi of the right hind leg. Box M1.

A junior synonym of *Hemihetrodes bachmanni* (Karsch, 1887).

peringueyi Pictet, 1888: 62-63, figs 16 & 21 [*Thoracistus*].

Transvaal (Peringuey). Unspecified number of ♂ and ♀.

Lectotype ♂ (designated by Rentz, 1988: 258) with labels: "Transvaal, Leyenb. Dist." [printed on white card]; "Thoracistus peringueyi Pict." [handwritten on pink paper]; "LECTOTYPE, Thoracistus peringueyi Pictet, designated by Rentz 1985" [printed on white card coloured pink]. Specimen has lost both antennae and the left middle leg. A micro-tube containing dissected parts is secured on a separate pin with the label "LECTOTYPE, Thoracistus peringueyi Pictet" [printed on white coloured pink], while a third pin has two card mounted dissected parts and the labels ""LECTOTYPE, Thoracistus peringueyi Pictet, designated by Rentz 1985" [printed on white card coloured pink], "SEM # 13401-03, 13300, Det. D.C.F. Rentz 1985" [handwritten on white card with "Det. D.C.F. Rentz 19" printed] and "SCANNING ELECTRON PHOTOS MADE FROM THIS SPECIMEN" [printed on white card]. A ♀ paralectotype is also present. Images on OSF. Box K10.

Thoristicus peringueyi Pictet, 1888.

personata Pictet, 1888: 17-18, fig. 6 [*Cocconotus*].

Locality unknown. Unspecified number of ♀.

One ♀ syntype with labels: "Cocconotus personata Pict." [handwritten on yellow paper]; "Genre Cocconotus St." [handwritten on white card with "Genre" printed and "Paradryma" handwritten on the other side]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "?" handwritten in the lower left corner. The specimen has lost most of the right antenna and the left middle leg. The abdomen has shrunk and is somewhat distorted. The locality is given as "?" in the description, but the yellow name label on the pin and the yellow margin of the

label in the insect box indicate that the specimen was assumed to have been from the Oriental region, although this is not reliable. Box E25.

Cocconotus personatus Pictet, 1888.

peruviana Pictet & Saussure, 1887: 352-353 [*Rhomalea*].

Perou. Unspecified number of ♀.

Lectotype ♀ (designated by Roberts & Carbonell, 1982: 56) with labels: "Pérou, M H de Saussure" [handwritten on a strip of white card]; "Rhomalea peruviana ♀ P. et S." [handwritten on green paper]; "Rhomalea peruviana P.S., Hololectotypus [sic] ♀, C S Carbonell - 1966" [Handwritten by Carbonell on red card]. Specimen set with wings spread; the right antenna, the claw of the left hind leg and the entire right hind leg are missing. The head has a hole in it behind the right eye and the tips of the wings are lost. Another ♀ with the same data label is present and was probably part of the type series. There is also a ♂ with the same data label, and although only female characters were mentioned in the original description, Carbonell has labelled this as a paratype. Images on OSF. Box Z8.

Chromacris peruviana (Pictet & Saussure, 1887).

peruvianum Pictet, 1888: 29, fig. 10 [*Typophyllum*].

Pérou. Unspecified number of ♀.

One ♀ syntype with labels: "Pérou, peruvianum" [handwritten in pencil on whitish card]; "Typophyllum peruvianum Pict." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread; most of both antennae, the right middle leg and both hind legs are missing. The abdomen is damaged, as noted by Vignon (1925: 257). A second ♀ with labels "Pérou, M. H. de S." [handwritten on white paper]; "Typophyllum peruvianum Pict." [handwritten on green paper]; "Possible syntype of T. peruvianum Pictet, 1888? Hollier, 2010" [handwritten on red paper], and mentioned by Vignon (1931: 140) may also be a syntype. This specimen was set with wings spread, but most of the left forewing is missing, and the hind wings reduced to a few shreds; most of both antennae, the right front and middle legs, the tarsi of the left middle leg, and the right hind leg are missing. Images on OSF. Box E30.

Typophyllum peruvianum Pictet, 1888.

peruvianus Saussure & Pictet, 1898: 421, 423, pl. 20, fig. 12 [*Anchiptolis*].

Peru (Mus. Genavense). Unspecified number of ♂.

One ♂ syntype with labels: "Pérou, M. H de Saussure" [handwritten on white paper]; "Anchiptolis peruviana Sauss & P." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings spread; most of both antennae, the tibia and tarsi of the left front leg, the tarsi of the right front leg, the tarsi of the left middle leg and the left hind leg are lost. The femur of the left front leg and the right hind leg are detached and secured on the original pin. The wings and abdomen have holes indicating that the specimen was originally pinned with the wings folded, and has been reset. Box E21.

A junior synonym of *Triencentrus amazonicus* Brunner von Wattenwyl, 1895.

philippinensis Pictet & Saussure, 1892: 18 [*Microprion*].

Insulae Philippinae. Unspecified number of ♀.

One ♀ syntype with labels: "Luzon, Fagor" [handwritten on yellow card]; "philippinensis" [handwritten in pencil on white card]; "Phyllomimus granulosus Stål" [handwritten on yellow paper]; "Microprion philippinensis P. & S., det. C. de Jong 1938, TYPE" [determination handwritten on printed white card]. Specimen set with left wings spread and right wings roughly folded; most of both antennae is missing. Images on OSF. Box E8.

A junior synonym of *Phyllomimus detersus* (Walker, 1869).

phthisica Saussure & Pictet, 1897: 318 [*Hormilia*].

Mexico, Temax in Northern Yucatan (Gaumer). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Insara phthisica (Saussure & Pictet, 1897).

pictipennis Saussure & Pictet, 1898: 441, pl. 21, figs. 3-8 [*Euacris*].

Costa Rica, Volcan de Irazu, 7000 ft. (Rogers). Unspecified number of ♂ and ♀.

The single specimen found in MHNG collections was collected in 1900, after the publication of the description, and is therefore not a type. The type material is in the BMNH (images on OSF). Box E27.

A junior synonym of *Diyllus fasciatus* (Brunner von Wattenwyl, 1895).

platyceps Saussure & Pictet, 1897: 301, 302 [*Hemiudeopsylla*].

Sancelito in California (Mus. Genavense). Unspecified number of ♂.

One ♂ syntype with labels: "Californie, M. H de S." [handwritten on white paper]; "Sancelito, Jun 71" [handwritten on pale blue paper]; "Hemiudeop. platyceps Sauss" [handwritten on green paper]; "Ceuthophilus (Hemiudeopsylla) californicus S., det. T.H. Hubbell, 1966" [designation and last numeral of date handwritten on printed white card]; "Holotypus" [printed on red card]. Specimen lacks most of the left antenna, the tarsi of both front legs, the tarsi of the left middle leg and the claw of the right hind leg. Box O9.

A junior synonym of *Ceuthophilus californianus* Scudder, 1862.

prasina Pictet & Saussure, 1892: 22, fig. 14 [*Chloracris*].

India, Sina. Unspecified number of ♀.

Although the MHNG collections contain a number of specimens (mainly from Java, some without locality labels) in boxes E2 and E3, the ♀ type(s) could not be positively identified.

Chloracris prasina Pictet & Saussure, 1892.

prasina Saussure & Pictet, 1897: 318, 319-320 [*Hormilia*].

Mexico, Mazatlan in Sinaloa (Forrer), Guerrero (H. H. Smith). Unspecified number of ♂ and ♀.

No specimens found in MHNG collections. The lectotype (designated by Rehn & Hebbard, 1914: 63) is in the BMNH (images on OSF).

Insara prasina (Saussure & Pictet, 1897).

prudhommi Saussure & Pictet, 1898: 349 [*Hyperphrona*].

Guiana, Cayenne (Prudhomme). Unspecified number of ♀.

One ♀ syntype with labels: "CAYENNE" [printed on green paper]; "Hyperphronia prudhommi Sauss." [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings folded; the entire left antenna and most of the right antenna are missing. Images on OSF. Box B33.

