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ANNALES

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SOCIÉTÉ SUISSE DE ZOOLOGIE  
et du  
MUSÉUM D'HISTOIRE NATURELLE  
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TOME 109—FASCICULE 4

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VILLE DE GENÈVE  
SOCIÉTÉ SUISSE DE ZOOLOGIE

VOLKER MAHNERT  
Directeur du Muséum d'histoire naturelle de Genève

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Il est constitué en outre du président de la Société suisse de Zoologie, du directeur du Muséum de Genève et de représentants des instituts de zoologie des universités suisses.

Les manuscrits sont soumis à des experts d'institutions suisses ou étrangères selon le sujet étudié.

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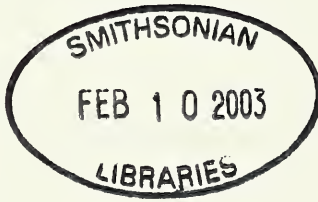
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## Systématique évolutive des *Pseudosinella*. XVI. Espèces édaphiques de la Moldavie (Insecta: Collembola)

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**Evolutionary systematics of *Pseudosinella*. XVI. Edaphic species from Moldavia (Insecta: Collembola).** - The authors have studied ten edaphic species of the genus *Pseudosinella*, six of which are new: *P. moldavica* sp. n., *P. simpatica* sp. n., *P. codri* sp. n., *P. gruiiae* sp. n., *P. larisae* sp. n. and *P. ioni* sp. n. The phylogenetic position of these taxa is also considered.

**Key-words:** Insecta – Collembola – *Pseudosinella* – new species.

### INTRODUCTION

Les matériaux qui servent de base à l'étude des espèces traitées dans cet article ont été récoltés dans le sol et la litière de différents écosystèmes forestiers, dans un verger de pommiers et dans un champ de blé dans la République de la Moldavie. De ce pays une centaine d'espèces de collemboles ont été déjà citées, parmi lesquelles cinq espèces du genre *Pseudosinella* : *P. alba* (Packard, 1873), *P. octopunctata* Börner, 1901, *P. sexoculata* Schött, 1902, *P. wahlgreni* (Börner, 1907) et *P. imparipunctata* Gisin, 1953.

Cette étude, concernant les espèces du genre *Pseudosinella* Schäffer, 1897, s'intègre dans un projet financé par "NATO Science Fellowship" du Portugal au moyen d'une bourse attribuée au deuxième auteur qui veut manifester sa reconnaissance à cette Institution. Ce projet comprend encore l'étude d'autres genres de la famille *Entomobryidae* dont les résultats seront publiés plus tard.

Dans cet article sont décrites six espèces nouvelles de *Pseudosinella* provenant de la Moldavie, dont *Pseudosinella moldavica* sp. n., *Pseudosinella simpatica* sp. n., *Pseudosinella codri* sp. n., *Pseudosinella gruiiae* sp. n. et *Pseudosinella larisae* sp. n. sont probablement des représentants de la lignée généalogique sensu Gisin et Gama, dont l'ancêtre doit être une espèce de *Lepidocyrtus* Bourlet qui n'est pas encore connue: p présent sur l'abdomen II, R cilié sur la base du labium (Gama, 1984). L'espèce-mère de la lignée généalogique sensu Gisin et Gama à laquelle doit appartenir *Pseudosinella ioni* sp. n. est *Lepidocyrtus pallidus* Reuter, 1890 emend. Gisin, 1965: p présent sur l'abdomen II, r rudimentaire sur la base du labium (Gisin, 1967).

On a encore identifié dans ce matériel trois espèces de *Pseudosinella* (*Ps. noski* Rusek, 1985, *Ps. imparipunctata* Gisin, 1953 et *Ps. octopunctata* Börner, 1901),

qui font également partie de cette dernière lignée généalogique et *Ps. horaki* Rusek, 1985 qui doit être un représentant de la lignée dont l'ancêtre est *Lepidocyrtus* sp.

Les types des nouvelles espèces sont déposés au Muséum d'histoire naturelle de Genève (MHNG), au Musée de Zoologie de l'Université de Coimbra (MC) et au Muséum d'Entomologie de Chisinau (MEC).

## SYSTÉMATIQUE ET ÉVOLUTION DES ESPÈCES

### 1. *Pseudosinella moldavica* sp. n.

Figs 1-4

#### STATIONS ET TYPES

Moldavie: Lozova, forêt de *Tilia*, holotype et 1 paratype (prép.), 05.1995 (MHNG); Bahmut, forêt de *Quercus*, 2 paratypes (prép.), 04.2001 (MHNG), 3 paratypes (prép.), 04.2001 (MC); Inesti, plantation d'*Acacia*, 1 paratype (prép.), 04. 2000 (MC); Sadova, plantation d'*Acacia*, 1 paratype (prép.), 05.1996 (MEC).

#### DESCRIPTION

Taille: 1,2-1,4 mm. Habitus normal du genre. Le pigment bleu se trouve uniquement dans les 3 + 3 yeux, de taille identique, dont 2 + 2 sont placés en position antérieure et le troisième en position postérieure (fig. 1). Rapport entre la longueur des antennes et la diagonale céphalique = 1, 3. Articles antennaires sans écailles. Macrochètes dorsaux: R111/10/0101+2. Pour la chétotaxie de la tête voir fig. 5. Chétotaxie de l'abd. II: p a B q<sub>1</sub> q<sub>2</sub> (fig. 2). Soie accessoire "s" de l'abd. IV absente. Base du labium: M<sub>1</sub> M<sub>2</sub> R E L<sub>1</sub> L<sub>2</sub>, tous ces poils étant distinctement ciliés (fig. 3). La dent impaire de la griffe (fig. 4) est située à environ 74% de sa crête interne et les deux dents proximales ont à peu près la même taille. Empodium lancéolé. Ergot tibiotarsal spatulé. Les dents apicale et anteapicale du mucron sont subégales.

### 2. *Pseudosinella simpatica* sp. n.

Fig. 5

#### STATIONS ET TYPES

Moldavie : Inesti, plantation d'*Acacia*, holotype et 1 paratype (prép.), 04.2000 (MHNG); Lozova, forêt de *Acerum-Carpenetum*, 1 paratype (prép.), 05.1996 (MEC); Sadova, plantation d'*Acacia*, 5 paratypes (prép.), 05.1996 (MC).

#### DESCRIPTION

Taille: 1, 5 – 1, 8 mm. Rapport entre la longueur des antennes et la diagonale céphalique = 1,6. Griffe, empodium et ergot tibiotarsal comme chez *Ps. moldavica* sp. n.

Cette espèce se distingue de *Ps. moldavica* sp. n. principalement par le fait de posséder 2 + 2 yeux, dont un en position antérieure et le deuxième en position postérieure, lequel est un peu plus petit que l'antérieur (fig. 5). Le pigment bleu se trouve seulement dans les yeux.

### 3. *Pseudosinella codri* sp. n.

#### STATIONS ET TYPES

Moldavie : Radeni, plantation d'*Acacia*, holotype et 1 paratype (prép.), 06.2001 (MHNG); Bravicea, verger de pommiers, 1 paratype (prép.), 06.2001 (MEC); Dragusani, plantation d'*Acacia*, 2 paratypes (prép.), 06.2001 (MC); Tabara, forêt mixte, 2 paratypes (prép.), 06.2001 (MEC).

## DESCRIPTION

Taille: 1,7-1,9 mm. Rapport entre la longueur des antennes et la diagonale céphalique = 1,5. Griffes, empodium et ergot tibiotarsal comme chez *Ps. moldavica* sp. n.

Cette espèce est presque identique aux deux espèces antérieures, *Ps. moldavica* sp. n. et *Ps. simpatica* sp. n., ne se séparant essentiellement de celles-ci que par l'absence des yeux et du pigment.

## DISCUSSION

Ces trois espèces, *Ps. moldavica* sp. n., *Ps. simpatica* sp. n. et *Ps. codri* sp. n., qui ont été trouvées dans différentes localités, présentent une distribution identique des macrochètes dorsaux céphaliques, thoraciques et abdominaux, la même formule chétotaxique de l'abdomen II et de la base du labium et l'absence de la soie accessoire "s" de l'abdomen IV. Elles se séparent essentiellement par le nombre des yeux. Il semble que leur évolution a été réalisée par la réduction progressive du nombre des yeux, car les autres caractères adaptatifs et les caractères non-adaptatifs sont presque identiques chez ces espèces.

D'après les arbres généalogiques établis par da Gama (1984), elles doivent dériver d'une espèce de *Lepidocyrtus* qui n'est pas encore connue et dont les caractères fondamentaux sont les suivants: p de l'abdomen II présent et R de la base du labium cilié.

Ces espèces à 3 + 3, 2 + 2 et 0 + 0 yeux respectivement sont très voisines, du point de vue généalogique, de *Ps. charoae* Villanueva & Jordana, 1988, récoltée en Espagne, qui possède 6 + 6 yeux, et dont les caractères non-adaptatifs sont identiques à ceux de nos espèces. On peut même essayer de reconstituer la lignée évolutive de ces espèces, dans laquelle les espèces à 1 + 1, 4 + 4 et 5+5 yeux n'ont pas encore été décrites: *Ps. charoae* (6+6 yeux) → ..... → ..... → *Ps. moldavica* sp. n. (3+3 yeux) → *Ps. simpatica* sp. n. (2+2 yeux) → ..... → *Ps. codri* sp. n. (0+0 yeux).

4. *Pseudosinella horaki* Rusek 1985

## STATIONS

Moldavie : Copanca, forêt inondable, 3 exemplaires (alcool), 05.2001 (MEC); Durlesti, forêt mixte, 1 exemplaire (alcool), 03.2001 (MEC); Edinet, plantation d'*Acacia*, 3 exemplaires (alcool), 06.2001 (MEC); Glodeni, forêt mixte, 5 exemplaires (alcool), 06.2001 (MEC); Lozova, forêt de *Tilia*, 3 exemplaires (prép.), 10.1997 (MEC); forêt de *Acerum-Carpenetum*, 4 exemplaires (prép.), 05.1995 (MEC); Navarnet, forêt mixte, 3 exemplaires (alcool), 06.2001 (MEC); Scauca, forêt mixte, 1 exemplaire (alcool), 06.2001 (MEC); Stejareni, forêt de *Acerum-Carpenetum*, 2 exemplaires (prép.), 05.1998 (MEC).

## TAXONOMIE

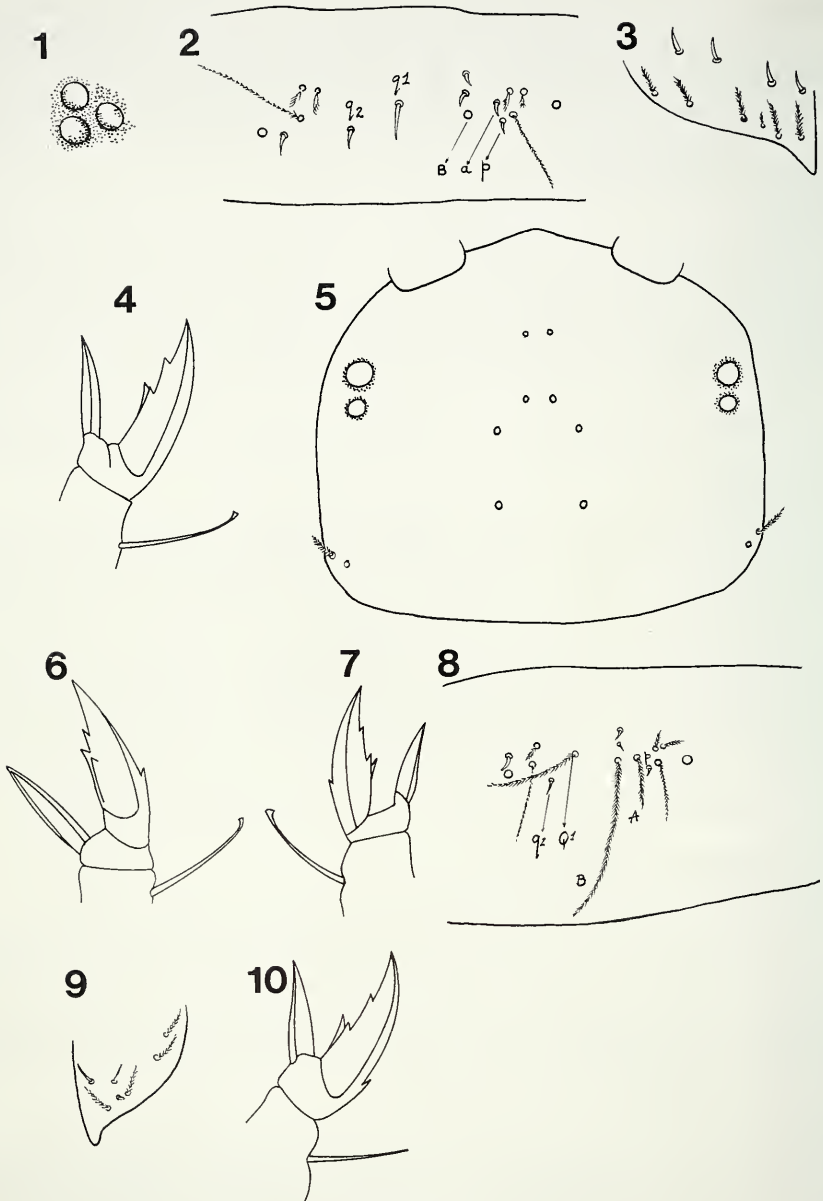
Cette espèce possède 5 + 5 yeux et les caractères chétotaxiques suivants: Macrochètes dorsaux: R001/00/0101+2. Chétotaxie de l'abd. II: p a B q<sub>1</sub> q<sub>2</sub>. Base du labium: M<sub>1</sub>M<sub>2</sub>R E L<sub>1</sub>L<sub>2</sub>, M<sub>1</sub> et M<sub>2</sub> présentant la même longueur. La soie accessoire "s" de l'abd. IV fait défaut.

5. *Pseudosinella gruiæ* sp. n.

Fig. 6

## STATIONS ET TYPES

Moldavie : Durlesti, forêt mixte, holotype et 6 paratypes (prép.), 03.2001 (MHNG); Bahmut, forêt de *Quercus*, 3 paratypes (prép.), 03.2001 (MC), 4 paratypes (prép.), 04.2001



FIGS 1-10

*Pseudosinella* spp.: 1. *P. moldavica* sp. n., yeux, côté droit. 2. *P. moldavica* sp. n., chétotaxie dorsale de l'abd. II, côté gauche. 3. *P. moldavica* sp. n., chétotaxie de la base du labium, côté droit. 4. *P. moldavica* sp. n., griffe III, face antérieure. 5. *P. simpatica* sp. n., répartition des yeux, des macrochètes et des trichobothries céphaliques. 6. *P. gruiuae* sp. n., griffe III, face antérieure. 7. *P. larisae* sp. n., griffe III, face antérieure. 8. *P. ioni* sp. n., chétotaxie dorsale de l'abd. II, côté gauche. 9. *P. ioni* sp. n., chétotaxie de la base du labium, côté gauche. 10. *P. ioni* sp. n., griffe III, face antérieure.