Hyperphrona prudhommi Saussure & Pictet, 1898.

puelchus Pictet & Saussure, 1887: 375 [*Diponthus*].

République Argentine. Unspecified number of ♂ and ♀.

One ♂ and two ♀ syntypes. A ♂ with labels: "Republ. Argentine" [handwritten on green paper]; "Diponthus puelchus ♂ P. et S." [handwritten on green paper]; "Prionac. pulchus [sic] Pict. et Sss." [handwritten on green paper]; "CSC 1138" [handwritten by Carbonell on a strip of white card]; "Diponthus puelchus P.-S., Hololectotypus [sic] $, C S Carbonell – 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread; the left middle leg is missing. A micro-tube containing dissected parts and a label "1138" is secured on the original pin. A ♀ with labels: "Buenos Ayres" [handwritten on white paper]; "Diponthus puelchus ♀ P. et S." [handwritten on green paper]; "Prionac. pulchus [sic] Pict. et Sss." [handwritten on green paper]; "Diponthus puelchus P.-S., Allolectotypus [sic] ♀. C S Carbonell – 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread; the last tarsal segment of the left front leg is missing. A ♀ with labels: "Republ. Argentine" [handwritten on green paper]; "Prionac. pulchus [sic] Pict. et Sss." [handwritten on green paper]; "Diponthus puelchus P.-S., Paratypus C SC S 1966" [handwritten by Carbonell on red card]. Specimen set with wings folded; the left antenna is missing. Images on OSF. Box Z15.

A junior synonym of *Diponthus pictus* (Bolivar, 1884).

pulchripennis Pictet, 1888: 32-33, fig. 7 [*Rhodopteryx*].

Nouvelle Grenade. Unspecified number of ♀.

One ♀ syntype with labels: "294" [printed on white paper]; "Rhodopteryx pulchripennis Pic." [handwritten on white paper]; "Rhodopteryx pulchripennis Pict." [handwritten on green paper]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Nouvelle Grenade" written in the lower left corner. Specimen set with wings spread; most of both antennae, two tarsal segments of the left front leg and the tarsi of the right hind leg are lost. Images on OSF. Box E29b.

Rhodopteryx pulchripennis Pictet, 1888.

puncticeps Pictet & Saussure, 1891: 297-299, fig. 3 [*Onosandrus*].

Afrique méridionale. Unspecified number of ♂.

One ♂ syntype with labels: "519 S-Afr. (Sud Africa) Onosandrus sp. n." [handwritten, locality in black ink, determination in red ink, on a strip of white paper]; "519" [handwritten on white paper]; "1029/ S. Afr." [handwritten on a disc of white paper]; "1734" [handwritten on white paper]; "O. puncticeps, Africa, Ss. Et P." [handwritten on white paper]; "Onosandrus puncticeps Pict. et Sauss." [handwritten on pink paper];

"Holotypus" [printed on red card]; "Onosandrus puncticeps Pictet & Saussure, 1891 HT" [handwritten by Johns on white card]. Specimen has lost both antennae, all the left legs, the tarsi of the right front and middle legs and the last tarsal segment of the right hind leg. Box O5.

Bochus puncticeps (Pictet & Saussure, 1891).

pupus Saussure in Pictet, 1888: 49-50, fig. 28 [*Agraecia*].

Nouvelle Irlande. Unspecified number of ♀.

One ♀ syntype with labels: "Agraecia pupus Sss, type" [handwritten on white paper]; "Salomona pupus Sauss., type!" [handwritten on green paper]; "Holotypus" [printed on red card]. Specimen set with wings folded; most of the right antenna is missing and the right front, left middle and right hind legs each lack the last tarsal segment. Images on OSF. Box F15.

Salomona pupus (Saussure in Pictet, 1888).

pycnostictus Pictet & Saussure, 1887: 373-374 [*Diponthus*].

République Argentine, Entre.Rios (Claraz). Unspecified.

One ♀ syntype. A ♀ with labels: "Bahia Blanca, env G Claraz" [handwritten on white paper]; "Prionacris pycnostictus Pict. et Sauss." [handwritten on green paper]; "Diponthus pycnostictus P. et S." [handwritten on green paper]; "Diponthus pycnostictus P.-S., Hololectotypus [sic] ♀, C S Carbonell – 1966" [handwritten by Carbonell on red card]. Specimen set with wings spread. A ♀ with labels: "14" [printed on a square of white card]; "609 33, Buen. Air., La Plata, Mr Hy de Sauss" [numerals and first part of locality handwritten, the rest printed on ruled white card]; "Prionacris pycnostictus Pict. et Sauss." [handwritten on green paper] might also be a syntype, as might a ♂ with labels: "Buenos Ayres, Février 1868" [handwritten on white paper]; "Prionacris pycnostichus Pict. et Sss." [handwritten on green paper]. Images on OSF. Box Z15.

Diponthus picnostictus Pictet & Saussure, 1887.

recticauda Saussure & Pictet, 1897: 341, 343, pl. 16, fig. 13 [*Anaulacomera*].

Mexico, Acapulco in Guerrero (H. H. Smith). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Anaulacomera recticauda Saussure & Pictet, 1897.

resinum Saussure & Pictet, 1898: 396, 398; pl. 19, figs 26-27 [*Xiphidium*].

Mexico, Orizaba (H. H. Smith, F. D. G.). More than one ♂.

One ♂ syntype with labels: "Orizaba. H.H.S. & D.F.G., Dec. 1887" [printed on white card]; "Xiphidium resimus [sic] P et S" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae is lost, and the left hind leg is detached and secured through the femur on the original pin. There is a ♂ syntype, erroneously referred to as the holotype on OSF, in the BMNH (images on OSF). Box F23.

Conocephalus resinus (Saussure & Pictet, 1898).

reticulatus Pictet & Saussure, 1892: 25-26, fig. 20 [*Brochopeplus*].

Patria? Unspecified number of ♀.

One ♀ syntype with labels: "Brochopeplus reticulatus P. & Sauss." [handwritten on yellow paper]; "Brochopeplus reticulates P. & s., det. C. de Jong 1938, LECTOTYPE" [determination and "LECTO" handwritten on white card with de Jong's name, date and "TYPE" printed]. The species name label in the insect box has the locality "Ceylon" handwritten in the lower left corner. Specimen set with wings spread; most of both antennae, the left middle leg and the tarsi of the right middle leg are lost. The lectotype does not seem to have been officially designated. Box E7.

A junior synonym of *Brochopeplus exaltatus* (Walker, 1869).

rex Saussure & Pictet, 1898: 446, 447-448, pl. 21, figs 21-23 [*Diophanes*].

Antilles, Martinique (Mus. Genavense). Unspecified number of ♂ and ♀ (colour variation mentioned).

One ♂ and two ♀ syntypes. A ♂ with labels: "Martinique" [handwritten on a strip of white paper]; "222/23" [handwritten on stained white paper]; "Elloropetalum[?] rex. Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; the abdomen has been eviscerated and stuffed. A ♀ with labels: "Martinique" [handwritten on a strip of white paper]; "222/23" [handwritten on stained white paper]; "Elloropetalum[?] rex. Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; the abdomen has been eviscerated and stuffed. A ♀ with labels: "222/23" [handwritten on whitish paper]; "Elloropetalum [?] rex. Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. The species name label in the insect box has the locality "Martinique" handwritten in the lower left corner. Specimen set with wings roughly folded. Images on OSF. Box E27.

A junior synonym of *Mastophyllum scabricolle* (Serville, 1838).

rhinoceros Pictet, 1888: 48-49, fig. 25 [*Copiophora*].

Amérique centrale. Unspecified number of ♀.

Possible syntype with labels: "Guaitilde, Pinus, 252 (Pac.), Copiphora?, P. Biolley" [handwritten on white paper]; "Copiophora longicauda Serv." [handwritten on green paper]; "Type of C. rhinoceros Pictet, 1888? Hollier 2010" [handwritten on red paper]. Specimen set with right wings spread and left wings folded; most of the left antenna is missing. The left middle leg is detached and secured on the original pin. No specimens in the MHNG collections were labelled as *C. rhinoceros*. This specimen was placed in the collection as *C. longicauda* Serville, 1838 but is clearly not that species; the specimen matches the description, measurements and illustration of *C. rhinoceros* given by Pictet. A specimen in the BMNH is recorded as a type on their database. Box F1.

Copiphora rhinoceros Pictet, 1888.

rogersi Saussure & Pictet, 1898: 386, 387, pl. 19, figs 13-14 [*Pyrgocorypha*].

Costa Rica, Caché (Rogers). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Pyrgocorypha rogersi Saussure & Pictet, 1898.

rosescens Saussure & Pictet, 1898: 446, 447, pl. 21, figs 19-20 [*Diophanes*].

Panama, Bugaba, Volcan de Chiriqui (Champion). Unspecified number of ♂ and ♀.

Three ♂ and one ♀ syntype. A ♂ with labels: "Bugaba, 800-1500 ft., Champion." [printed on white card]; "Diophanes rosescens Sauss, et P." [handwritten on green paper]; "LECTOTYPE, P. Naskrecki design." [handwritten on red card]. Specimen set with right wings spread and left wings folded; most of the right antenna is missing. A ♂ with labels: "V. de Chiriqui, 2-3000 ft., Champion" [printed on white card]; "Diophanes rosescens Sauss, et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A ♂ with labels: "Bugaba, 800-1500 ft., Champion." [printed on white card]; "Diophanes rosescens Sauss, et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded. A ♀ with labels: "Bugaba, 800-1500 ft., Champion." [printed on white card]; "Diophanes rosescens Sauss, et P." [handwritten on green paper]; "PARALECTOTYPE, P. Naskrecki design." [handwritten on red card]. Specimen set with left wings spread and right wings folded; much of the right antenna, the last tarsal segment of the left middle leg and the right hind leg are missing. There are further syntypes in the BMNH. No formal lectotype designation appears to have been published. Images on OSF. Box E28.

Diophanes rosescens Saussure & Pictet, 1898.

sagittatus Saussure & Pictet, 1898: 431, 433, pl. 20, fig. 29 [*Cocconotus*].

Panama, Volcan de Chiriqui (Champion). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Docidocerus sagittatus (Saussure & Pictet, 1898).

saharae Pictet & Saussure, 1891: 293-294 [*Pamphagus*].

Algerie sud, Biskra. Unspecified number of ♂ and ♀.

Three ♂ and two ♀ syntypes. A ♂ with labels: "621 11, Biskra, Algerie, Mr A. Pictet" [handwritten on ruled white card]; "Biskra" [printed on white card]; "saharae, P. et S." [handwritten on white paper]; "Pamph. saharae Sss et Pict" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen has lost about half of the left antenna and the last tarsal segment of the right hind leg. A ♂ with labels: "621 11, el Kantara, Algerie, Mr A. Pictet" [handwritten on ruled white card]; "el Kantara" [printed on a strip of white paper]; "Pamphagus saharae, Sss et P., Biskra" [handwritten on white paper]; "Pamph. saharae Sss et Pict" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen has lost the last tarsal segment of the left hind leg. A ♂ with labels: "621 11, el Kantara, Algerie, Mr A. Pictet" [handwritten on ruled white card]; "el Kantara" printed on a strip of white paper]; "saharae, P. et S." [handwritten on white paper]; "Pamph. saharae Sss et Pict" [handwritten on pink paper]; "Syntypus"

[printed on red paper]. Specimen has lost about half of the left antenna and the last tarsal segment of the left hind leg. A ♀ with labels: "621 11, Biskra, Algerie, Mr A. Pictet" [handwritten on ruled white card]; "Biskra" [printed on white card]; "saharae, P. et S." [handwritten on white paper]; "Pamph. saharae Sss et Pict" [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen lacks part of both antennae. A ♀ with labels: "el Kantara" [printed on a strip of white paper]; "Pamph. saharae Sss et Pict" [handwritten on pink paper]; "Syntypus" [printed on red paper]. There are also one ♂ and one ♀ labelled "Col de Sfa, Algerie, Brunner d W", which might also be syntypes. Box Y5.

Paracinipe saharae (Pictet & Saussure, 1891).

saltator Saussure & Pictet, 1897: 293, 294, pl. 14, fig. 16 [*Schoenobates*].

Costa Rica, Volcan de Irazu 6000 ft. (Rogers). Unspecified number of ♀.

No specimens found in MHNG collections. OSF states that the holotype is in the BMNH.

Anabropsis saltatrix (Saussure & Pictet, 1897).

salvini Saussure & Pictet, 1897: 305, 306 [*Gryllacris*].

Panama, Bugaba (Champion). One damaged ♂.

No specimens found in MHNG collections. The holotype is in the BMNH according to their database.

Abelona salvini (Saussure & Pictet, 1897).

schumanni Saussure & Pictet, 1897: 334 [*Phrixa*].

Mexico, Atoyac in Vera Cruz (Schumann). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Phrixa schumanni Saussure & Pictet, 1897.

siccifolia Saussure & Pictet, 1898: 452, 454, pl. 22, figs 14-16 [*Mimetica*].

Panama, Volcan de Chiriqui 4000 to 6000 ft., Caldera (Champion). More than one ♂ (variation in wing shape mentioned).

One syntype with labels: "V. de Chiriqui, 25-4000 ft., Champion." [printed on white card]; "Mimetica siccifolia Sauss & P." [handwritten on green paper]; "Mimetica saussurei, Kirby 1906 n.n." [handwritten on white paper]; "Paralectotype, P. Nasrecki design." [handwritten on red card]. Specimen set with right wings spread and left wings folded; most of both antennae is missing. There is at least one other syntype in the BMNH according to their database. No formal lectotype designation appears to have been published. Images on OSF. Box E29b.

Mimetica siccifolia Saussure & Pictet, 1898.

spinifrons Saussure & Pictet, 1898: 381, 382 [*Exocephala*].

Guiana, Cayenne. More than one ♀ (colour variation mentioned).

Probable syntype ♀ with labels: "Guyane française" [handwritten on ruled white card]; "Syntype of E. spinifrons Saus. & Pict. 1898?, Hollier 2010" [handwritten

on red paper]. Specimen set with wings folded; the left antenna and most of the right antenna are missing, as are two tarsal segments of the left hind leg. There are two further ♀ and a ♂ each with a locality label "CAYENNE" printed on a strip of green paper (similar to that shown with the so-called ♂ holotype in the BMNH on OSF), and these may be other syntypes. It is more likely, given that the description only treats ♀, that neither they nor the ♂ specimen in the BMNH are syntypes. There may be further ♀ syntypes in the BMNH. Box F2.

Moncheca spinifrons (Saussure & Pictet, 1898).

stolli Pictet & Saussure, 1887: 351 [*Rhomalea*].

Brésil, Bahia. Unspecified.

Lectotype ♂ (designated by Roberts & Carbonell, 1982: 51) with labels: "Bahia" [printed on white card]; "Rhomaleae stollii Sss. Pict." [handwritten on green paper]; "Rhomalea Stollii ♂ S. et P." [handwritten on green paper]; "CSC 1136" [handwritten by Carbonell on a strip of white card]; "Rhomalea stolli P. S. ♂, Hololectotypus [sic], C S Carbonell - 1966" [handwritten by Carbonell on red card]. Specimen set with left wings spread and right wings folded; both antennae, the last tarsal segment of the left middle leg and the last tarsal segment of the right hind leg are lost. A micro-tube containing dissected parts and a label "CSC 1136" is secured on the original pin. A ♀ paralectotype is also present. Images on OSF. Box Z6.

A junior synonym of *Chromacris speciosa* (Thunberg, 1824).

subconspersa Saussure & Pictet, 1898: 421, 422 [*Anchiptolis*].