(MEC), 3 paratypes (prép.), 05.2000 (MEC); Beriozovca, forêt mixte, 2 paratypes (prép.), 06.2001 (MEC); Copanca, forêt inondable, 2 paratypes (prép.), 04.2001 (MEC); Radeni, plantation d'*Acacia*, 1 paratype (prép.), 06.2001 (MEC); Taul, forêt de *Quercus*, 1 paratype (prép.), 06.2001 (MEC).

#### DESCRIPTION

Taille: 1, 5 – 1, 8 mm. Habitus normal du genre. Pigment et yeux absents. Rapport entre la longueur des antennes et la diagonale céphalique = 1, 9 – 2. Articles antennaires sans écailles. Macrochètes dorsaux: R001/00/0101+2. Chétotaxie de l'abdomen II: p a Bq<sub>1</sub> q<sub>2</sub>. Soie accessoire " s " de l'abdomen IV absente. Base du labium: M<sub>1</sub> M<sub>2</sub> R E L<sub>1</sub> L<sub>2</sub>, tous les poils sont nettement ciliés et M<sub>1</sub> et M<sub>2</sub> ont la même longueur. La dent impaire de la griffe se situe à environ 70% de sa crête interne (fig.6) et les deux dents proximales présentent une taille identique. Empodium lancéolé. Ergot tibiotarsal spatulé. Mucron à dents subégales.

#### DISCUSSION

*Ps. gruiæ* sp. n. présente les mêmes caractères non - adaptatifs et la plupart des caractères adaptatifs de *Ps. horaki*, se séparant principalement de celle-ci par l'absence des yeux et du pigment. *Ps. sandelsorum* Gruia, 1977 possède 5+5 yeux comme *Ps. horaki*, dont elle est très proche, mais la structure de la griffe semble avoir des petits détails différents de la griffe de *Ps. horaki* et M<sub>1</sub> de la base du labium est plus courte que M<sub>2</sub>, contrairement à *Ps. gruiæ* sp. n. et à l'espèce de Rusek. L'espèce ancestrale de ces trois espèces doit être également *Lepidocyrtus* sp. (Gama, 1984).

### 6. *Pseudosinella larisæ* sp. n.

Fig. 7

#### STATIONS ET TYPES

Moldavie: Durlesti, forêt mixte, holotype et 3 paratypes (prép.), 03.2001 (MHNG); Taul, forêt mixte, 1 paratype (prép.), 06.2001 (MC); Bahmut, forêt de *Quercus*, 1 paratype (prép.), 03.2001 (MEC); Malinovscoe, plantation d'*Acacia*, 1 paratype (prép.), 06.2001 (MEC).

#### DESCRIPTION

Taille: 1, 9 – 2, 1 mm. Habitus normal du genre. Pigment et yeux absents. Rapport entre la longueur des antennes et la diagonale céphalique = 1, 6. Articles antennaires avec écailles. Macrochètes dorsaux: R001/00/0101+3, le macrochète le plus postérieur de l'abd. IV est plus petit que les deux autres. Chétotaxie de l'abdomen II: p a B q<sub>1</sub> q<sub>2</sub>. Soie accessoire " s " de l'abdomen IV absente. Base du labium: M<sub>1</sub> M<sub>2</sub> R E L<sub>1</sub> L<sub>2</sub>, tous ces poils sont ciliés. La dent impaire de la griffe (fig. 7) est placée à 70% environ de sa crête interne et les deux dents proximales sont subégales. Empodium lancéolé. Ergot tibiotarsal spatulé. La dent apicale du mucron n'est pas plus grande que l'antéapicale.

#### DISCUSSION

La formule des macrochètes dorsaux avec 1 + 3 sur l'abdomen IV distingue cette espèce de *Ps. gruiæ* sp. n., étant la seule espèce connue de la lignée de *Lepidocyrtus* sp. à présenter cette particularité.

**7. *Pseudosinella ioni* sp. n.**

Figs 8-10

## STATIONS ET TYPES

Chisinau, plantation d'*Acacia*, holotype et 5 paratypes (prép.), 09.2000 (MHNG); Taul, bois de pins, 1 paratype (prép.), 06.2001 (MC); Micauti, dans un champ de blé, 1 paratype (prép.), 04.2000 (MEC).

## DESCRIPTION

Taille: 1, 3 – 1, 6 mm. Habitus normal du genre. Pigment et yeux absents. Rapport entre la longueur des antennes et la diagonale céphalique = 1, 2. Articles antennaires sans écailles. Macrochètes dorsaux: R111/10/0301+2. Chétotaxie de l'abd. II: p A B Q<sub>1</sub> q<sub>2</sub>, B est trois fois environ plus long que A et deux fois plus long que Q<sub>1</sub> (fig. 8). Soie accessoire "s" de l'abdomen IV absente. Base du labium: M r E L<sub>1</sub> L<sub>2</sub>, r est rudimentaire et les autres soies sont ciliés (fig. 9). La dent impaire de la griffe (fig. 10) est placée à environ 75% de sa crête interne et la dent proximale postérieure est un peu plus développée que la proximale antérieure. Empodium lancéolé. Ergot tibiotarsal pointu. La dent apicale du mucron n'est pas plus longue que l'anteapicale.

## DISCUSSION

*P. ioni* sp. n. semble appartenir à la même lignée généalogique de *Ps. octopunctata* Börner, 1901 (4+4 yeux), de *Ps. staryi* Rusek, 1981 (4+4 yeux), de *Ps. hauseri* Gama, 1973 (3+3 yeux) et de *Ps. imparipunctata* Gisin, 1953 (2+2 yeux) dont l'espèce – mère est *Lepidocyrtus pallidus*: p présent sur l'abd. II, r de la base du labium rudimentaire. En effet, les caractères chétotaxiques principaux sont identiques chez ces cinq espèces.

**8. *Pseudosinella octopunctata* Börner, 1901**

## STATION

Moldavie : Micauti, verger de pommiers, 1 exemplaire (prép.), 04.2000 (MEC).

**9. *Pseudosinella imparipunctata* Gisin, 1953**

## STATIONS

Moldavie : Bahmut, forêt de *Quercus*, 1 exemplaire (alcool), 04.2001 (MEC); Rascaeti, forêt inondable, 1 exemplaire (alcool), 09.2001 (MEC) .

**10. *Pseudosinella noseki* Rusek, 1985**

## STATION

Moldavie : Olanesti, forêt inondable, 2 exemplaires (prép.), 07.2001 (MEC).

## TAXONOMIE

Chez cette espèce le pigment et les yeux n'existent pas et les caractères chétotaxiques sont les suivants: Macrochètes dorsaux: R011/32/0201+2. Chétotaxie de l'abd. II: p A B q<sub>1</sub> q<sub>2</sub>. Base du labium: M<sub>1</sub> M<sub>2</sub> r E L<sub>1</sub> L<sub>2</sub>. Soie accessoire "s" de l'abd. IV absente. Ainsi *Ps. noseki* doit appartenir également à la lignée dérivée de *Lepidocyrtus pallidus*.

## CLÉ D'IDENTIFICATION DES ESPÈCES

- 1 La soie R de la base du labium ciliée ..... 2  
 - La soie r de la base du labium rudimentaire ..... 6  
 2 Formule des macrochètes dorsaux céphaliques et thoraciques R111/10. .... 3  
 - Formule des macrochètes dorsaux céphaliques et thoraciques R001/00 ..... 4  
 3 3 + 3 yeux ..... *P. moldavica* sp. n.  
 - 2 + 2 yeux ..... *P. simpatica* sp. n.  
 - 0 + 0 yeux ..... *P. codri* sp. n.  
 4 Formule des macrochètes de l'abdomen IV 1 + 2. .... 5  
 - Formule des macrochètes de l'abdomen IV 1 + 3 ..... *P. larisae* sp. n.  
 5 5 + 5 yeux ..... *P. horaki* Rusek, 1985  
 - 0 + 0 yeux ..... *P. gruiæ* sp. n.  
 6 Une seule soie M sur la base du labium. Chétotaxie de l'abdomen II pABQ<sub>1</sub>q<sub>2</sub> ..... 7  
 - Deux soies M (M<sub>1</sub>, M<sub>2</sub>) sur la base du labium. Chétotaxie de l'abdomen II pABq<sub>1</sub>q<sub>2</sub> ..... *P. noseki* Rusek, 1985  
 7 4 + 4 yeux ..... *P. octopunctata* Börner, 1901  
 - 2 + 2 yeux ..... *P. imparipunctata* Gisin, 1953  
 - 0 + 0 yeux ..... *P. ioni* sp. n.

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## Deux psoques intéressants de Corse (Psocoptera: Caeciliusidae) avec une liste des espèces ouest-paléarctiques de la famille

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**Two interesting psocids from Corsica (Psocoptera: Caeciliusidae) with a checklist of the Western Palaearctic species of the family.** - *Valenzuela labrostylus* sp. n. is described and illustrated (female only). The generic placement of this species remains doubtful because of the presence of labral stylets, which are absent in all other known *Valenzuela* species. The holotype of *Caecilius corsicus* Kolbe, 1882 is redescribed and the synonymy of this name with *rhenanus* Tetens, 1891 is proposed: *Valenzuela corsicus* (Kolbe) becomes the valid name of the most common Mediterranean species of Caeciliusidae. The 15 presently recognized Western Palaearctic species of this family are listed.

**Key-words:** Psocoptera - Caeciliusidae - new species - new synonymy - Corsica.

### INTRODUCTION

Pour définir le statut d'un psoque apparemment inédit de Corse il m'a paru indispensable de réétudier le type de *Caecilius corsicus* Kolbe, 1882, réputé introuvable. Grâce à la perspicacité du Dr David Hollis (BMNH) l'exemplaire type de *corsicus* a pu être retrouvé dans la collection de McLachlan. Son étude a montré qu'il appartient à l'espèce actuellement appelée *Valenzuela rhenanus* (Tetens, 1891). Cette espèce largement répandue dans la région ouest-paléarctique et très commune dans le bassin méditerranéen doit donc porter le nom de *Valenzuela corsicus* (Kolbe, 1882).

L'espèce qui a déclenché cette étude s'est avérée inédite. Elle est provisoirement placée dans le genre *Valenzuela* malgré la présence de styli labraux absents chez les autres espèces du genre. Il s'agit d'une espèce hémiedaphique trouvée dans un éboulis de roches à 1000 m d'altitude; pour le moment une seule femelle aptère est connue.

Les abréviations suivantes sont utilisées dans le texte: BMNH = The Natural History Museum, Londres; MHNG = Muséum d'histoire naturelle, Genève. IO/D = index oculaire (Lienhard, 1998: fig. 4b); f1, f2,... = les articles du flagelle antennaire; P2 = deuxième segment du palpe maxillaire; P4 = dernier segment du palpe maxillaire; AP = areola postica (aile antérieure); PSG = plaque subgénitale (femelle). LC =

longueur du corps; Ant = longueur de l'antenne; Aa = longueur de l'aile antérieure; F = longueur du fémur postérieur; T = longueur du tibia postérieur; t1, t2 = longueur des articles du métatarse (de condyle à condyle). Pour la terminologie générale utilisée dans les descriptions, voir Lienhard (1998).

## DESCRIPTIONS

### *Valenzuela labrostylus* sp. n.

Figs 1-8

#### MATÉRIEL

Holotype ♀ (MHNG, préparation microscopique n° 7563). FRANCE: Corse: Ht. Asco, 1000m, 13.IX.2001, éboulis, sous une pierre, leg. B. Knoflach & K. Thaler.

#### ETYMOLOGIE

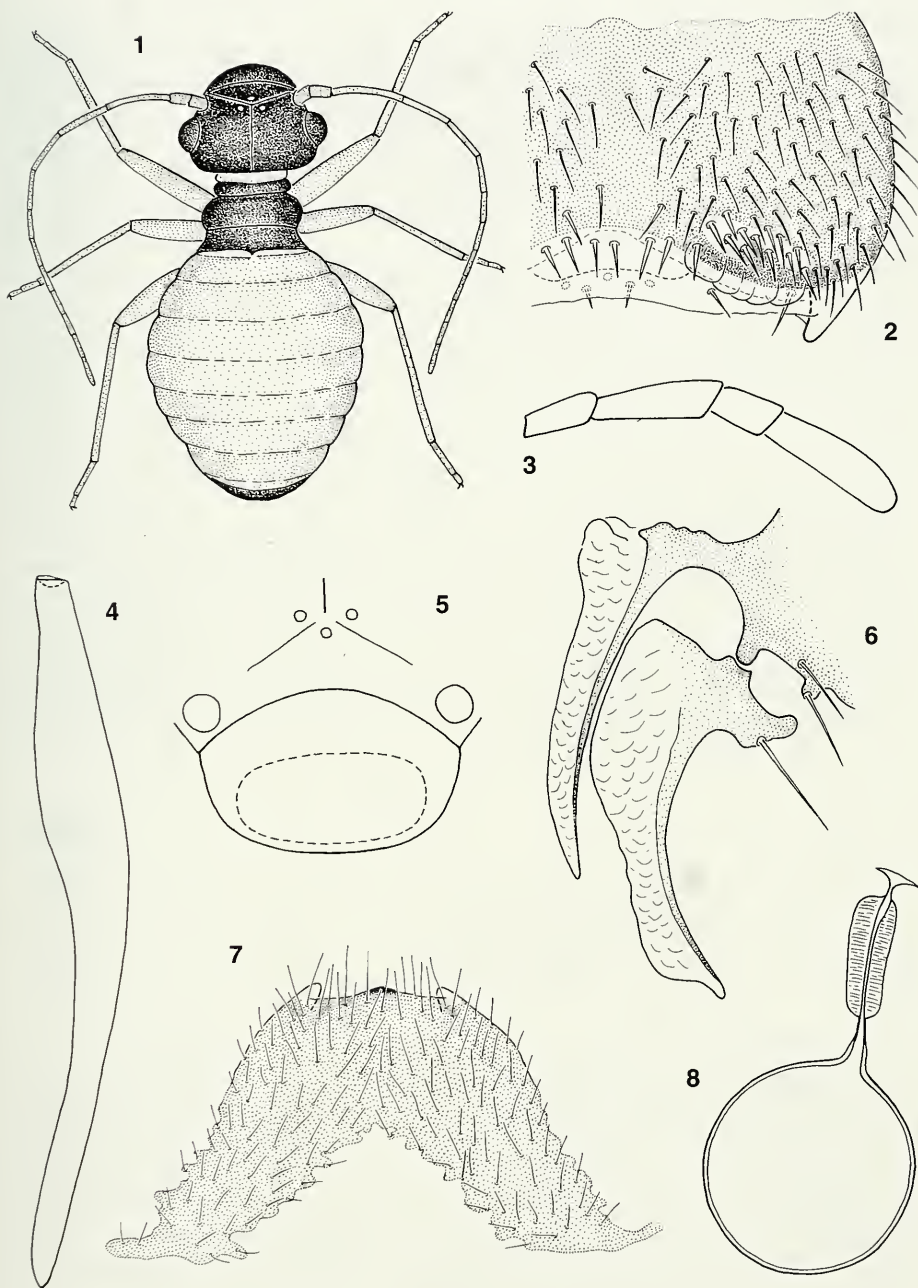
Le nom spécifique *labrostylus* fait allusion à la présence de styli labraux, exceptionnelle chez le genre *Valenzuela*; il s'agit d'un substantif en apposition composé des mots latins "labrum" et "stylus".