Guatemala (Mus. Genavense). Unspecified number of ♂ and ♀ (colour variation mentioned).

One ♂ syntype with labels: "Guatemala 603, M Oltram. 51" [printed on white card]; "Anchiptolis, subconsper-, sa Sauss." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; most of both antennae, the tarsi of the left front leg, the last tarsal segment of the right front and middle legs and two tarsal segments of the right hind leg are lost. There is at least one other syntype in the BMNH according to their database. Images on OSF. Box E21.

A junior synonym of *Gongrocnemis fusca* (Brunner von Wattenwyl, 1895).

subfalcata Saussure & Pictet, 1898: 437, pl. 20, figs 30-32 [*Thamnobates*].

Panama, Volcan de Chiriqui (Champion). Unspecified number of ♂ and ♀.

One ♂ syntype with labels: "COLL GOD SALV, VOLC CHIRIQI, G.C. CHAMPION" [printed on white paper]; "subfalcata, ♂ S – P." [handwritten on green paper]; "Thamnobates subfalcata Sauss et Pict., LECTOTYPE, P. Neskrecki design." [handwritten on red card]. Specimen set with right wings spread and left wings folded; most of the right antenna and the right hind leg are missing. There are further syntypes in the BMNH. No formal lectotype designation appears to have been published. Images on OSF. Box E27.

Thamnobates subfalcata Saussure & Pictet, 1898.

subintegra Saussure & Pictet, 1898: 452, 453, pl. 22, fig. 9 [*Mimetica*].

Colombia? Unspecified number of ♀.

No specimens found in MHNG collections. Vignon (1931: 151) could not trace the type.

Mimetica subintegra Saussure & Pictet, 1898.

subquadratum Saussure & Pictet, 1898: 424, 426, pl. 20, figs 22-23 [*Idiarthron*].

Guatemala (Oltramare), Pantaleon (Champion); Costa Rica (Van Patten). Unspecified number of ♂ and ♀ (♀ colour variation mentioned).

Three ♂ and two ♀ syntypes. A ♂ with labels: Guatemala 603, Mr Oltram. 51" [printed on white paper]; "Idiarthron, subquadratum, Sauss + P." [handwritten on green paper]; "Lectotypus, Idiarthron subquadratum S & P, should be designated" [handwritten on red card with "Lectotypus" printed]. Specimen set with wings spread; the last tarsal segment of both front legs and of the right middle leg is missing, as is the last tarsal segment of the left hind leg. A ♂ with labels: "Mr Oltram. 51, Guatemala 603" [printed on white paper]; "Idiarthron, subquadra-,tum Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; most of both antennae, the last tarsal segment of the left middle leg and the right hind leg are lost. The right middle leg and left hind leg are detached and secured through the femur on the original pin along with a femur from another specimen. A ♂ with labels: "Guatemala 603, Mr Oltram. 51" [printed on white paper]; "Idiarthron, subquadratum, Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae, the left front leg, and two tarsal segments of the left middle leg are lost. The subgenital plate is damaged. A ♀ with labels: "Guatemala" [handwritten on a strip of white paper]; "Idiarthron, subquadratum, Sauss + P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the left antenna, the tarsi of the right front leg and the last tarsal segment of both hind legs are lost. A ♀ with labels: "Cache, Costa Rica, H. Rogers" [printed on white card, the label having been torn in half]; "Cache, Costa Rica, H. Romers [sic]" [handwritten on white card]; "Idiarthron subquadrata , ♀ S. P., var: lamina- supraanalis" [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded; the last tarsal segment of the left middle and left hind legs is lost. There are three other ♀ collected by Biolley in Costa Rica in the collection. There are further syntypes in the BMNH according to their database. A lectotype does not seem to have been formally designated. Images on OSF. Box E22.

Idiarthron subquadratum Saussure & Pictet, 1898.

syriaca Pictet, 1888: 55-56, fig. 37 [*Paradymadusa*].

Syrie. Unspecified number of ♀.

One ♀ syntype with labels: "Musée de Genève, Tripoli, Syrie, No" [locality handwritten in pencil on printed white card]; "Paradrymadusa syriaca Pict" [hand-written on blue paper]; "Holotypus" [printed on red card]. The specimen has lost the antennae, the left middle leg, two tarsal segments of the right middle leg and the last tarsal segment of the left hind leg. Images on OSF. Box K2.

Scotodrymadusa syriaca (Pictet, 1888).

taeniatifrons Saussure & Pictet, 1898: 428, 429, pl. 20, fig. 25 [*Bliastes*].

Guatemala, Lanquin in Vera Paz (Champion). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

A junior synonym of *Cocconotus vittifrons* (Walker, 1871).

tenuistylus Saussure & Pictet, 1898: 421, 422-3 [*Anchiptolis*].

Guatemala, Panzos in Vera Paz (Conradt). Unspecified number of ♂.

No specimens found in MHNG collections. There is a ♂ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Gongrocnemis tenuistyla (Saussure & Pictet, 1898).

tepaneca Saussure & Pictet, 1897: 336, 337 [*Amblycorypha*].

Mexico (Mus. Genavense). Unspecified number of ♂.

One ♂ syntype with labels: "Mexique, Sumichron" [handwritten on white paper]; "Amblycorypha Tepaneca ♂ S. et P." [handwritten on green paper]; "Holotypus, Amblycorypha tepaneca S. + P." [handwritten on red card with "Holotypus" printed]. Specimen set with wings folded; the left hind leg lacks the tarsi and the left middle and right hind legs are lost. Images on OSF. Box B28.

Amblycorypha tepaneca Saussure & Pictet, 1897.

texensis Saussure & Pictet, 1897: 328, 330, pl. 15, figs 18-19 [*Scudderia*].

Dallas in Texas (Boll). Unspecified number of ♂.

Two ♂ syntypes. A ♂ with labels: "Dallas, Texas" [printed on white paper]; "Scudderia Texensis ♂ S et P." [handwritten on green paper]; "Lectotypus, Scudderia texensis S & P, To be designated." [handwritten on red card with "Lectotypus" printed]. Specimen set with wings folded; most of the left antenna, the entire right antenna and the last tarsal segment of both hind legs are lost. A ♂ with labels: "TYPE BRUNN" [printed on a strip of white paper]; "Scudderia Texensis ♂ S et P." [handwritten on green paper]; "Syntypus?" [printed on red paper with the "?" added by hand]. Specimen set with wings roughly spread: most of the right antenna, the entire left antenna, the left front leg, the tarsi of the right front leg and the tibia and tarsi of the left hind leg are missing. The femur of the left hind leg has been glued to the abdomen. Images on OSF. Box B21.

Scudderia texensis Saussure & Pictet, 1897.

tristani Saussure & Pictet, 1898: 389, 391, pl. 19, fig. 22 [*Conocephalus*].

Costa Rica, Tucurrique (Tristan). Unspecified number of ♀.

No specimens found in MHNG collections. Type apparently lost.

Conocephalus tristani Saussure & Pictet, 1898 (*nomen dubium* on OSF).

truncatifolia Pictet & Saussure, 1892: 19, fig. 10 [*Phyllomimus*].

Molluccae. Unspecified number of ♀.

One ♀ syntype with labels: "Moluques, Mr. Griolet. 662 68" [printed on whitish paper]; "Phyllomimus truncatifolia P & Sss." [handwritten on white paper];

"Phyllomimus granulosus Stål" [handwritten on yellow paper]; "Phyllomimus truncatifolia P. & S., det. C. de Jong 1938, TYPE" [determination handwritten on white card with de Jong's name, date and "TYPE" printed]. Specimen set with wings spread; the left front leg and both hind legs are missing. Images on OSF. Box E7.

A junior synonym of *Phyllomimus detersus* (Walker, 1869).

unispina Saussure & Pictet, 1898: 396, 398-399 [*Xiphidium*].

Mexico, Jalisco (Schumann), Orizaba (Saussure). Unspecified number of ♂ and ♀ (variation in subgenital plate mentioned).

The two specimens in the MHNG collection were collected in 1917 and 1918, after the description was published, and are therefore not types. The types are in the BMNH collection according to their database (images on OSF). Box F22.

Orchelimum unispina (Saussure & Pictet, 1898).

vaginalis Saussure & Pictet, 1897: 325-326 [*Godmanella*].

Mexico, Omilteme in Guerrero 8000 ft. (H. H. Smith). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Godmanella vaginalis Saussure & Pictet, 1897.

vaginalis Pictet & Saussure, 1891: 309-310, fig. 11 [*Gryllacris*].

Indes orientales. Unspecified number of ♀.

One ♀ syntype with labels: "Capt. Buther[?], Naga-H." [collector's name handwritten and locality printed on whitish card]; "Musée de Genève, No 62" [number handwritten on printed white card]; "524" [printed on white card]; "1843" [handwritten on white paper]; "Gryllacris vaginalis, ♀ P. et S." [handwritten on yellow paper]; "Gr. vaginalis Pic. et Ss." [handwritten on lined white paper]; "Pict. Sss., Type" [names written and "Type" printed on pink card with black printed margin]. Specimen set with right wings spread and left wings folded; the extremities of both spread wings are missing, as are most of the left antenna and all of the right antenna, the left front leg, the tibia and tarsi of the right front leg, and the tibiae and tarsi of both middle and both hind legs. Box N4.

Eugryllacris vaginalis (Pictet & Saussure, 1891).

vaginalis Saussure & Pictet, 1898: 409-410 [*Lichenochrus*].

Guatemala (Mus. Genavense). Unspecified number of ♀.

Four ♀ syntypes. A ♀ with labels: "3 28, Guatema-, la, M. H. de Sauss." [handwritten on ruled white card]; "Lichenochrus vaginalis Sauss. et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with left wings spread and right wings folded; most of both antennae, the last tarsal segment of the left front leg, the right middle leg and two tarsal segments of the left hind leg are missing. A ♀ with labels: "3 28, Guatema-, la, M. H. de Sauss." [handwritten on ruled white card]; "Lichenochrus vaginalis Sauss et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with right wings spread and left wings folded;

most of both antennae, the right middle leg, two tarsal segments of the left middle leg and two tarsal segements of both hind legs are lost. A ♀ with labels: "2 14, Guatemala, M. H. d. Sauss." [handwritten on ruled white card]; "Lichenochrus vaginalis Sauss. et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; most of both antennae and the left hind leg are missing. A ♀ with labels: "3 28, Guatema-, la, M. H. de Sauss." [handwritten on ruled white card]; "Lichenochrus vaginalis Sauss et P." [handwritten on green paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; most of the left antenna and both front legs are lost. Box E16.

A junior synonym of *Gongrocnemis tenebrosa* (Walker, 1870).

vaginatus Pictet, 1888: 53-54, fig. 27 [*Macroxiphus*].

Java. Unspecified number of ♀.

One ♀ syntype with labels: "vaginalis Sss [sic]" [handwritten on white paper]; "Macroxiphus vaginatus Pict." [handwritten on yellow paper]; "Holotype of Macroxiphus vaginatus PICTET 1888, det. S. Ingrisch, 1998" [printed on white card with red inked border]; "Holotype of Macroxiphus vaginatus PICTET 1888, det. S. Ingrisch, 1998" [printed on white card]. The species name label in the insect box has the locality "Java" written in the lower left corner. Specimen set with wings folded; the right middle leg and part of the tibia and the tarsi of the left hind leg are missing. Images on OSF. Box F17.

Eumacroxiphus vaginatus (Pictet, 1888).

validus Saussure & Pictet, 1898: 373, pl. 18, figs 10-11 [*Posidippus*].

Nicaragua, Chontales (Janson). Unspecified number of ♀.

The single ♀ specimen in the MHNG collections is from Costa Rica and not a type. There is a ♀ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF). Box B27.

A junior synonym of *Steirodon stalii* (Brunner von Wattenwyl, 1878).

variabilis Pictet, 1888: 38-39, fig. 19 [*Tanusia*].

Guyana (Bar et coll. Jurine). More than one ♂ and ♀

Two ♂ and three ♀ syntypes. A ♂ with labels: "Tanusia variabilis Pict." [handwritten on green paper]; "10 (Vignon)" [handwritten on white paper]; "Syntypus" [printed on red paper]. Specimen set with wings roughly spread; the antennae are missing as are the last tarsal segment of the left middle leg, the entire right middle leg and both hind legs. A ♂ with labels: "Tanusia variabilis Pict." [handwritten on green paper]; "9 (Vignon)" [handwritten on white paper]; "45" [handwritten on white card]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the front of the head and the antennae are missing, the right front leg, the tibia and tarsi of the left front leg are lost. A detached right hind leg is secured on a separate pin next to the specimen. A ♀ with labels: "E. Surinam" [handwritten on white card with a green printed border]; "Tanusia variabilis Pict." [handwritten on green paper]; "7 (Vignon)" [handwritten on white paper]; "Holotypus" [printed on red card]; "Syntype! Both sexes mentioned in description. Hollier 2010" [handwritten on red paper]. Specimen set with wings

spread; the ends of the antennae, the tarsi of the right front leg, two tarsal segments of the left front and middle legs, the tarsi of the right middle leg and two tarsal segments of the left hind leg are lost. A detached right hind leg is secured on a separate pin next to the specimen. The abdomen has been eviscerated (presumably at the time of capture) and stuffed. A ♀ with labels: "476/25" [handwritten on a disc of white card]; "Tanusia variabilis Pict." [handwritten on green paper]; "8 (Vignon)" [handwritten on white paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the entire left antenna and most of the right antenna are lost as is the right hind leg. The underside of the abdomen has been filled with plaster (?). A ♀ with labels: "Cayenne" [handwritten on white paper]; "Tanusia variabilis Pict." [handwritten on green paper]; "4 (Vignon)" [handwritten on white paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; the ends of the antennae and two tarsal segments of the right hind leg are lost. There is also a hind leg and two hind femurs pinned to a separate pin at the end of the series. The species name label in the insect box has the locality "Brasil. Guyana." handwritten in the lower left corner. Vignon (1923) stated that the male specimens 9 and 10 are *T. colorata* (Serville, 1838) and the female specimens 7 and 8 are *T. decorata* (Walker, 1870), without mentioning *T. variabilis*. He subsequently remarked in a footnote (Vignon, 1931: 83) that *T. variabilis* was not referable to a single species, and that the MHNG material included specimens of *T. colorata*, *T. decorata* and *T. cristata* (Serville, 1838). Images on OSF. Box E28b.

A junior synonym of *Tanusia colorata* (Serville, 1838) (partim), *Tanusia decorata* (Walker, 1870) (partim).

vaucherianus Pictet, 1888: 59-60, fig. 36 [*Eumeymus*].

Maroc, Tanger. Unspecified number of ♂ and ♀.

Five ♂ and five ♀ syntypes. A ♂ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Maroc., Vaucher" [printed on pink paper]; "Vaucherianus" [handwritten on a strip of white paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the abdomen has been eviscerated and stuffed. A ♂ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Maroc." [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the abdomen has been eviscerated and stuffed. A ♂ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Maroc." [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the left antenna and the last tarsal segment of the right hind leg are missing, and the abdomen has been eviscerated and stuffed. A ♂ with labels: "Maroc." [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Coll. Pictet" [printed on a strip of white paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the right antenna is missing and the abdomen has been eviscerated and stuffed. A ♂ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Maroc." [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the right antenna and the last tarsal segment of the right front leg are missing.