#### DESCRIPTION (♀)

*Coloration.* Tête, thorax et terminalia brun-noir, autres segments abdominaux avec une pigmentation hypodermale très dense de couleur rouge carmin. Antennes, palpes maxillaires et pattes d'un brun relativement clair. Labre brun foncé, yeux noirs, sutures frontale et verticale brun foncé.

*Morphologie.* Complètement aptère (fig. 1), mésothorax et métathorax sans traces de rudiments alaires. Yeux composés et ocelles bien développés (IO/D = 2,5). Antennes à peu près aussi longues que le corps, flagelle sans articles épaissis (en particulier f1 à f4 non épaissis), f1 légèrement courbé et relativement long, mais plus court que f2+f3. Bord antérieur du labre (fig. 2) avec une paire de styli latéraux bien développés et 5 sensilles marginaux (dont 3 placoïdes) correspondant au "type 2" de Mockford (2000: fig. 4). P4 légèrement plus long que P2 (fig. 3). Lacinia à apex étroit et tronqué (fig. 4). Endophragme annulaire du postclypeus ("inner clypeal shelf" de Mockford, 2000) bien développé (fig. 5). Organe coxal de Pearman non différencié. Aucune vésicule adhésive visible sur la face ventrale de l'abdomen de la femelle étudiée (ce qui ne surprend pas chez une forme aptère). Epiprocte sans caractères particuliers. Paraprocte avec un champ sensoriel composé de 8 à 10 trichobothries et une soie sans rosette basale, bord postérieur du paraprocte avec un tubercule marginal à peine développé, à apex faiblement bilobé (semblable à celui représenté sur la fig. 15). PSG (fig. 7) avec un dessin brun en "V" largement ouvert antérieurement et avec deux petits lobes apicaux incolores bien développés, bord postérieur un peu plus sclérifié au milieu. Gonapophyses relativement peu sclérifiées, bord postérieur basal de la valve ventrale courbé en arc, partie membraneuse de la valve dorsale brusquement rétrécie peu avant l'apex (fig. 6). Canal de la spermathèque entouré d'un manchon relativement long (fig. 8).

*Dimensions* (♀ holotype). LC = 1,9 mm; Ant = 2,1 mm; f1 = 390 µm; f2 = 250 µm; f3 = 200 µm; F = 550 µm; T = 840 µm; t1 = 230 µm; t2 = 105 µm.



FIGS 1-8

*Valenzuela labrostylus* sp. n., ♀ (holotype): 1, habitus; 2, labre (milieu et moitié gauche); 3, palpe maxillaire (pilosité non figurée); 4, lacinia; 5, postclypeus avec endophragme annulaire (vu par transparence, trait interrompu); 6, gonapophyses; 7, plaque subgénitale; 8, spermatèque.

## DISCUSSION

Les genres de la famille des Caeciliusidae ont récemment été redéfinis par Mockford (2000, 2001). Lienhard & Smithers (2002) ont donné une liste complète de toutes les espèces actuellement connues. D'après la clé d'identification et les diagnoses présentées par Mockford (2000) la nouvelle espèce se place dans la sous-famille des Caeciliusinae et la tribu des Coryphacini, qui contient 5 genres dont seuls *Stenocaecilius* Mockford et *Valenzuela* Navas sont représentés dans la région paléarctique (cf. Lienhard & Smithers, 2002). *Stenocaecilius* est caractérisé par la présence de styli labraux, probablement un caractère plésiomorphe au sein de la famille des Caeciliusidae (cf. Mockford, 2000), et par un article P4 nettement raccourci (plus court que P2), probablement une synapomorphie des espèces de ce genre (cf. Mockford, 2000). Chez *Valenzuela* la longueur de P4 est à peu près égale à celle de P2 et les styli labraux manquent. Les trois autres genres de la tribu sont également caractérisés par l'absence de styli labraux et chacun possède quelques caractères autapomorphes supplémentaires qui font défaut chez la nouvelle espèce (cf. Mockford, 2000). Les espèces de *Stenocaecilius* possèdent en outre un dimorphisme sexuel concernant f1 épaissi chez le mâle et normal chez la femelle. En l'absence de mâle nous ne pouvons pas avoir recours à ce caractère pour décider du placement générique de la nouvelle espèce, et les caractères alaires restent également inconnus. Vu l'absence du raccourcissement apomorphe de P4 et malgré la présence de styli labraux nous la plaçons provisoirement dans le genre *Valenzuela* sans l'attribuer à un des groupes d'espèces définis par Mockford (2000). Dans la région ouest-paléarctique, la plupart des espèces de la famille appartiennent à ce genre tandis que *Stenocaecilius* n'y est représenté que par une seule espèce (voir liste à la fin de ce travail).

*Valenzuela corsicus* (Kolbe, 1882)

Figs 9-18

*Caecilius corsicus* Kolbe, 1882: 209.

*Valenzuela corsicus* (Kolbe). Mockford, 2000: 381.

*Caecilius rhenanus* Tetens, 1891: 372, 382. **Syn. n.**

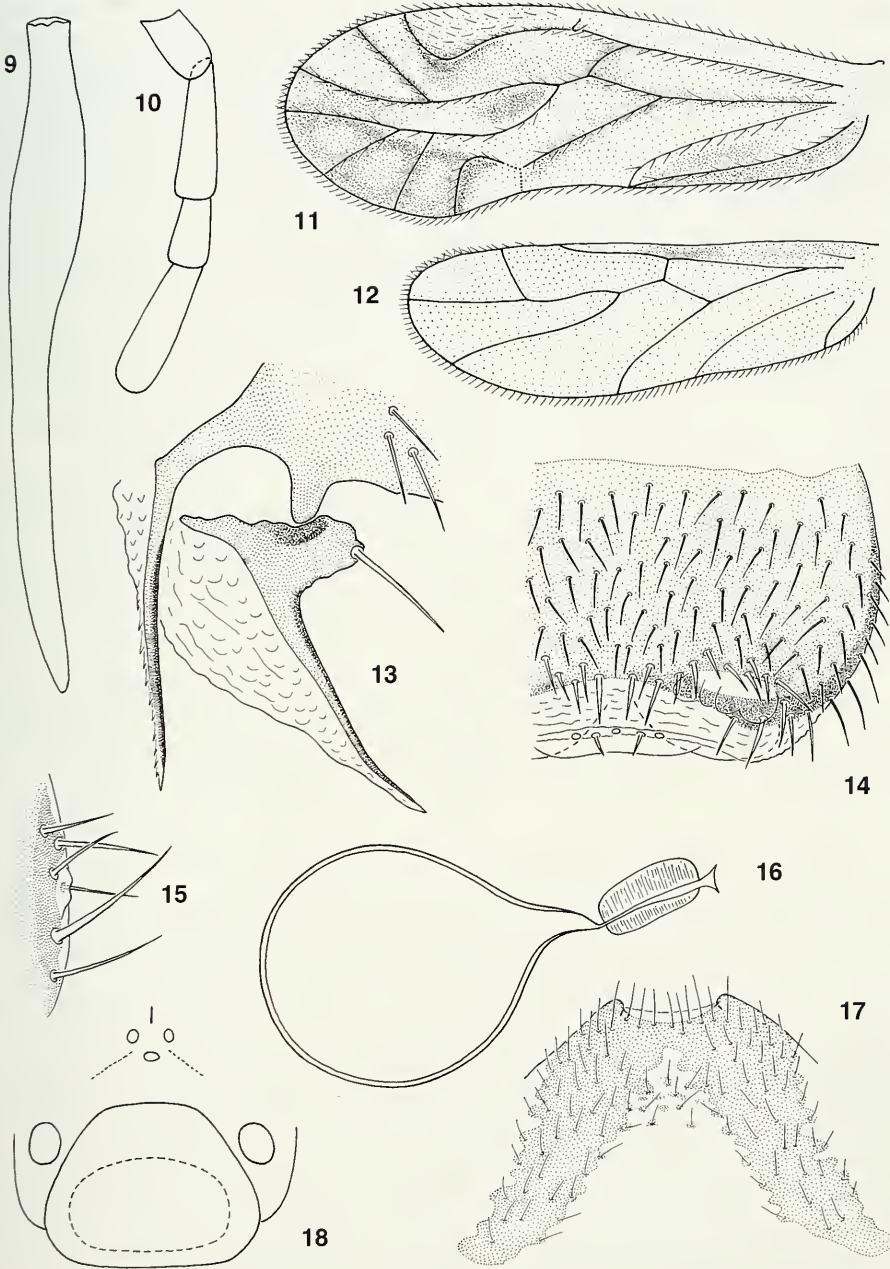
*Valenzuela rhenanus* (Tetens). Mockford, 2000: 351.

Pour la synonymie complète, voir Lienhard & Smithers, 2002: 180.

## HOLOTYPE (♀)

Étiquettes originales: "Corsica / McLachlan Coll. B.M.1938-674 / *Caecilius corsicus* K. / Type". Le spécimen était conservé à sec au BMNH, collé sur une paillette. Il a été transféré dans l'eau distillée, régénéré dans une solution de phosphate trisodique, transféré en alcool, disséqué et en partie monté sur une lame selon la méthode décrite par Lienhard (1998). Quelques restes se trouvent encore en alcool: capsule céphalique avec mandibules, tronc du thorax. Les quatre étiquettes originales ont été collées sur la lame de la préparation microscopique permanente. Une nouvelle étiquette avec le texte suivant a aussi été collée sur cette lame: "*Caecilius corsicus* Kolbe, 1882, Holotype, vid. C. Lienhard, 2002 (see also spirit)". Le tube en verre avec les restes en alcool contient deux étiquettes portant les mêmes informations que les étiquettes sur la lame. Le matériel a été renvoyé au BMNH.





FIGS 9-18

*Valenzuela corsicus* (Kolbe), ♀ (holotype): 9, lacinia; 10, palpe maxillaire (pilosité non figurée); 11, aile antérieure; 12, aile postérieure; 13, gonapophyses; 14, labre (milieu et moitié gauche); 15, bord postérieur du paraprocte gauche; 16, spermathèque; 17, plaque subgénitale; 18, post-clypeus avec endophragme annulaire (vu par transparence, trait interrompu).

## DESCRIPTION

Sous le nom de *Caecilius rhenanus* on peut trouver plusieurs descriptions détaillées de cette espèce dans la littérature (cf. Badonnel, 1943: 120; Günther, 1974: 140; Lienhard, 1998: 198). C'est pourquoi nous nous contentons ici de préciser quelques caractères observés chez la femelle holotype, de présenter quelques données biométriques et d'illustrer les caractères taxonomiques les plus importants basés sur l'étude microscopique de ce spécimen (figs 9-18).

*Morphologie* (♀ holotype). Macroptère, aile antérieure droite un peu abîmée sur le bord postérieur et avec une légère anomalie de nervation concernant la fourche radiale (r4+5 n'atteignant pas le bord de l'aile). Longueur de la fourche radiale de l'aile antérieure à peu près égale (aile gauche, fig. 11) ou légèrement inférieure (aile droite) à la longueur de son pédoncule (ces longueurs mesurées selon la méthode décrite par Lienhard, 1985: 121). Endophragme annulaire du postclypeus ("inner clypeal shelf" de Mockford, 2000) bien développé (fig. 18). Une antenne tombée, l'autre abîmée (intacte jusqu'à f7); flagelle antennaire sans articles épaissis (en particulier f1 à f4 non épaissis), f1 rectiligne et beaucoup plus court que f2+f3. P4 et P2 à peu près de longueur égale (fig. 10). Bord antérieur du labre (fig. 14) sans styli latéraux, avec 5 sensilles marginaux (dont 3 placoides) correspondant au "type 2" de Mockford (2000: fig. 4). Sans suture précoxale mésothoracique. Paraprocte gauche avec un tubercule marginal incolore faiblement développé, aplati, à apex légèrement bilobé (fig. 15); paraprocte droit sans tubercule marginal.

*Dimensions* (♀ holotype). Mensurations faites sur le spécimen transféré en alcool. Longueur du corps jusqu'à la pointe des ailes = 3,6 mm (Kolbe, 1982: "Long. corp. c. al. 3,5 mm"). LC = 2,6 mm; Aa = 2,6 mm; f1 = 325 µm; f2 = 265 µm; f3 = 230 µm; F = 580 µm; T = 1010 µm; t1 = 255 µm; t2 = 140 µm; IO/D = 2,0.

## DISCUSSION

Il s'agit ici de l'unique exemplaire mentionné par Kolbe (1882: 210) dans la description originale. Il peut donc être considéré comme l'holotype de l'espèce. L'excellent état de conservation du spécimen permet d'observer tous les caractères taxonomiques importants et il ne subsiste aucun doute que les noms *corsicus* Kolbe, 1882 et *rhenanus* Tetens, 1891 se rapportent à la même espèce. Déjà Badonnel (1943: 122) a constaté que, sur la base de la description originale, *corsicus* pourrait être identique à *rhenanus*, mais il n'avait pas l'occasion de réétudier le type de *corsicus*. Pendant une longue période, le nom *corsicus* a donc été traité comme nomen dubium (cf. Lienhard, 1998: 191). Mockford (2000) l'a provisoirement combiné avec le nom générique *Valenzuela* dont il représente maintenant l'espèce type qui avait été décrite sous le nom de *Valenzuela marianus* Navas, un synonyme de *rhenanus* selon Meinander (1979). *Valenzuela corsicus* (Kolbe) est largement répandu dans la région ouest-paléarctique, notamment dans le bassin méditerranéen, où il est l'espèce la plus commune de la famille. Les détails de sa répartition géographique sont présentés par Lienhard & Smithers (2002), sa biologie est brièvement décrite par Lienhard (1998).