A ♀ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Tanger, Vaucher" [handwritten on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings spread; most of the left antenna is missing. A ♀ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Maroc., Vaucher" [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; two tarsal segments of the right middle leg are lost and the abdomen has been eviscerated and stuffed. A ♀ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Maroc., Vaucher" [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the abdomen has been eviscerated and stuffed. A ♀ with labels: "620 61 Maroc., Mr. Vaucher" [handwritten on ruled white card]; "Maroc., Vaucher" [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; the last tarsal segment of the left middle leg and the tibia and tarsi of the left hind leg are lost, and the abdomen has been eviscerated and stuffed. A ♀ with labels: "Maroc." [printed on pink paper]; "Locusta vaucheriana Pict." [handwritten on pink paper]; "Coll. Pictet" [printed on a strip of white paper]; "Syntypus" [printed on red paper]. Specimen set with wings folded; two tarsal segments of the left middle leg and the last tarsal segment of the right hind leg are lost, and the abdomen has been eviscerated and stuffed. The left front leg, which lacks the tarsi, is detached and secured on the original pin. Several other specimens which may have been part of the type series but which lack data labels are present in box "Doubles 45", and OSF indicates that there are syntypes in other institutions. Images on OSF. Box H2.

Tettigonia vaucheriana (Pictet, 1888).

vepretorum Saussure & Pictet, 1898: 365 [*Ischyra*].

Central America (Mus. Genavense). Unspecified number of ♂.

One ♂ syntype with labels: "Ischyra vepretorum Sss. + P." [handwritten on green paper]; "Holotypus" [printed on red card]. The green label indicates that the specimen was assumed to be Neotropical. Specimen set with wings folded; most of the right antenna, the tarsi of the left front leg, the last tarsal segment of the right front and middle legs and the left hind leg are missing. Images on OSF. Box B36.

Ischyra vepretorum Saussure & Pictet, 1898.

vermiculatus Saussure & Pictet, 1898: 430 [*Parabliastes*].

Panama, Volcan de Chiriqui (Champion). One damaged ♂.

No specimens found in MHNG collections. The holotype is in the BMNH (images on OSF).

Bliastes vermiculatus (Saussure & Pictet, 1898).

verruculosa Pictet & Saussure, 1892: 23, fig. 17 [*Phyllotribonia*].

Africa centralis. Unspecified number of ♂.

Probable ♂ syntype with labels: "Afrique central" [handwritten on white paper]; "Mataeus apicalis Bol." [handwritten on pink paper]; "Syntype of P. verrucu-

losa Pict. & Sauss., 1892? Hollier 2010" [handwritten on red paper]. Specimen set with left wings spread and right wings folded; the antennae, left front leg, right middle leg and both hind legs are missing. The left middle leg is detached and secured through the femur on the original pin. There is no material placed under the name *P. verruculosa* in the MHNG collection. This specimen was found under *Mateaus apicalis* Bolivar, 1886 in the collection, but it matches the description, measurement and illustration given for *P. verruculosa*. Box E1.

Zabalius verruculosa (Pictet & Saussure, 1892).

viridifolia Saussure & Pictet, 1898: 349, 350 [*Hyperphrona*].

Guiana, Cayenne (Prudhomme). Unspecified number of ♀.

One ♀ syntype with labels: "Hyperphrona viridifolia Sass." [handwritten on green paper]; "Geneva" [printed on a strip of yellow paper]; "Holotypus" [printed on red card]. The species name label in the insect box has the locality "Brésil" handwritten in the lower left corner but the type locality was given as Cayenne; this is probably because the other specimen standing under this name in the collection has a locality label and is from Brazil. Specimen set with left wings spread, the right wings are now lost; the right antenna, all three right legs and the left hind leg are missing. Images on OSF. Box B33.

Hyperphrona viridifolia Saussure & Pictet, 1898.

zendala Saussure & Pictet, 1898: 414, 418 [*Gongrocnemis*].

Mexico, Teapa in Tabasco (H. H. Smith). Unspecified number of ♀.

No specimens found in MHNG collections. There is a ♀ specimen from the type series, referred to as the holotype on OSF, in the BMNH (images on OSF).

Gongrocnemis bivittata zendala Saussure & Pictet, 1898.

UNAVAILABLE NAMES

Several unavailable names associated with Pictet appear in catalogues, apparently due to confusion between the citation of names and authors in the original publications and the act of description resulting in homonyms.

Mimetica brunneri Saussure & Pictet (1898: 453) was given as a replacement name for "*M. mortuifolia* Brunner, 1895", but in that publication Brunner refers explicitly to *M. mortuifolia* Pictet, 1888 (Brunner von Wattenwyl, 1895: 256). *M. brunneri* (which is now considered a junior synonym of *M. mortuifolia* Pictet), was clearly an unnecessary new name, and the material seen by Brunner, including the specimen referred to as the holotype on OSF which is now in the Naturhistorisches Museum in Vienna (NHMW), has no type status.

Hemiudeopsylla californiana Saussure & Pictet (1897: 302) was listed by Kirby (1906: 130) as a species "nec. Scudder" despite the fact that the reference in the Saussure & Pictet is explicitly to *H. californiana* (Scudder, 1862). *H. californiana* Saussure & Pictet is currently considered a junior synonym of *Pristoceuthophilus celatus* (Scudder, 1894) but was actually a misidentification, and the name is unavailable.

Kirby (1906: 346) lists *Meroncidius rosalia* Pictet, 1888 as a junior synonym of *Diophanes salvifolia* (Lichtenstein, 1798) but Pictet explicitly cited the species as "*M. rosalia* Stoll", based on plate 7 figures 23 and 24 in Stoll (no exact reference given), and the name *M. rosalia* Pictet is unavailable. Pictet's material has not been located, but may be amongst the specimens currently in the collection as *Diophanes perspicillatus* Stoll, 1813.

Kirby (1906: 353) gave *Cycloptera reticulata* as a replacement name for *C. aurantifolia* Pictet, 1888 on the grounds that this was a junior homonym of *C. aurantifolia* (Stoll, 1813). In the text, however, Pictet explicitly refers to *C. aurantifolia* Stoll and the name *C. aurantifolia* Pictet is thus unavailable. Vignon (1931: 161) designated a specimen seen by Pictet (in box E31 of the MHNG collection) as the holotype of *Cycloptera reticulata* Kirby, 1906.

ACKNOWLEDGEMENTS

Thanks are due to Anita Hollier and Peter Schwendinger for comments on the layout and text, and to Bernd Hauser for historical information about the MHNG collection. Special thanks are due to Carlos Carbonell, who made available his notes on the MHNG collection. David Rentz provided information about lectotype designations and George Beccaloni kindly checked some of the BMNH information. David Eades and Sam Heads kindly made data held by OSF available. The paper was greatly improved by the suggestions of the subject editor, Bernhard Merz.

REFERENCES

Brunner von Wattenwyl, C. 1895. Monographie der Pseudophylliden. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien* 45: 1-282, 10 plates.

Carbonell, C. S. 2007. The genus Zoniopoda Stål 1872 (Acridoidea, Romaleidae, Romaleinae). *Journal of Orthoptera Research* 16: 1-33.

De Jong, C. 1938. On Indo-Malayan Pterophyllinae (Orthoptera, family Tettigoniidae). *Zoologische Mededeelingen* 21: 1-109.

Eades, D. C. & Otte, D. 2010. *Orthoptera Species File Online*. Version 2.0/4.0. Online at http://www.Orthoptera.SpeciesFile.org [Accessed 10.vii.2010].

Emsley, M. G. 1970. A revision of the steirodontine katydids (Orthoptera: Tettigoniidae: Phaneroperinae: Steirodontini). *Proceedings of the Academy of Natural Sciences, Phila - delphia* 122:125-248.

Griffini, A. 1909. Studi sopra alcune *Gryllacris* del Museum d'histoire naturelle de Genève. *Revue suisse de Zoologie* 17: 374-404.

Hollier, J. A. 2007. Continuité entre le Musée Académique et le Muséum actuel – l'example des "Névroptères du musée" de F.-J. Pictet. *Bulletin Romand d'Entomologie* 24: 51-54.

Hollier, J. 2010. An annotated catalogue of the primary type specimens of the Orthoptera (Insecta) species described by Johann Carl and Adolf Fritze. *Revue suisse de Zoologie* 117: 23-44.

Hubbell, T. H. 1977. The American cave crickets and allies. I. The group Phoberopodes, with a review of the phallic structures of the Ceuthophilinae (Orthoptera Saltatoria: Ensifera: Rhaphidophoridae). *Subterranean Fauna of Mexico. Part III. Further results of the Italian zoological missions to Mexico, sponsored by the National Academy of Lincei (1973 and 1975)* 171: 275-324.

Johns, P. M. 1997. The Gondwanaland Weta: Family Anostostomatidae (formerly in Stenopelmatidae, Henicidae or Mimnermidae): Nomenclatural problems, world checklist, new genera and species. *Journal of Orthoptera Research* 6: 125-138.

Kirby, W. F. 1906. A Synonymic Catalogue of Orthoptera. Volume 2 Orthoptera Saltatoria. Part 1. (Achetidae et Phasgonuridae). *Trustees of the British Museum, London*. 562pp.

Ohl, M. & Oswald, J. D. 2004. Annotated list of the primary type specimens of Megaloptera and Raphidioptera (Insecta, Neuropterida) in the Museum für Naturkunde der Humbolt-Universität zu Berlin. *Deutsche Entomologische Zeitschrift* (N.S.) 51: 87-96.

Pictet, A. 1888. Locustides nouveaux ou peu connus du Musée de Genève. *Mémoires de la Société de Physique et d'Histoire naturelle de Genève* 30 (6): 1-84, 3 plates.

Pictet, A. & Saussure, H. de 1887. Catalogue d'Acridiens. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 7: 331-376.

Pictet, A. & Saussure, H. de 1891. De quelques orthoptères nouveaux. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 8: 293-318, 2 plates.

Pictet, A. & Saussure, H. de 1892. Iconographie des quelques sauterelles vertes. *Aubert-Schuchardt, Genève*. 28pp, 3 plates.

Redtenbacher, J. 1891. Monographie der Conocephaliden. *Verhandlungen der Kaiserlich-Königlichen Zoologisch-Botanischen Gesellschaft in Wien* 41: 315-562.

Rehn, J. A. G. & Hebard, M. 1914. A Revision of the Orthopterous Group Insarae (Tettigoniidae, Phaneropterinae). *Transactions of the American Entomological Society* 40(2): 37-184.

Rentz, D. C. F. 1973. The shield-backed katydids of the genus *Idiostatus*. *Memoirs of the American Entomological Society* 29: 1-211.

Rentz, D. C. F. 1988. The shield-backed katydids of Southern Africa: their taxonomy, ecology and relationships to the faunas of Australia and S. America (Orthoptera: Tettigoniidae: Tettigoniinae). *Invertebrate Taxonomy* 2(2):223-335.

Richards, A. M. 1972. Revision of the Rhaphidophoridae (Orthoptera) of New Zealand. Part XIV. Three Alpine genera from the South Island. *Journal of the Royal Society of New Zealand* 2: 151-174.

Roberts, H. R. & Carbonell, C. S. 1982. A revision of the grasshopper genera *Chromacris* and *Xestotrachelus* (Orthoptera, Romaleidae, Romaleinae). *Proceedings of the California Academy of Science* 43: 43-58.

Roberts, H. R. & Carbonell, C. S. 1992. A revision of the genera *Agriacris* Walker 1870 and *Staleochlora* nov. (Orthoptera, Romaleidae). *Journal of Orthoptera Research* 1: 75-106.

Saussure, H. de & Pictet, A. 1897. Locustidae pp. 285-344 in Godman, F. D. & Salvin, O. (eds) Biologia Centrali-Americana. Insecta Orthoptera (Orthoptera Genuina) Volume 1: i-x, 1-458, 22 plates.

Saussure, H. de & Pictet, A. 1898. Locustidae pp. 345-456 in Godman, F. D. & Salvin, O. (eds) Biologia Centrali-Americana. Insecta Orthoptera (Orthoptera Genuina) Volume 1: i-x, 1-458, 22 plates.

Vignon, P. 1923. Deuxième note sur les Pterochrozae du Muséum National de Paris. Essai de classification du genre *Tanusia* Stål. *Bulletin du Muséum d'Histoire Naturelle* 29: 435-442.

Vignon, P. 1925. Essai de classification du genre *Typophyllum* Serville (Orth. Phasgon.). Eos 1: 249-281.

Vignon, P. 1931. Recherches sur les Sauterelles-Feuilles de l'Amérique tropicale. *Archives du Muséum d'Histoire Naturelle* (6e série) 5: 57-214, 12 plates.

REVUE SUISSE DE ZOOLOGIE

Tome 118 — Fascicule 2

REVUE SUISSE DE ZOOLOGIE

Volume 118 — Number 1

Indexed in CURRENT CONTENTS, SCIENCE CITATION INDEX

PUBLICATIONS DU MUSEUM D'HISTOIRE NATURELLE DE GENÈVE

CATALOGUE DES INVERTEBRES DE LA SUISSE, Nos 1-17 (1908-1926) ..... série Fr. 285.—
(prix des fascicules sur demande)

REVUE DE PALÉOBIOLOGIE ..... Echange ou par fascicule Fr. 35.—

LE RHINOLOPHE (Bulletin du centre d'étude des chauves-souris) ..... par fascicule Fr. 35.—

THE EUROPEAN PROTURA: THEIR TAXONOMY, ECOLOGY AND DISTRIBUTION, WITH KEYS FOR DETERMINATION
J. Nosek, 345 p., 1973 ..... Fr. 30.—

CLASSIFICATION OF THE DIPLOPODA
R. L. Hoffman, 237 p., 1979 ..... Fr. 30.—

LES OISEAUX NICHEURS DU CANTON DE GENÈVE
P. Géroudet, C. Guex & M. Maire
351 p., nombreuses cartes et figures, 1983 ..... Fr. 45.—

CATALOGUE COMMENTÉ DES TYPES D'ECHINODERMES ACTUELS CONSERVÉS DANS LES COLLECTIONS NATIONALES SUISSES, SUIVI D'UNE NOTICE SUR LA CONTRIBUTION DE LOUIS AGASSIZ À LA CONNAISSANCE DES ECHINODERMES ACTUELS
M. Jangoux, 67 p., 1985 ..... Fr. 15.—

RADULAS DE GASTÉROPODES LITTORAUX DE LA MANCHE (COTENTIN-BAIE DE SEINE, FRANCE)
Y. Finet, J. Wüest & K. Mareda, 62 p., 1991 ..... Fr. 10.—

GASTROPODS OF THE CHANNEL AND ATLANTIC OCEAN: SHELLS AND RADULAS
Y. Finet, J. Wüest & K. Mareda, 1992 ..... Fr. 30.—

O. SCHMIDT SPONGE CATALOGUE
R. Desqueyroux-Faundez & S.M. Stone, 190 p., 1992 ..... Fr. 40.—

ATLAS DE RÉPARTITION DES AMPHIBIENS ET REPTILES DU CANTON DE GENÈVE
A. Keller, V. Aellen & V. Mahnert, 48 p., 1993 ..... Fr. 15.—

THE MARINE MOLLUSKS OF THE GALAPAGOS ISLANDS: A DOCUMENTED FAUNAL LIST
Y. Finet, 180 p., 1995 ..... Fr. 30.—

NOTICE SUR LES COLLECTIONS MALACOLOGIQUES DU MUSEUM D'HISTOIRE NATURELLE DE GENEVE
J.-C. Cailliez, 49 p., 1995 ..... Fr. 22.—

PROCEEDINGS OF THE XIIIth INTERNATIONAL CONGRESS OF ARACHNOLOGY, Geneva 1995 (ed. V. Mahnert), 720 p. (2 vol.), 1996 ..... Fr. 160.—