## LES ESPÈCES OUEST-PALÉARCTIQUES DE LA FAMILLE DES CAECILIUSIDAE

Toutes les espèces ouest-paléarctiques actuellement placées dans la famille des Caeciliusidae (sauf évidemment *V. labrostylus* sp. n.) ont déjà été traitées par Lienhard (1998) qui en présente aussi une clé d'identification. Mais à l'époque toutes les espèces, à l'exception de *Enderleinella obsoleta*, étaient attribuées au genre *Caecilius*. Selon la révision de Mockford (2000, 2001) les espèces ouest-paléarctiques de "*Caecilius* s. l." appartiennent à six genres différents. C'est pourquoi il me paraît utile de présenter ici une liste actualisée des Caeciliusidae ouest-paléarctiques:

Famille: CAECILIUSIDAE

Sous-famille: CAECILIUSINAE

- Caecilius fuscopterus* (Latreille, 1799)
- Epicaecilius pilipennis* (Lienhard, 1996)
- Lienhardiella dahli* (Badonnel, 1963)
- Maoripsocus koriflae* (Arahou, 1984)
- Stenocaecilius caboverdensis* (Meinander, 1966)
- Valenzuela atricornis* (McLachlan, 1869)
- Valenzuela burmeisteri* (Brauer, 1876)
- Valenzuela corsicus* (Kolbe, 1882) [= *Valenzuela rhenanus* (Tetens, 1891) syn. n.]
- Valenzuela despaxi* (Badonnel, 1936)
- Valenzuela flavidus* (Stephens, 1836)
- Valenzuela fortunatus* (Enderlein, 1929)
- Valenzuela gynapterus* (Tetens, 1891)
- Valenzuela labrostylus* sp. n.
- Valenzuela piceus* (Kolbe, 1882)

Sous-famille: PARACAECILIINAE

- Enderleinella obsoleta* (Stephens, 1836)

## REMARQUES

Pour la subdivision de la sous-famille des Caeciliusinae en plusieurs tribus et sous-tribus on peut se référer à Lienhard & Smithers (2002) et Yoshizawa (2001). Ces subdivisions, certes justifiées pour la faune mondiale, compliqueraient inutilement la classification des quelques espèces ouest-paléarctiques. Nous nous contentons donc d'une classification simplifiée, en présentant les genres de cette sous-famille par ordre alphabétique.

Les espèces du genre *Valenzuela* sont aussi mentionnées par ordre alphabétique sans tenir compte des groupes d'espèces définis par Mockford (2000). L'attribution à ces groupes d'espèces est signalée dans le catalogue de Lienhard & Smithers (2002) où la distribution géographique de toutes les espèces est également documentée.

Il faut aussi noter que le genre monotypique *Lacroxiella* Badonnel, avec la seule espèce *L. martini* (Lacroix), a été placé par Mockford (2000) dans la catégorie

“Psocida agnota”, son attribution à une famille étant actuellement impossible. Cette classification a été reprise par Lienhard & Smithers (2002) alors que Lienhard (1998) avait conservé le placement provisoire de cette espèce exotique accidentellement introduite en Europe au sein des Caeciliusidae, initialement proposé par Badonnel (1943).

## REMERCIEMENTS

Je remercie très cordialement Barbara Knoflach et Konrad Thaler (Innsbruck) d’avoir mis à ma disposition leur récolte de Corse et David Hollis (BMNH) de m’avoir prêté le matériel type de *Caecilius corsicus*. Edward L. Mockford (Normal, Illinois, USA) et Nico Schneider (Luxembourg) ont eu l’amabilité de relire le manuscrit; je les remercie de leurs remarques critiques.

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## Two new species of the genus *Mecyclothorax* Sharp from Papua New Guinea (Insecta, Coleoptera, Carabidae, Psydrinae)

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**Two new species of the genus *Mecyclothorax* Sharp from Papua New Guinea (Insecta, Coleoptera, Carabidae, Zuphiinae).** - Two additional new species of the psydrine genus *Mecyclothorax* Sharp are described from Papua New Guinea: *M. cuccodoroi* and *M. loebli*. They occur sympatrically at median altitude and are distinguished from all other New Guinean species by external structure and shape, and by the structure of their aedeagi. A revised key to all New Guinean species of *Mecyclothorax* is presented.

**Key-words:** Coleoptera – Carabidae – Psydrinae – *Mecyclothorax* – new species – Papua New Guinea.

### INTRODUCTION

The psydrine genus *Mecyclothorax* in New Guinea was repeatedly subject of descriptions of new species and of revisions (Darlington, 1962, 1971; Baehr, 1992, 1995, 1998) which are evidence that the mecyclothoracine fauna of New Guinea by no means is adequately recorded. On the contrary, even the increasing collecting work during the last 20 years only could give a very imperfect picture of the number of species occurring and of their distribution.

Until now, altogether 10 species were described from the whole island of New Guinea, but even their recorded distribution (see appendix) demonstrates our limited knowledge. Thus far, the genus was recorded almost exclusively from few scattered localities within a limited area in central and eastern Irian Jaya. In spite of much longer and better exploration, from the eastern half of the island (Papua New Guinea) to date only a single species was described that occurs on the highest top of Mt. Wilhelm. It was difficult to understand, then, why Papua New Guinea should not harbour additional species at lower altitudes. This defiance, and likewise the scattered records in western New Guinea, most probably reflect the yet absolutely inadequate sampling of these small beetles that probably are best collected by sieving or Berlese extraction of litter or soil. Therefore, it is not too surprising, that both new species described in the present paper were collected by staff of the Geneva Museum who are well known for their very successful sampling of litter and soil inhabiting tiny insects.

As a conclusion, in New Guinea the genus *Mecyclothorax* to date is yet unknown from Owen Stanley Range, Huon Peninsula, the western part of Papua New Guinea, and also from the whole western part of Irian Jaya including Snow Mountains

and Vogelkop Peninsula. Most probably species will be discovered in most of these areas in future, because this originally Australian genus is as well distributed to the east of New Guinea, e.g. in New Caledonia (Jeannel, 1944; Deuve, 1987; unpublished records), Tahiti (Perrault, 1978, 1992), and Hawaii (Britton, 1948), as to the west, e.g. in Borneo (Baehr & Lorenz, 1999) and Java (Louwerens, 1949).

#### MATERIAL AND METHODS

Both new species were obtained within a sample of carabid beetles that were collected by G. Cuccodoro of the Muséum d'histoire naturelle, Genève (MHNG) in 1992 and kindly were loaned for examination from the collector. The holotypes are located in that museum, paratypes are shared with the working collection of the author at Zoologische Staatssammlung, München (CBM).

For dissection of the male genitalia specimens were soaked in a wet jar for a night, then the genitalia were cleaned for a short while in hot 4% KOH. For the descriptions normal taxonomic methods have been used.

Measurements were taken using a stereo microscope with an ocular micrometer. Length has been measured from apex of labrum to apex of elytra. Length of pronotum was measured along midline, width of pronotum at widest part, width of base of pronotum at the extreme tips of the basal angles. Measurements and ratios were obtained in the same manner as in Baehr (1992, 1995, 1998).

#### *Mecyclothorax cuccodoroi* sp. n.

Figs 1, 3

*Holotype*: ♂, PAPUA NG: Morobe Bulldog Rd. Hidden Valley Gold 2550m, 16.V.1992 G. Cuccodoro #238 (MHNG).

*Paratypes*: 2 ♂♂, 1 ♀, same data (CBM, MNHG)

*Etymology*: The name is a patronym in honour of the collector.

*Distribution*: Central eastern Papua New Guinea. Known only from type locality.

*Collecting circumstances*: Probably collected by sieving ground litter in rain forest at median altitude.

#### DIAGNOSIS

Small, piceous-castaneous species, characterized by absence of the posterior lateral pronotal seta, distinct basal angle and coarsely punctate basal part of pronotum, short, not oviform elytra with markedly punctate striae, and glossy, though not iridescent surface. According to shape of aedeagus the species probably is most closely related to *M. sapae* Baehr, but is distinguished from this species by much lesser size, different shape of pronotum, and absolute lack of microreticulation on dorsal surface.

#### DESCRIPTION

Measurements: Length: 3.5-3.8 mm; width: 1.5-1.7 mm. Ratios. Width head/prothorax: 0.64-0.68; width/length of prothorax: 1.21-1.27; width base/apex of prothorax: 1.04-1.07; width elytra/prothorax: 1.33-1.35; length/width of elytra: 1.30-1.32.

Colour: Head and prothorax piceous, elytra lighter, castaneous. Mouthparts, antennae, and legs light reddish. Lower surface reddish-piceous, elytral epipleurae light reddish.

Head: Rather narrow in relation to prothorax. Eyes comparatively large, convex, rather protruding, orbits small, oblique, c. 1/4 of length of eye. Frontal furrows



deep, oblique, elongate, completely encircling the eye. Frons with more or less distinct, about circular, paramedian grooves. Posterior supraorbital seta situated slightly behind posterior margin of eye. Clypeal suture well impressed. Labrum transverse, truncate, 6-setose. Mandibles moderately elongate, apically suddenly curved. Mentum with distinct, apically rounded tooth. Submentum with very elongate setae. Antenna rather short, slightly surpassing posterior border of pronotum, median antennomeres slightly  $>1.5$  x as long as wide. Surface impunctate, without microreticulation, glossy.

Pronotum: Large, wide, circular, considerably wider than long, disk fairly convex, laterally evenly curved, with a short but conspicuous excision in front of the basal angles. Widest diameter about at middle. Base slightly wider than apex. Apex straight, apical angles slightly projecting, rounded off. Base almost straight, only laterally faintly oblique. Basal angles distinct, almost right, though at apex very obtuse. Marginal channel rather narrow, little widened near basal angles, base and apex not margined. Anterior transverse sulcus absent, posterior transverse sulcus barely perceptible. Median line feebly impressed, anteriorly and posteriorly abbreviated. Basal grooves about circular, rather indistinct. Basal area not explanate, on same level with disk, very coarsely punctate. Anterior marginal seta situated slightly in front of middle, slightly removed from lateral margin, posterior marginal seta absent. Surface impunctate, without any microreticulation, highly glossy.

Elytra: Short and wide, dorsally markedly convex, widest diameter about at middle. Humeri obtusely rounded, lateral margin evenly curved. Basal margin distinct, oblique, slightly sinuate, connected to scutellary striole. Striae except for sutural stria abbreviated at humerus, all striae except for inner two also abbreviated at apex. All striae except for 7<sup>th</sup> well impressed, very coarsely punctate. Inner six intervals distinctly convex. 7<sup>th</sup> stria impressed only near base, punctate. Scutellary striole fairly elongate, situated mediad of the outturned sutural stria. Marginal channel narrow. 3<sup>rd</sup> interval with 2 setiferous punctures in centre of interval, anterior puncture situated in basal fourth, posterior puncture in middle. Punctures rather inconspicuous, setae extremely short. Near apex with a single setiferous puncture at end of 3<sup>rd</sup> stria. Marginal pores conspicuous, about 13 in a row that is slightly interrupted in middle, marginal setae very elongate. Intervals impunctate, without any traces of microreticulation. Surface highly glossy, though not iridescent. Inner wings absent.

Lower surface: Largely impunctate, though mesepisternum with a row of very coarse punctures. Metepisternum about as long as wide. Sternum VII in ♂ bisetose, in ♀ quadrisetose.

Legs: Without striking features. Three basal tarsomeres of male anterior tarsus expanded and biserially squamose.

Male genitalia: Genital ring short and wide, highly asymmetric, with conspicuously incurved lateral flanges. Aedeagus moderately elongate, suddenly curved down towards apex, lower surface with a heavily sclerotized ridge which in middle forms a conspicuous convexity. Apex markedly compressed, foliaceous, conspicuously spatulate, with convex tip, strongly sclerotized, slightly curved to left side and slightly concave on left side. Orifice almost completely situated on right side. Internal sac with two complexly shaped sclerites and with some folding. Both parameres of fairly similar size and shape, though right paramere more hollowed and with longer and

narrower apex. Apex with 2-3 rather elongate setae, lower margin in middle with c. 6-8 setae. Left paramere with shorter and wider apex that bears two fairly elongate setae. Lower margin apparently asetose.

Female genitalia: Stylomere 1 compact, at apical rim with 2 setae. Stylomere 2 rather short, dentiform, with two elongate ventrolateral ensiform setae, one elongate dorsomedian ensiform seta situated about in middle of stylomere, and two short apical nematiform setae originating from a groove.

Variation: Apart from some variation in colour that may be due to incomplete pigmentation, some minor variation in relative shape of pronotum and elytra was noted. One specimen, however, has some elongate, very deep longitudinal sulci on head, much alike the trechine sulci, though in this specimen asymmetrically arranged. Certainly, this is an accidental deformation.

*Mecyclothorax loebli* sp. n.

Figs 2, 4

*Holotype*: ♂. PAPUA NG: Morobe Bulldog Rd. Mt. Nako 2600m, 29.VI.1992 G. Cuccodoro #250 (MHNG).

*Paratypes*: 4 ♀♀, PAPUA NG: Morobe Bulldog Rd. Hidden Valley Gold 2550m, 16.V.1992 G. Cuccodoro #238 (CBM, MHNG).

*Etymology*: The name is a patronym in honour of the former Curator of Coleoptera of the Geneva Museum, Dr I. Löbl, who kindly loaned the material.

*Distribution*: Central eastern Papua New Guinea. Known only from vicinity of Bulldog Rd. in Morobe Province.

*Collecting circumstances*: Probably collected by sieving ground litter in rain forest at median altitude.

DIAGNOSIS

Small, uniformly black species, characterized by absence of the posterior lateral pronotal seta, obtuse basal angle and scarcely though coarsely punctate basal part of pronotum, short, convex, not oviform elytra with markedly punctate striae, and rather glossy, though not iridescent surface. With respect to shape and structure of the aedeagus, this species is most closely related to *M. riedeli* Baehr, but is distinguished from the latter species by its shorter, more quadrate elytra and the more regularly curved aedeagus that bears a more distinctly upturned apex.

DESCRIPTION

Measurements: Length: 3.8-4.2 mm; width: 1.85-1.90 mm. Ratios. Width head/prothorax: 0.63-0.65; width/length of prothorax: 1.19-1.25; width base/apex of prothorax: 0.87-0.92; width elytra/prothorax: 1.46-1.50; length/width of elytra: 1.26-1.30.

Colour: Black, labrum, mandibles, and legs dark reddish, palpi and antennae light reddish. Lower surface dark piceous, elytral epipleurae reddish.

Head: Rather narrow in relation to prothorax. Eyes comparatively large, convex, rather protruding, orbits rather small, oblique, slightly > 1/4 of length of eye. Frontal furrows deep, oblique, elongate, completely encircling the eye. Frons with a more or less distinct, about circular median groove. Posterior supraorbital seta situated slightly behind posterior margin of eye. Clypeal suture well impressed. Labrum transverse, truncate, 6-setose. Mandibles moderately elongate, apically suddenly curved. Mentum with distinct, apically rounded tooth. Submentum with very elongate setae.

TABLE 1. Measurements and ratios of the *Mecyclothorax* species of New Guinea.

For better comparison of the species the measurements and ratios are compiled in the following table. For both Darlington's species some ratios were taken from the descriptions, though these species are rather easily identified.

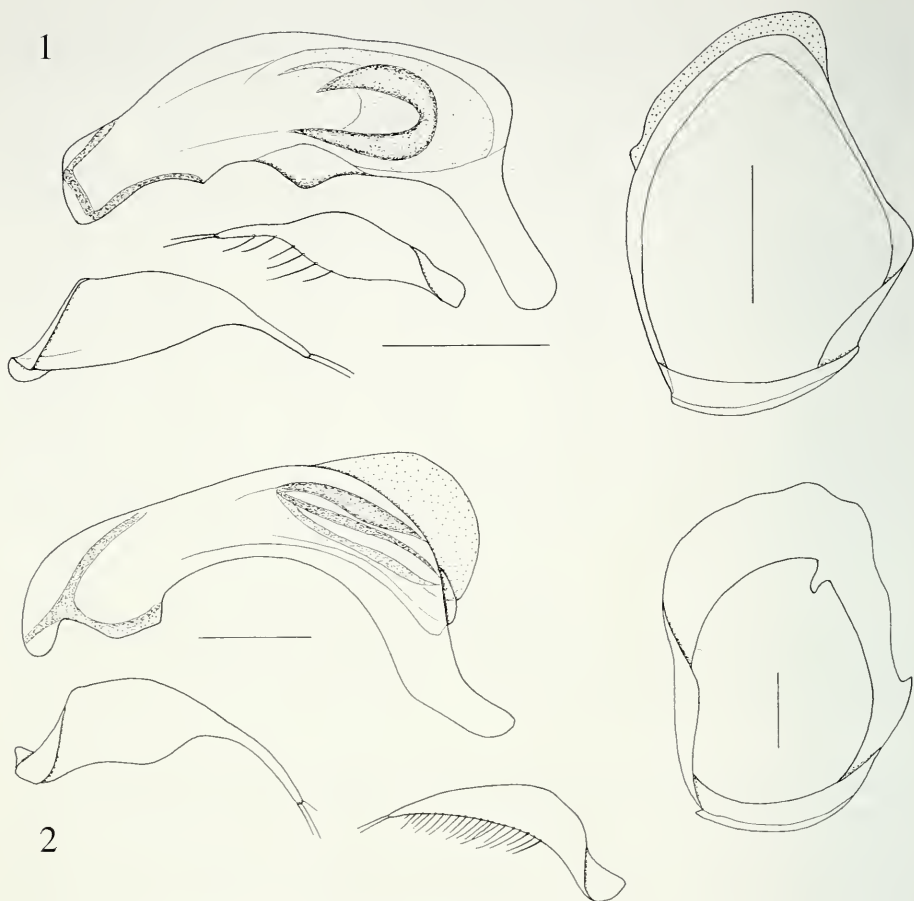
	Body length (mm)	ratio width head/pronotum	ratio width/length of pronotum	ratio width base/apex pronotum	ratio width elytra/pronotum	ratio length/width elytra
<i>toxopei</i> Darlington	4.7	0.76	1.29	0.98	1.50	1.41
<i>sedlaceki</i> Darlington	4.3	0.77	1.36	0.98	1.46	1.37
<i>julianae</i> Baehr	4.6	0.69	1.25	1.11	1.42	1.47
<i>eipomeki</i> Baehr	5.5	0.69	1.18	1.06	1.38	1.49
<i>elitii</i> Baehr	5.8-6.3	0.65-0.69	1.15-1.19	1.09-1.12	1.38-1.40	1.42-1.45
<i>sapei</i> Baehr	5.25	0.75	1.13	0.96	1.50	1.39
<i>cuccodoroi</i> sp. n.	3.5-3.8	0.64-0.68	1.21-1.27	1.04-1.07	1.33-1.35	1.30-1.32
<i>jivikae</i> Baehr	3.5-3.75	0.64-0.66	1.18-1.20	0.95-0.98	1.42-1.43	1.37
<i>langdae</i> Baehr	4.6	0.65	1.17	1.05	1.38	1.52
<i>bilaianus</i> Baehr	4.0	0.65	1.17	1.01	1.45	1.42
<i>riedeli</i> Baehr	4.0-4.4	0.59	1.18-1.21	1.18-1.19	1.35-1.38	1.42-1.44
<i>loebli</i> sp. n.	3.8-4.2	0.63-0.65	1.19-1.25	0.87-0.92	1.46-1.50	1.26-1.30

Antenna rather short, barely surpassing the posterior border of pronotum, median antennomeres c.1.5 x as long as wide. Surface impunctate, rather glossy, with traces of slightly transverse microreticulation which is more distinct on neck, and also in the three females than in the single male.

Pronotum: Large, wide, circular, considerably wider than long, disk moderately convex, laterally evenly and strongly curved, without or with a very slight excision in front of the basal angles. Widest diameter slightly in front of middle. Base considerably narrower than apex. Apex straight, apical angles barely projecting, rounded. Base almost straight or very gently convex, laterally faintly oblique. Basal angles obtuse, very wide. Marginal channel narrow throughout, not widened near basal angles, apex and base not margined, though lateral margin slightly incurved at base. Anterior transverse sulcus barely indicated, posterior transverse sulcus shallow. Median line distinct, though rather faintly impressed, anteriorly and posteriorly shortly abbreviated. Basal grooves about linear, slightly oblique, fairly distinct. Basal area not explanate, on same level with disk, sparsely though coarsely punctate. Anterior marginal seta situated slightly in front of middle, slightly removed from lateral margin, posterior marginal seta absent. Surface impunctate, glossy, with very superficial, transverse, somewhat irregular microreticulation that is more distinct in apical and basal parts and in the females.

Elytra: Very short and wide, dorsally markedly convex, widest diameter about at middle. Humeri obtusely rounded, lateral margin in middle barely convex, almost straight, hence, shape of elytra somewhat rectangular. Basal margin distinct, sinuate, connected to scutellary striole. Striae except for sutural stria much abbreviated at humerus, all striae except for inner two also abbreviated at apex. Inner five striae well impressed, very coarsely punctate. Inner five intervals distinctly convex. 6<sup>th</sup> stria stria impressed only near base, 7<sup>th</sup> stria not impressed, both punctate. Scutellary striole fairly





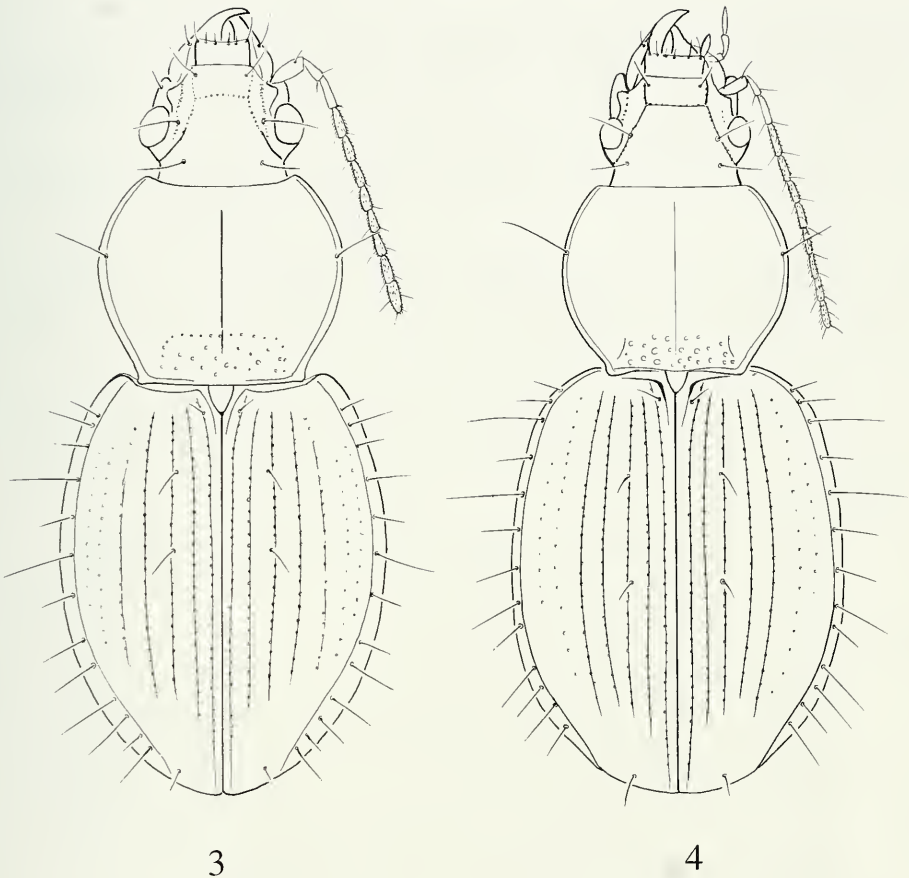
FIGS 1, 2

Male genitalia. Aedeagus, parameres, and genital ring. 1. *Mecyclothorax cuccodoroi* sp. n. 2. *M. loebli* sp. n. Scales: 0.25 mm.

elongate, situated mediad of the outturned sutural stria. Marginal channel moderately wide. 3<sup>rd</sup> interval with 2 setiferous punctures in centre of interval, anterior puncture situated in basal fourth, posterior puncture in middle, though two specimens with a single puncture unilaterally. Punctures rather inconspicuous, setae extremely short. Near apex with a single setiferous puncture near end of 3<sup>rd</sup> stria. Marginal pores fairly conspicuous, about 13 in a row that is slightly interrupted in middle, marginal setae very elongate. Intervals impunctate, with very fine, highly superficial, transverse microreticulation. Surface glossy, though not iridescent. Inner wings absent.

Lower surface: Largely impunctate, though mesothorax sparsely though very coarsely punctate. Metepisternum about as long as wide. Sternum VII in ♂ bisetose, in ♀ quadrisetose.

Legs: Without striking features. Three basal tarsomeres of male anterior tarsus expanded and biserially squamose.



FIGS 3, 4

Habitus. 3. *Mecyclothorax cuccodoroi* sp. n. 4. *M. loebli* sp. n. Lengths: 3.5 mm; 4.2 mm.

Male genitalia: Genital ring short and wide, highly asymmetric, with conspicuously wide lateral flanges, very thickly sclerotized. Aedeagus moderately elongate, remarkably curved, with deeply concave lower surface. Apex wide, compressed, moderately foliaceous, somewhat spatulate, with convex tip, strongly sclerotized, curved down though near tip withdrawn and slightly curved to the right side. Orifice largely situated on right side. Internal sac with an about circular sclerite and with some folding. Both parameres of fairly similar size and shape, though right paramere narrower and with shorter, wider, more tapering apex. Apex with 2 moderately elongate setae, lower margin densely fringed with numerous (> 20) rather elongate setae. Left paramere slightly larger, with longer and narrower apex, that bears two fairly elongate setae and a shorter one. Lower margin asetose.

Female genitalia: Stylocere 1 compact, at apical rim with 2-3 setae. Stylocere 2 rather short, dentiform, with two elongate ventrolateral ensiform setae, one elongate

dorsomedian ensiform seta situated about in middle of stylomere, and two short apical nematiform setae originating from a groove.

Variation: Some sexual variation apparently present, because the single male possesses a slightly narrower abdomen, and the microreticulation of the dorsal surface is less distinct than in the three examined females.

#### REVISED KEY TO THE SPECIES OF *MECYCLOTHORAX* SHARP FROM NEW GUINEA

Because both new species do not fit the present full or partial keys to the New Guinean species of *Mecyclothorax* (Baehr, 1995, p. 4; 1998, p. 23), a completely new key is presented that should replace both former keys. For easier determination, however, figures from the former papers (Baehr, 1992, 1995, 1998) are quoted where necessary.

Although range is not a *prima facie* distinguishing character, the ranges of most species seem to be so restricted that they can be used as support for the differentiation of the species. Therefore, geographic and altitudinal ranges are included in the key as exactly as possible.

- 1 Elytral striae 3 and 5 with setiferous punctures. Wilhelmina Top (Gn. Trikora), central Irian Jaya, at 4200 m . . . . . *toxopei* Darlington
- Only elytral stria 3 with setiferous punctures . . . . . 2
- 2 Posterior lateral seta of pronotum present . . . . . 3
- Posterior lateral seta of pronotum absent . . . . . 5
- 3 Elytra with 4 discal setae; elytral striae well impressed, crenulate, intervals convex, stria 7 fairly well developed. Juliana Top (Gn. Mandala), eastern central Irian Jaya, at 3500 m . . . . . *julianae* Baehr
- Elytra with 2, rarely unilaterally 3 discal setae; elytral striae weakly impressed, outer striae consisting of rows of punctures only, intervals depressed, stria 7 scarcely indicated. Distribution different . . . . . 4
- 4 Smaller, shorter species, length c. 4.3 mm; colour black; pronotum wider, ratio w/l c. 1.36, lateral margin very shortly sinuate in front of the subidentiform basal angles; surface of elytra irregularly microreticulate. Mt. Wilhelm, central Papua New Guinea, at 4250 m . . . . . *sedlaceki* Darlington
- Larger, longer species, length c. 5.5 mm; colour reddish-piceous; pronotum narrower, ratio w/l <1.20, lateral margin barely sinuate in front of the obtusely subidentiform basal angles; surface of elytra regularly microreticulate. Eipomek-Langda area, eastern central Irian Jaya, at 3500 m . . . . . *eipomeki* Baehr
- 5 Basal angles of pronotum almost rectangular, lateral margin near base distinctly sinuate; aedeagus see Baehr (1995, figs 5, 7) and fig. 1 . . . . . 6
- Basal angles of pronotum obtuse, lateral margin near base not or barely sinuate; aedeagus see Baehr (1992, fig. 2; 1995, figs 11, 12; 1998, fig. 2) and fig. 2 . . . . . 8
- 6 Larger species, length > 5 mm; surface at least with traces of microreticulation; aedeagus see Baehr (1995, figs 5, 7). Eastern central Irian Jaya, above 3200m . . . . . 7