CATALOGUE OF THE SCAPHIDIINAE (COLEOPTERA: STAPHYLINIDAE)
(*Instrumenta Biodiversitatis* I), I. Löbl, xii + 190 p., 1997 ..... Fr. 50.—

CATALOGUE SYNONYMIQUE ET GEOGRAPHIQUE DES SYRPHIDAE (DIPTERA) DE LA REGION AFROTROPICALE
(*Instrumenta Biodiversitatis* II), H. G. Dirickx, x +187 p., 1998 ..... Fr. 50.—

A REVISION OF THE CORYLOPHIDAE (COLEOPTERA) OF THE WEST PALAEARCTIC REGION
(*Instrumenta Biodiversitatis* III), S. Bowestead, 203 p., 1999 ..... Fr. 60.—

THE HERPETOFAUNA OF SOUTHERN YEMEN AND THE SOKOTRA ARCHIPELAGO
(*Instrumenta Biodiversitatis* IV), B. Schätti & A. Desvoignes,
178 p., 1999 ..... Fr. 70.—

PSOCOPTERA (INSECTA): WORLD CATALOGUE AND BIBLIOGRAPHY
(*Instrumenta Biodiversitatis* V), C. Lienhard & C. N. Smithers,
xli + 745 p., 2002 ..... Fr. 180.—

REVISION DER PALÄARKTISCHEN ARTEN DER GATTUNG *BRACHYGLUTA* THOMSON, 1859 (COLEOPTERA, STAPHYLINIDAE) (1. Teil)
(*Instrumenta Biodiversitatis* VI), G. Sabella, Ch. Bückle, V. Brachat & C. Besuchet, vi + 283 p., 2004 ..... Fr. 100.—

PHYLOGENY, TAXONOMY, AND BIOLOGY OF TEPHRITOID FLIES (DIPTERA, TEPHRITOIDEA)
Proceedings of the "3rd Tephritoid Taxonomist's Meeting, Geneva, 19.-24. July 2004"
(*Instrumenta Biodiversitatis* VII). B. Merz, vi + 274 p., 2006 Fr. 100.—

Volume 118 - Number 2 - 2011

Revue suisse de Zoologie: Instructions to Authors

The *Revue suisse de Zoologie* publishes papers by members of the Swiss Zoological Society and scientific results based on the collections of the Muséum d'histoire naturelle, Geneva. Submission of a manuscript implies that it has been approved by all named authors, that it reports their unpublished work and that it is not being considered for publication elsewhere. A financial contribution may be asked from the authors for the impression of colour plates and large manuscripts. All papers are refereed by experts.

In order to facilitate publication and avoid delays authors should follow the *Instructions to Authors* and refer to a current number of R.S.Z. for acceptable style and format. Papers may be written in French, German, Italian and English. Authors not writing in their native language should pay particular attention to the linguistic quality of the text.

Manuscripts must be typed or printed, on one side only and double-spaced, on A4 (210 x 297 mm) or equivalent paper and all pages should be numbered. All margins must be at least 25 mm wide. Authors must submit **three paper copies** (print-outs), including tables and figures, in final fully corrected form, and are expected to retain another copy. **Original artwork** should only be submitted with the revised version of the accepted manuscript.

We encourage authors to submit the revised final text on a CD-R, using MS-WORD or a similar software. The text should be in roman (standard) type face throughout, except for genus and species names which should be formatted in *italics* (***bold italics*** in taxa headings) and authors' names in the list of references (not in other parts of the text!), which should be formatted in SMALL CAPITALS. LARGE CAPITALS may be used for main chapter headings and SMALL CAPITALS for subordinate headings. Footnotes and cross-references to specific pages should be avoided. Papers should conform to the following general layout:

Title page. A concise but informative full title plus a running title of not more than 40 letters and spaces, full name(s) and surname(s) of author(s), and full address(es) including e-mail address(es) if possible.

Abstract. The abstract is in English, composed of the title and a short text of up to 200 words. It should summarise the contents and conclusions of the paper and name all newly described taxa. The abstract is followed by up to 10 keywords, separated by hyphens, which are suitable for indexing. Some of the terms used in the title may be omitted from the list of keywords in favour of significant terms not mentioned in the title.

Introduction. A short introduction to the background and the reasons for the work.

Material and methods. Sufficient experimental details must be given to enable other workers to repeat the work. The full binominal name should be given for all organisms. The International Code of Zoological Nomenclature must be strictly followed. Cite the authors of species on their first mention.

Results. These should be concise and should not include methods or discussion. Text, tables and figures should not duplicate the same information. New taxa must be distinguished from related taxa. The abbreviations gen. n., sp. n., syn. n. and comb. n. should be used to distinguish all new taxa, synonymies or combinations. Primary types must be deposited in a museum or similar institution. In taxonomic papers the species heading should be followed by synonyms, material examined, description, distribution, and comments. All material examined should be listed in similar, compact and easily intelligible format; the information should be in the same language as the text. Sex symbols should be used rather than "male" and "female" (text file: $ = ♂, £ = ♀).

Discussion. This should not be excessive and should not repeat results nor contain new information, but should emphasize the significance and relevance of the results reported.

References. The author-date system (name-year system) must be used for the citation of references in the text, e.g. White & Green (1995) or (White & Green, 1995). For references with three and more authors the form Brown *et al.* (1995) or (Brown *et al.*, 1995; White *et al.*, 1996) should be used. In the text authors' names have to be written in standard type face. However, in the list of references they should be formatted in SMALL CAPITALS (see below). The list of references must include all publications cited in the text and only these. References must be listed in alphabetical order of authors, in the case of several papers by the same author, the name has to be repeated for each reference. The title of the paper and the name of the journal must be given in full in the following style:

PENARD, E. 1888. Recherches sur le *Ceratium macroceros. Thèse, Genève*, 43 pp.

PENARD, E. 1889. Etudes sur quelques Héliozoaires d'eau douce. *Archives de Biologie* 9: 1-61.

MERTENS, R. & WERMUTH, H. 1960. Die Amphibien und Reptilien Europas. *Kramer, Frankfurt am Main*, XI + 264 pp.

HANDLEY, C. O. Jr 1966. Checklist of the mammals of Panama (pp. 753-795). *In:* WENZEL, R. L. & TIPTON, V. J. (eds). Ectoparasites of Panama. *Field Museum of Natural History, Chicago*, XII + 861 pp.

Tables. These should be self-explanatory, not integrated in the text-file, with the title at the top, organised to fit 122 x 180 mm, each table on a separate sheet and numbered consecutively.

Figures. These may be line drawings or half tones, not integrated in the text-file, and all should be numbered consecutively. Figures should be arranged in plates which can be reduced to 122 x 160 mm. Drawings and lettering should be prepared to withstand reduction. Magnification should be indicated with scale lines. Authors should refrain from mixing drawings and half tones. Originals of figures (ink drawings, photographs, slides) should be submitted together with the revised version of the accepted manuscript. Original drawings will not be returned automatically. The *Revue suisse de Zoologie* declines responsibility for lost or damaged slides or other documents. If scanned figures are submitted on CD, this should be clearly indicated on the print-out. Scanned line drawings must be saved as TIF files in bitmap mode with a resolution of at least 600 dpi. Half tone illustrations and photos must have at least 300 dpi resolution.

Legends to figures. These should be typed in numerical order on a separate sheet.

Proofs. Only page proofs are supplied, and authors may be charged for alterations (other than printer's errors) if they are numerous.

Offprints. Each author will receive a pdf offprint free of charge. Paper offprints may be purchased if ordered on the form sent with the proof.

Correspondence. All correspondence should be addressed to

Revue suisse de Zoologie, Muséum d'histoire naturelle, CP 6434, CH-1211 Genève 6, Switzerland.
Phone: +41 22 418 63 33 - Fax: +41 22 418 63 01. E-mail: danielle.decrouez@ville-ge.ch
Home page RSZ: http://www.ville-ge.ch/mhng/publication03.php