- Smaller species, length < 4 mm; surface without traces of microreticulation; aedeagus see fig. 1. Bulldog Rd., Morobe Prov., eastern central Papua New Guinea, at 2550m . . . . . *cuccodoroi* sp. n.
- 7 Larger species, length > 5.7 mm; microreticulation on head and pronotum barely indicated, on elytra rather superficial, but present on apical part of elytra; basal angles of pronotum obtuse at apex, lateral margins distinct, explanate and slightly upturned; at least median elytral striae deeply impressed, intervals distinctly convex; aedeagus see Baehr (1995, fig. 5). Gunung Elit, eastern central Irian Jaya, at 3200-3300 m . . . . . *eliti* Baehr
- Smaller species, length c. 5.3 mm; microreticulation distinct, on elytra even very conspicuous, but absent on apical part of elytra; basal angles of pronotum rectangular, lateral margins very narrow, barely explanate and upturned; elytral striae barely impressed, intervals depressed; aedeagus see Baehr (1995, fig. 7). Sape Valley, north of Juliana Top (Gn. Mandala), eastern central Irian Jaya, at 3400 m . . . . . *sapei* Baehr
- 8 Aedeagus with short, wide, laminate apical plate that is bent down (Baehr, 1995, figs 10, 11); basal angles of pronotum very obtuse, without any perceptible sinuosity (Baehr, 1995, figs 13, 14); either very small species (length < 3.7 mm) with short elytra, or larger species (length 4.6 mm) with elongate elytra . . . . . 9
- Aedeagus either with short, laminate apex that is markedly falciform (Baehr, 1998, fig. 2) or with elongate, less wide apex that is slightly curved upwards at tip (Fig. 2; Baehr, 1992, fig. 2); basal angles of pronotum obtuse, though commonly with perceptible sinuosity (Fig. 4; Baehr, 1992, fig. 1; 1998, fig. 1), medium sized species (length 3.8-4.4 mm) . . . . . 10
- 9 Smaller and shorter species, length < 3.8 mm, ratio l/w of elytra < 1.37; basal angles of pronotum almost rounded off; anterior transverse sulcus of pronotum weak; aedeagus elongate, markedly curved (Baehr, 1995, fig. 10). Jiwika area, central Irian Jaya, at 2300 m . . . . . *jiwikae* Baehr
- Larger and more elongate species, length > 4.5 mm, ratio l/w of elytra > 1.50; basal angles of pronotum distinct, though obtuse; aedeagus stouter, less curved (Baehr, 1995, fig. 11). Langda area, eastern central Irian Jaya, at 2300 m . . . . . *langdae* Baehr
- 10 Apex of aedeagus short, laminate, markedly falciform (Baehr, 1998, fig. 2). Bilai area, central Irian Jaya, at 1900-2300 m . . . . . *bilaianus* Baehr
- Apex of aedeagus elongate, not falciform, only feebly curved up (Fig. 2; Baehr, 1992, fig. 2) . . . . . 11
- 11 Elytra longer and narrower (ratio length/width > 1.42), more oviform (Baehr, 1992, fig. 1); base of pronotum distinctly wider than apex (ratio base/apex > 1.18); lower surface of aedeagus in middle straight, apex less upturned (Baehr, 1992, fig. 2). Kangine area, Baliem Valley, central Irian Jaya, at 1900 m . . . . . *riedeli* Baehr
- Elytra shorter and wider (ratio length/width < 1.30), more quadrate (Fig. 4); base of pronotum distinctly narrower than apex (ratio base/apex



< 0.92); lower surface of aedeagus in middle evenly concave, apex more distinctly upturned (Fig. 2). Bulldog Rd. area, Morobe Prov., eastern central Papua New Guinea, at 2550-2600 m . . . . . *loebli* sp. n.

#### ACKNOWLEDGEMENTS

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#### APPENDIX. Checklist of the *Mecyclothorax* species of New Guinea

Abbreviations: c. = central, e. = eastern, ce. = central eastern.

- bilaianus* Baehr, 1998 c. IRIAN JAYA: Bilai – 1900-2300 m
- cuccodoroi* sp. n. ce. PAPUA NEW GUINEA: Bulldog Range – 2550 m
- eipomeki* Baehr, 1995 e. IRIAN JAYA: Eipomek – 3500 m
- eliti* Baehr, 1995 c. IRIAN JAYA: Gn. Elit – 3200-3300 m
- jiwika* Baehr, 1995 c. IRIAN JAYA: Jiwika – 2300 m
- julianae* Baehr, 1995 e. IRIAN JAYA: Juliana Top (Gn. Mandala) – 3500 m
- langdae* Baehr, 1995 c. IRIAN JAYA: Langda – 2300 m
- loebli* sp. n. ce. PAPUA NEW GUINEA: Bulldog Range – 2550-2600 m
- riedeli* Baehr, 1992 c. IRIAN JAYA: Baliem Vy. – 1900 m
- sapei* Baehr, 1995 e. IRIAN JAYA: Juliana Top (Gn. Mandala) – 3400 m
- sedlaceki* Darlington, 1971 c. PAPUA NEW GUINEA: Mt. Wilhelm – 4250 m
- toxopei* Darlington, 1962 c. IRIAN JAYA: Wilhelmina Top (Gn. Trikora) – 4200 m

## Four new species of the genus *Gnypeta* Thomson, 1858 from the Oriental Region (Coleoptera, Staphylinidae, Aleocharinae)

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**Four new species of the genus *Gnypeta* Thomson, 1858 from the Oriental Region (Coleoptera, Staphylinidae, Aleocharinae).** - Four new Oriental species of the genus *Gnypeta* Thomson, 1858 are described and illustrated: *Gnypeta bolmi* sp. n., *Gnypeta mindanaoensis* sp. n., *Gnypeta sabangensis* sp. n. and *Gnypeta guineensis* sp. n. Their affinities with related species are discussed.

**Key-words:** Coleoptera - Staphylinidae - Aleocharinae - *Gnypeta* - new species - Oriental Region.

The genus *Gnypeta* Thomson, 1858 contains more than 70 species distributed throughout all zoogeographical regions. Twenty three species of *Gnypeta* have previously been recorded from the Oriental Region (Bernhauer & Scheerpeltz, 1926; Cameron, 1933, 1939, 1950; Pace, 1984a, 1984b, 1986, 1987, 1989, 1990a, 1990b, 1991, 2000). Four additional new species from the Oriental Region are described in the present paper.

The holotypes and paratypes of new species have been deposited in the Staatliches Museum für Naturkunde in Stuttgart (SMNS), Muséum d'histoire naturelle in Geneva (MHNG) and in the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Krakow (ISEA).

*Gnypeta bolmi* sp. n.

Figs 1-4

*Material.* Holotype, ♂: Philippines, Mindanao, 30 km E of Malaybalay, Busdi, 1000 m, 5-9.V.1996, leg. Bolm (SMNS).

*Description.* Length 2.7 mm. Body convex, parallel-sided, weakly shiny; ground colour pitchy brown; posterior margin of elytra, tibiae and tarsi yellow, antennae brown with antennomeres 1-2 and 11 red.

Head circular in outline, moderately convex, shiny, widest across eyes; eyes moderately large, protruding from lateral contours of head, eye length seen from above subequal to that of postocular region; temples relatively strongly arcuately narrowed to hind angles; surface of head without microsculpture; punctuation fine, dense, and asperate; pubescence short and moderately dense, directed medially.

Antennae moderately long, distinctly increasing in width apically, extending to middle of elytra, antennomere 3 longer than 2, antennomeres 4-8 longer than wide, decreasing in length, antennomeres 9-10 quadrate, antennomere 11 as long as antennomeres 9 and 10 combined.

Pronotum subquadrate, convex, widest in apical third, lateral sides clearly sinuate, hind angles obtuse; before base with small and shallow transverse impression; surface without microsculpture; punctation fine, very dense and asperate; pubescence short and moderately dense, along midline directed anteriorly.

Elytra subquadrate, slightly wider than pronotum, widest behind middle, lateral sides moderately arcuate, at suture as long as pronotum at midline, at sides distinctly longer than pronotum at midline; postero-lateral angles weakly sinuate; surface lacking microsculpture; punctation fine, dense and asperate; pubescence short and dense, directed obliquely posteriorly.

Abdomen weakly constricted at base, widest at level of tergites 5 and 6, bases of tergites 3-5 each with deep transverse impression, impressions smooth and impunctate; tergal punctation fine and dense, tergite 8 with fine transverse microsculpture; pubescence relatively short and moderately dense.

Male. Tergite 8 as in Fig. 3, sternite 8 as in Fig. 4; aedeagus as in Figs 1 and 2. Female unknown.

*Remarks.* *Gnypeta bolmi* sp. n. is similar to *G. tronqueti* Pace, 1987, from which it can be distinguished by the darker body colour, the shorter and more incrassate antennae, the posterior more strongly narrowed temples and by the shape of aedeagus.

### *Gnypeta mindanaoensis* sp. n.

Figs 5-11

*Material.* Holotype, ♂: Philippines, Mindanao, 30 km E of Malaybalay, Busdi, 1000 m, 5-9.V.1996, leg. Bolm (SMNS); Paratypes, ♂: Philippines, Mindanao, Mt. Apo Ilomavis, 1400 m, 18-19.V.1996, leg. Bolm (SMNS); ♂ and ♀: Philippines, Mindanao, Prov. Davao, 25 km W of New Bataan, 1200 m, 20-22.V.1996, leg. Bolm (SMNS and ISEA).

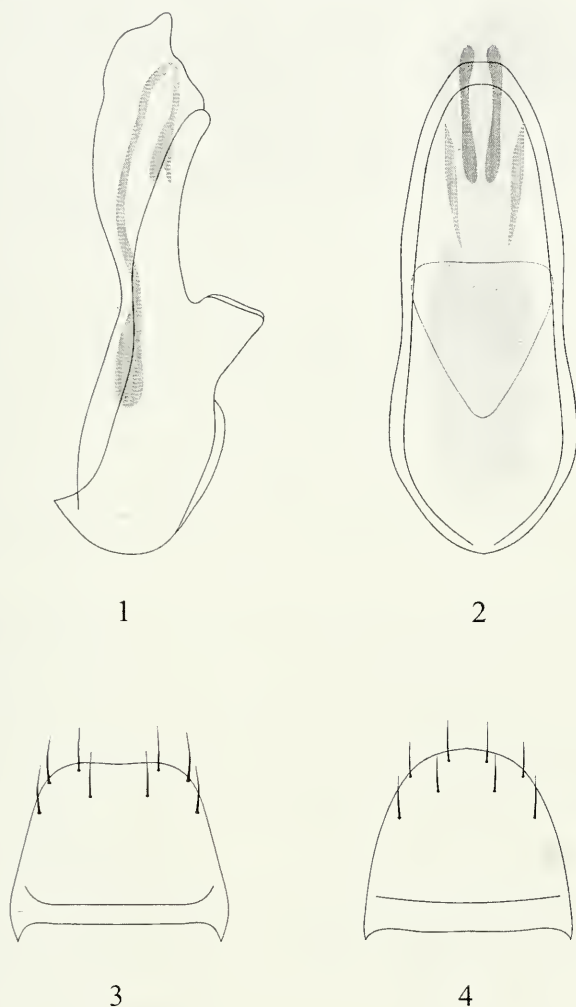
*Description.* Length 3.0-3.2 mm. Body convex, parallel-sided, weakly shiny; ground colour pitchy brown; base and posterior margin of elytra, tibiae and tarsi yellow, antennae brown with antennomeres 1-2 and 11 red.

Head circular in outline, flattened dorsally, narrowly and shallowly impressed medially, widest across eyes; eyes moderately large, protruding from lateral contours of head, eye length seen from above subequal to that of postocular region; temples moderately arcuately narrowed to hind angles; surface of head without microsculpture; punctation fine, dense and asperate; pubescence short and moderately dense, directed medially.

Antennae very long, very weakly increasing in width apically, extending to 3/4 of elytra, antennomere 3 longer than 2, antennomeres 4-9 longer than wide, decreasing in length, antennomere 10 quadrate, antennomere 11 as long as antennomeres 9 and 10 combined.

Pronotum slightly transverse, moderately convex, widest in apical third, lateral sides sinuate, hind angles obtuse; before base with small and shallow transverse impression; surface without microsculpture; punctation fine, very dense and asperate; pubescence short and moderately dense, along midline directed anteriorly.



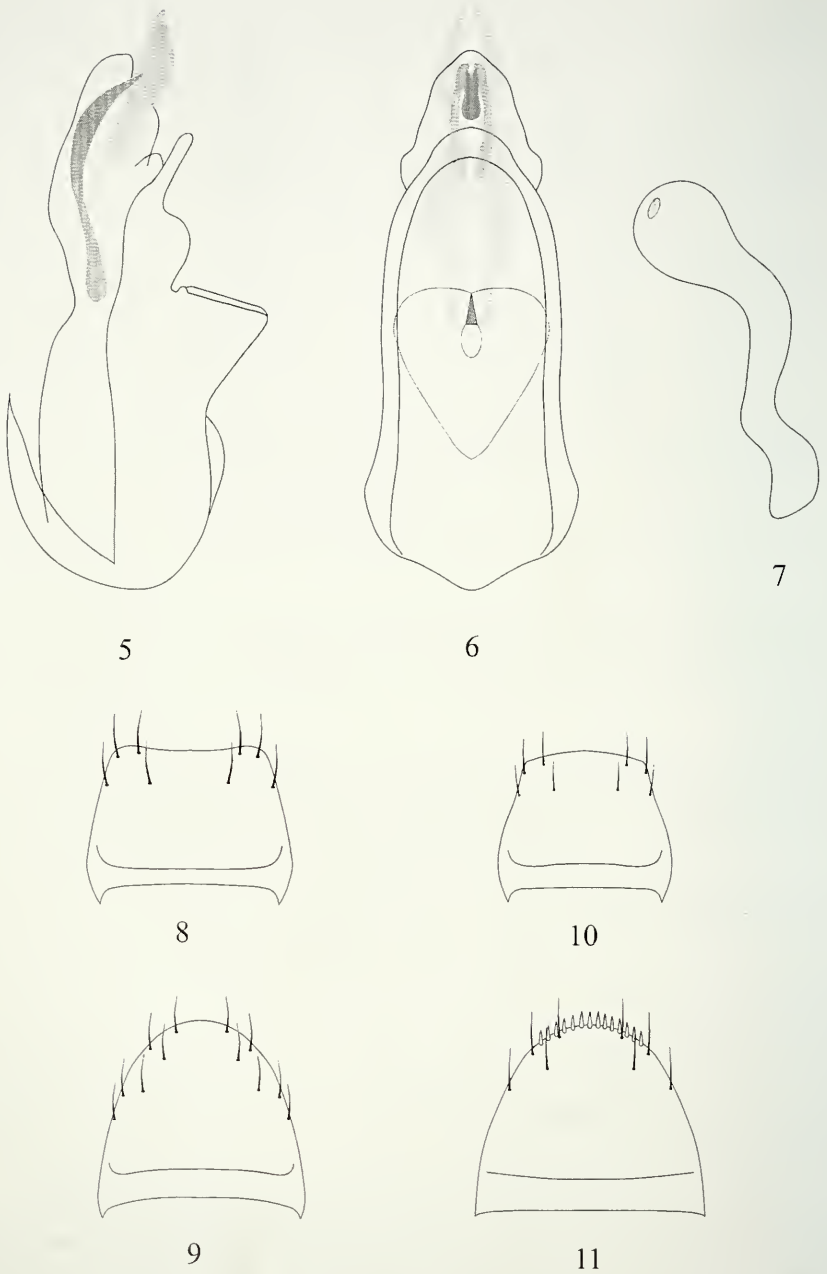


FIGS 1-4

*Gnypeta bolmi* sp. n.: 1 - aedeagus in lateral view, 2 - aedeagus in ventral view, 3 - male tergite 8, 4 - male sternite 8.

Elytra subquadrate, slightly wider than pronotum, widest behind middle, lateral sides moderately arcuate, at suture as long as pronotum at midline, at sides distinctly longer than pronotum at midline; postero-lateral angles weakly sinuate; surface lacking microsculpture; punctation fine, dense, and asperate; pubescence short and dense, directed obliquely posteriorly.

Abdomen weekly constricted at base, widest at level of tergites 5 and 6, bases of tergites 3-5 each with deep transverse impression, impressions smooth and impunc-



FIGS 5-11

*Gnypeta mindanaoensis* sp. n.: 5 - aedeagus in lateral view, 6 - aedeagus in ventral view, 7 - spermatheca, 8 - male tergite 8, 9 - male sternite 8, 10 - female tergite 8, 11 - female sternite 8.

tate; tergal punctation fine and dense, tergite 8 with fine transverse microsculpture; pubescence relatively short and moderately dense.

Male. Tergite 8 as in Fig. 8, sternite 8 as in Fig. 9; aedeagus as in Figs 5 and 6.

Female. Tergite 8 as in Fig. 10, sternite 8 as in Fig. 11; spermatheca as in Fig. 7.

*Remarks.* *Gnypeta mindanaoensis* sp. n. is similar to *G. bohni* sp. n., from which it differs by its larger size, the very weakly incrassate antennae, the more elongate middle antennomeres, the denser and more asperate pronotal and elytral punctation and by the shape of aedeagus.

*Gnypeta sabangensis* sp. n.

Figs 12-18

*Material.* Holotype, ♂: Philippines, Palawan central, Sabang, 50-100 m, degraded rainforest on slope, 30.XI.1995, leg. Kodada (MHNG); Paratypes, 4♂♂ and 6♀♀: same data as holotype (MHNG); 2♂♂ and ♀: same data as holotype (ISEA); 3♂♂ and ♀: Philippines, Palawan centr., above San Rafael, ca. 300 m, degraded forest on slope, 4.XII.1995, leg. J. Kodada (MHNG); 2♂♂: same data as above (ISEA).

*Description.* Length 2.4-2.7 mm. Body convex, parallel-sided, weakly shiny; ground colour dark brown; base and posterior margin of elytra, tibiae and tarsi yellow, abdomen black with tergites 1-2 brown, antennae brown with antennomeres 1-3 and 11 red.

Head quadrate in outline, moderately convex, widest across eyes; eyes moderately large, protruding from lateral contours of head, eye length seen from above subequal to that of postocular region; temples broadly arcuately narrowed to hind angles; surface of head without microsculpture; punctation relatively coarse, dense and asperate; pubescence short and moderately dense, directed medially.

Antennae moderately short, clearly increasing in width apically, extending to 1/3 of elytra, antennomere 3 longer than 2, antennomeres 4-7 longer than wide, decreasing in length, antennomeres 8-10 quadrate, antennomere 11 as long as antennomeres 9 and 10 combined.

Pronotum slightly transverse, moderately convex, widest in apical third, lateral sides weakly sinuate, hind angles obtuse; before base with small and shallow transverse impression; surface without microsculpture; punctation coarse, very dense and asperate; subconfluent in central part of disc, pubescence short and moderately dense, along midline directed anteriorly.

Elytra transverse, 1.2 times wider than their length at sides, slightly wider than pronotum, widest behind middle, lateral sides moderately arcuate, at suture as long as pronotum at midline, at sides distinctly longer than pronotum at midline; posterolateral angles weakly sinuate; surface lacking microsculpture; punctation similar to that on pronotum but finer and not subconfluent; pubescence short and dense, directed obliquely posteriorly.

Abdomen weakly constricted at base, widest at level of tergites 5 and 6, bases of tergites 3-5 each with deep transverse impression, impressions smooth and impunctate; tergal punctation fine and dense, tergite 8 with fine transverse microsculpture; pubescence relatively short and moderately dense.

Male. Tergite 8 as in Fig. 15, sternite 8 as in Fig. 16; aedeagus as in Figs 12 and 13.



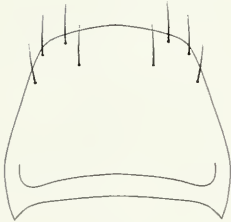
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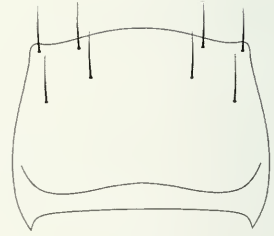
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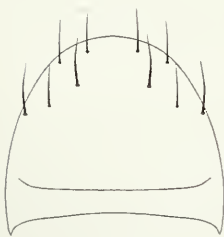
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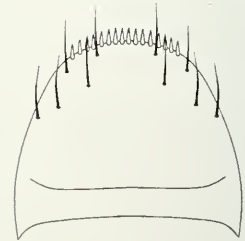
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17



16



18

FIGS 12-18

*Gnypeta sabangensis* sp. n.: 12 - aedeagus in lateral view, 13 - aedeagus in ventral view, 14 - spermatheca, 15 - male tergite 8, 16 - male sternite 8, 17 - female tergite 8, 18 - female sternite 8.

Female. Tergite 8 as in Fig. 17, sternite 8 as in Fig. 18; spermatheca as in Fig. 14.

*Remarks.* In general appearance and the shape of aedeagus, *Gnypeta sabangensis* sp. n. is similar to *G. modesta* Bernhauer, 1915 as well as its subspecies *celebensis* Pace, 1986. However, it may be readily distinguished from both by the darker body colour and the coarser punctation of head and pronotum. Additionally, it differs from the former by the more transverse pronotum and the eyes more protruding from the lateral contours of head, and the latter by the less transverse head and the more strongly narrowed temples.

*Gnypeta guineensis* sp. n.

Figs 19-21

*Material.* Holotype, ♀: Papua N. Guinea, env. Madang Nagada, VI.1979, leg. W. G. Ullrich (MHNG).

*Description.* Length 2.6 mm. Body convex, parallel-sided, weakly shiny; ground colour dark brown; pronotum brownish-red, elytra brown, with lateral sides blackish and posterior margin yellow, abdomen black with tergites 1-2 red, legs yellowish-red, antennae brown with antennomeres 1-3 and 11 red.

Head circular in outline, moderately convex, widest across eyes; eyes moderately large, protruding from lateral contours of head, eye length seen from above subequal to that of postocular region; temples gradually arcuately narrowed to hind angles; surface of head without microsculpture; punctation relatively coarse, dense and asperate; pubescence short and moderately dense, directed medially.

Antennae moderately short, clearly increasing in width apically, extending to 1/3 of elytra, antennomere 3 longer than 2, antennomeres 4-8 longer than wide, decreasing in length, antennomeres 9-10 quadrate, antennomere 11 as long as antennomeres 9 and 10 combined.

Pronotum slightly transverse, moderately convex, widest in apical third, lateral sides weakly sinuate, hind angles obtuse; before base with small and shallow transverse impression; surface without microsculpture; punctation coarse, umbilicate, very dense and asperate; pubescence short and moderately dense, along midline directed anteriorly.

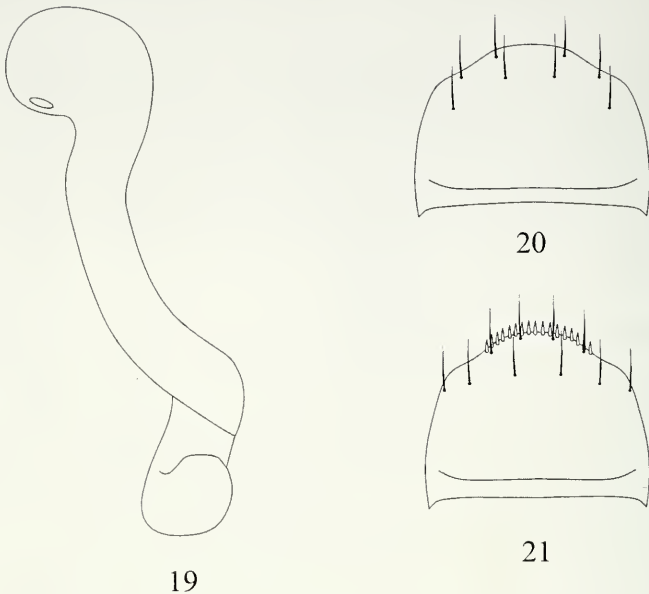
Elytra transverse, about 1.2 times wider than their length at sides, slightly wider than pronotum, widest behind middle, lateral sides moderately arcuate, at suture as long as pronotum at midline, at sides distinctly longer than pronotum at midline; postero-lateral angles weakly sinuate; surface lacking microsculpture; punctation similar to that on pronotum, but finer and slightly sparser; pubescence short and dense, directed obliquely posteriorly.

Abdomen weakly constricted at base, widest at level of tergites 5 and 6, bases of tergites 3-5 each with deep transverse impression, impressions smooth and impunctate; tergal punctation fine and moderately dense, tergite 8 with fine transverse microsculpture; pubescence relatively short and moderately dense.

Male unknown.

Female. Tergite 8 as in Fig. 20, sternite 8 as in Fig. 21; spermatheca as in Fig. 19.





FIGS 19-21

*Gnypeta guineensis* sp. n.: 19 - spermatheca, 20 - female tergite 8, 21 - female sternite 8.

*Remarks.* *Gnypeta guineensis* sp. n. differs from all other species of *Gnypeta* by the umbilicate pronotal punctation. In general appearance the new species is similar to *G. elegans* Bernhauer, 1902 and *Gnypeta sabangensis* sp. n., but it may be readily distinguished from both by the posteriad more strongly narrowed temples, the sparser abdominal punctation and by the elytral colour.

#### ACKNOWLEDGEMENTS

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## New Dacnusiini from the Iberian Peninsula and the Canary Islands (Hymenoptera, Braconidae, Alysiinae)

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**New Dacnusiini from the Iberian Peninsula and the Canary Islands (Hymenoptera, Braconidae, Alysiinae).** - Four species of Dacnusiini, two from the Iberian Peninsula: *Chorebus crenesulcis* and *C. fragilosus*, and two from Canary Islands: *Coloneura fuerteventurensis* and *C. ortegae*, are described as new, drawn, and are compared with allied species. Keys for their discrimination are provided.

**Key-words:** New species - *Chorebus* - Alysiinae - Braconidae.

### INTRODUCTION

Hymenoptera are characterized by their so-called haplo-diploidy. This means that males are haploid, females diploid. As a consequence, females lay eggs which, if not fertilized, give rise to males. Many descendants of a population may thus consist of males only until these males can copulate with the females. Then, the females will lay fertilized eggs only and these will give rise to female descendants. The result will be a sequence of generations which will consist alternatively predominantly either of females or males. One may therefore collect at the same time only females of one species and males of another species, i.e., specimens of different sex that do not necessarily belong to the same species.

In this article four species of Dacnusiini (Hymenoptera: Braconidae: Alysiinae), two from the Iberian Peninsula: *Chorebus crenesulcis* and *C. fragilosus*, and two from Canary Islands: *Coloneura fuerteventurensis* and *C. ortegae*, and are described as new, drawn, and are compared with allied species. Keys for their discrimination are provided.

The specimens of this study are preserved in the following Institutions: Holotypes at the Muséum d'histoire naturelle de Genève (MHNG); paratypes at the Institut Cavanilles de Biodiversitat i Biologia Evolutiva (ICBBE).



Abbreviations used in the descriptions: IOL = postocellar line = interocellar line. OOL = oculo-ocellar line. F, F1, F2 etc. : Flagellomere (s), Flagellomere 1, 2 etc., Fm, Fp = middle Flagellomere (s), penultimate Flagellomere. T, T1, T2 = tergite (s), first, second tergite. st = pterostigma. r, r1, r2 = radial vein, first, second abscissa of radius. cc = cubital cross vein. nr = recurrent vein (Nervus recurrens). b = basal vein. cu2 = 2nd abscissa of cu (= cubital vein). d = discoidal vein. nv = nervulus. np = parallel vein (nervus parallelus). R = radial cell. B = brachial cell. nr' = radiellus (radial vein of hind wing). cu2' = second abscissa of cubital vein of hind wing. nr' = recurrent vein of hind wing.

## SYSTEMATIC PART

### DACNUSINI Förster

Diagnosis: Remarks on Dacnusiini of the Dacnusa-genus group (*Dacnusa* Haliday, *Chorebus* Haliday, *Coloneura* Foerster and others) in general: a) The mandible has an outer surface, an inner surface, and a dorsal surface. The latter is delimited from the outer surface by a strong lamella. As a rule, as well as the inner surface, it is not visible in the resting position of the mandible; b) If not stated otherwise: maxillary palpi 6-segmented, not longer than height of head; labial palpi 4-segmented; c) Clypeus is about 3-times as wide as high, shiny, with a few setae, projecting from face at an obtuse angle; upper and lower edges somewhat bent and parallel; d) Hind mesopleural furrow, prepectal furrow, and furrows of sides of pronotum smooth, unless otherwise stated; e) The wing membrane is nearly always hyaline; f) The pterostigma is nearly always longitudinally folded in dried specimens, thus hindering visualization of its true width. The relative proportions given refer to the visible, not true width of the pterostigma. The data given relative to the pterostigma are therefore only approximate; g) Hind wing with no peculiarities, this means r' and cu2' indicated, if at all, only as folds; nr' absent.

### *Coloneura* Foerster

#### *Coloneura fuerteventurensis* sp. n.

Figs 1, 2

*Holotype female*: Canary Islands, Fuerteventura, Villaverde, 18.II.1980, leg. G. Ortega, Museo Insular Ciencias Nat., Hy 4157 (MHNG).

*Paratypes*: 1 female, same data as holotype (ICBBE); 1 female, same locality, but 21.II.1980, leg. M. Báez (ICBBE).

*Etymology*: The name indicates the original locality.

*Taxonomic position*: The species runs to *Coloneura moskovita* Tobias, 1986 in key of Tobias (1986). The two species can be distinguished as follows:

1. Precoxal sulcus absent. T1 entirely glabrous. r2 completely and evenly bent. Antennae 18-segmented Russia: Moscow region  
 ..... *moskovita* Tobias, female/male
- Precoxal sulcus weakly crenelated (Fig. 1). T1 longitudinally striated (Fig. 2). r2 not evenly bent, but distal half nearly straight, at most with S-shaped outline (Fig. 1). Antennae 24-segmented. Canary Islands  
 ..... *fuerteventurensis* sp. n., female

FEMALE. – Length of body: 2.2 mm.

*Head*: 1.5-times as wide as long between eyes, 2.1-times as wide as face, 1.4-times as wide as mesoscutum, at most 3-fold width behind eyes; temples 1.8-times as long as eyes; antennal sockets as distant from each other as from eyes; occiput clearly bent inwards. IOL greater than width of one ocellus wide; OOL longer than width of ocellar area. Upper side inconspicuously setose laterally and on occiput. Epicranial suture weak, with a very weak epifrontal suture. Face 1.1-times as wide as high, central elevation very weak, long, whitish, felt-like setae in central area, setae of lateral areas inconspicuous, inner edges of eyes only weakly bent. Tentorial pits small. Clypeus ordinary in shape. Mandible as long as apically wide, denticle 1 blunt, slightly deflected sideways, denticle 2 pointed, denticle 3 very broad and rounded, incisions between denticles; outer surface rugose, upper surface delimited by a keel, glabrous; maxillary palpi 6-segmented, labial palpi 4-segmented. Antennae about as long as body, 24-segmented: F1 4-times, F2-F5 about 2.5-times, remainder about twice as long as wide, numerous setae shorter than width of F; in lateral view 3 or 4 sensilla visible.

*Mesosoma*: 1.4-times as long as high, upper side bent. Mesoscutum 1.4-times as wide as long; a few setae along the imaginary course of the notauli and on the declivity; dorsal fovea moderately elongate; notauli only developed on declivity and crenelated, passing into the lateral furrows. Praescutellar fovea divided, lateral areas with faint folds. Axillae and scutellum setose. Postaxillae and lateral areas of metascutum smooth. Propodeum rugose, with some white setae, especially laterally. Anterior furrow of sides of pronotum smooth. Precoxal sulcus (Fig. 1) narrow, crenelated; praepectal and epicnemial furrow crenelated. Metapleuron seta-pointed partly smooth. Hind femur 5-times as long as wide; hind tarsus slightly shorter than its tibia.

*Wing* (Fig. 1): fore wing: st parallel-sided, distal part twice as long as metacarp, proximal part as long as r1; distal half of r2 very weakly sinuate, nearly straight; R ending before tip of wing; nr antefurcal; d 1.5-times as long as nr; nv slightly postfurcal; B open; culb absent; a2 present, but weakened distally; hind wing with normal structure.

*Metasoma*: T1 (Fig. 2) nearly as long as wide, nearly parallel-sided, basally only slightly narrowed, irregularly and longitudinally striate, dorsal carinae short. Ovipositor sheaths concealed.

*Colouration*: Black. Yellow: anellus, mouth parts, all legs, tegulae, and wing venation. Very faintly darkened: base of hind coxa, tips of hind femur and hind tibia, hind tarsus.

*Variation*: One example with dull yellowish T2+3.

MALE. – Unknown.

*Coloneura ortegae* sp. n.

Fig. 3

*Holotype male*: Canary Islands, Fuerteventura, Villaverde, 18-II-1980, leg. G. Ortega, Museo Insular ciencias Nat., Hy 4155 (MHNG).

*Paratypes*: 1 male, 4158, same data as holotype (ICBBE); 1 male, same island, but Los Molinos, 22-II-80, leg. M. Báez (ICBBE).

*Etymology*: Dedicated to the collector Gloria Ortega.

*Taxonomic position:* This species runs to *Coloneura siciliensis* Griffiths, 1968 in the keys of Griffiths (1968a) and Tobias (1986). The two species can be distinguished as follows:

1. Propodeum and T1 smooth. Anetnae 18-articulated. 1.4 mm. Sicily  
 ..... *siciliensis* Griffiths, female/male
- Propodeum rugose. T1 (Fig. 3) longitudinally striated. Antennae 23-24-articulated. 1.7 mm. Canary Islands ..... *ortegae* sp. n., male

MALE – Body length: 1.5 mm.

*Head:* 1.6-times as wide as long between eyes, 2.3-times as wide as face, 1.3-times as wide as mesoscutum, strongly widened behind eyes; temples twice as long as eyes, occiput bent inwards, antennal sockets as distant from each other as from eyes; upper side with inconspicuous setae laterally and on occiput; epicranial suture between ocelli; IOL longer than diameter of one ocellus; OOL longer than width of ocellar area; an inconspicuous epifrontal depression in front of ocelli. Face 1.3-times as wide as high; lateral areas with long erect setae and short setae; middle keel weakly indicated only above; eye edges weakly curved. Clypeus and labrum with long setae and recognizable seta points. Mandible about as long as wide, parallel-sided, but somewhat deflected upwards as a whole; denticle 1 broad, blunt, forming a right angle; denticle 2 pointed and projecting; denticles 3 and 4 small, retracted; small incisions between denticles 1, 2 and 3; outer surface coarsely reticulate, upper surface smooth; palpi short. Antennae 23-articulated, only slightly longer than body; F1 3-times as long as wide; following ones and Fp about twice as long as wide; most setae shorter than width of F, in lateral view 3 sensilla visible.

*Mesosoma:* 1.25-times as long as high, upper side slightly curved. Mesoscutum 1.25-times as wide as long; some setae on declivity and along the imaginary course of notauli hardly recognizable; dorsal fovea slightly elongated; notauli absent. Praescutellar fovea with some longitudinal carinae. Axillae setose. Postaxillae and lateral areas of metascutum shiny. Propodeum with delicate rugosity and weak, curved fold from middle of front margin to sides, with some setae laterally. Prexocal sulcus absent. Metapleuron inconspicuously seta-pointed posteriorly. Hind femora 5-times as long as wide; hind tarsus scarcely shorter than its tibia.

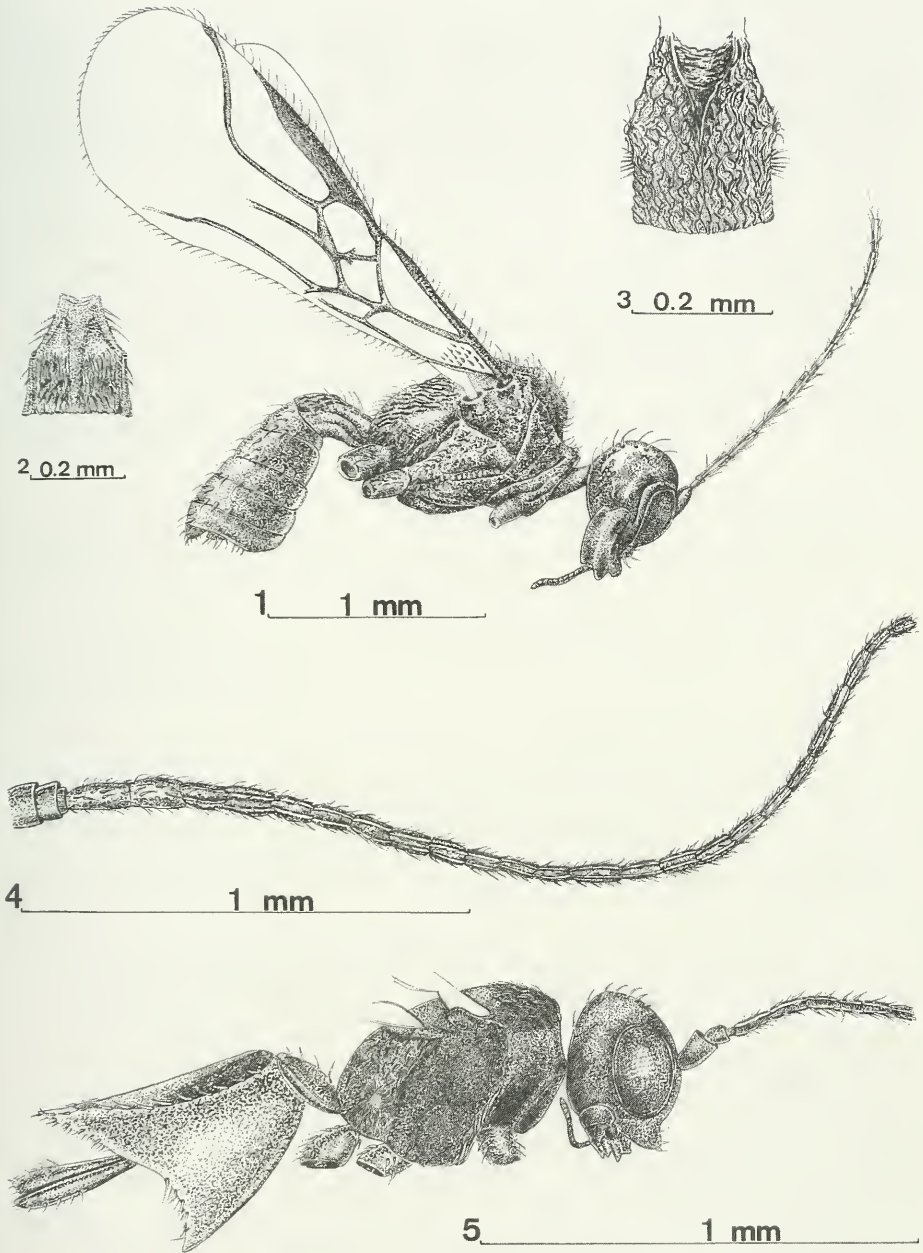
*Wings:* st parallel-sided, distal part twice as long as metacarp, proximal part as long as r1; distal half of r2 sinuate; R ending before tip of wing; d 1.2 times as long as nr; b and nr parallel; nv slightly postfurcal; B incompletely closed (culb obliterated); np arises from middle of B; hind wing normal.

*Metasoma:* T1 (Fig. 3) 1.5-times as long as wide, parallel-sided, irregularly and longitudinally striate, dorsal carinae only straight and well-differentiated in front.

*Coloration:* Black. Yellow: anelli, mouth parts, tegulae and wing venation. Legs predominantly dark. T2 brown.

*Variation:* One example with 24 antennal segments, and T1 scarcely striated.

FEMALE. – Unknown.



FIGS 1-5

*Coloneura fuerteventurensis* sp. n. (female). Body in lateral view (1); T1: First tergite of metasoma (2). *Coloneura ortegae* sp. n. (male). T1: First tergite of metasoma (3). *Chorebus crenulicis* sp. n. (male). Antenna (4). *Chorebus fragilosus* sp. n. (female). Body in lateral view (5).



*Chorebus* Haliday

The two following species described – *Chorebus crenesulcis* sp. n. and *Chorebus fragilosus* sp. n. – look similar when viewed superficially. However, they show differences that are commonly taken as specific characters. Since one species is based on a female, the other on a male, one could speculate that they might be the female and male of the same species. Readers are referred to the introduction.

*Chorebus crenesulcis* sp. n.

Fig. 4

Holotype male: España, Valencia, El Saler (Viveros), T.N., 29-X/1-XI-1991, leg. F. Luna - J.V. Falcó (MHNG).

*Etymology*: This abbreviation stands for crenelatisulcis. It is reminiscent of the crenelated precoxal sulcus, prepectal suture, and epicoxal suture.

*Taxonomic position*: This species runs in keys of Griffiths (1968b) and Tobias (1986) to *Chorebus geminus* (Tobias, 1962) from which it can be distinguished as follows:

1. T1 2.5-times as long as apically wide. Antennae 39-articulated, twice as long as body, apical flagellomeres 2.5-times as long as wide. Head narrowed behind eyes. 2.3 mm. Azerbaijan . . . . . *geminus* Tobias, female
- T1 1.6-times as long as apically wide. Antennae (Fig. 4) 26-articulated, 1.5-times as long as body, apical flagellomeres twice as long as wide. Head between temples as wide as between eyes. 1.6 mm. Iberian Peninsula . . . . . *crenesulcis* sp. n., male

MALE. – Body length: 1.6 mm.

*Head*: twice as wide as long, 1.75-times as wide as the face, 1.33-times as wide as mesoscutum; eyes as long as temples; between temples as wide as between the eyes; occiput slightly bent inwards; antennal sockets as distant from each other as from eyes; upper side with inconspicuous setae laterally and on occiput, OOL longer than width of ocellar area; IOL longer than the diameter of one ocellus; epicranial furrow distinct. Face 1.75-times as wide as high, with scattered setae, seta points recognizable; middle elevation scarcely developed and bare; edges of eyes nearly parallel-sided. Clypeus of ordinary shape. Mandibles parallel-sided, as wide as along length of middle line; denticle 2 pointed and strongly projecting; denticles 1, 3 and 4 also pointed, but shorter and somewhat bent outwards; incisions between the denticles; outer surface uneven and with long setae basally; from denticle 1 arises a small lamella; palpi about as long as height of the head. Antennae (Fig. 4) 1.5-times as long as body, 26-articulated; F1 5-times, F2 a little wider and 3-times, Fm and Fp twice as long as wide; the longest setae as long as width of F; in lateral view 2 sensilla recognizable.

*Mesosoma*: 1.4-times as long as high, upper side only weakly arched. Mesoscutum 1.3-times as wide as long; notauli almost absent, evenly and densely setose with visible seta points especially on declivity, dorsal fovea small. Prescutellar fovea divided; lateral areas quadrate. Axillae setose. Scutellum with fewer setae. Postaxillae smooth. Metascutum with smooth lateral areas and a blunt medial lamella. Propodeum with weakly developed, broad pentagonal area and small basal keel, with white, scattered seta, which do not hide the surface. Anterior furrow of sides of pronotum deli-

cately rugose. Precoxal sulcus narrow, densely crenelated, shortened behind, reaching anterior edge of mesopleuron; prepectal furrow narrowly crenelated, passing into the crenelated epicoxal furrow; subalar area separated by a lamella; area above middle coxa with long, white setae. Metapleuron with numerous long, white setae, some of them forming a rosette around a central tubercle. Hind coxa with some long, scattered setae, but without a real tuft of setae. Hind femora 5-times as long as wide, hind tarsi as long as their tibiae.

*Wings:* st nearly parallel-sided, distal part twice as long as metacarp, proximal part as long as r1; r1 slightly longer than st wide; distal half of r2 nearly straight (scarcely recognizable, sinuate); nr antefurcal; d 1,1-times as long as nr; b and nr parallel; nv postfurcal; B open on lower distal corner; culb absent.

*Metasoma:* T1 1,6-times as long as apically wide; parallel-sided, narrowed only right in front, irregularly rugose; dorsal lamellae converging and forming a medial keel, with scattered setae, some outstanding setae on sides. T2 with a few long setae at base; the T for the rest with a single cross-row of long setae each.

*Colouration.* Yellow: anellus, clypeus, mouth parts, mesosoma except mesoscutum and scutellum, legs, tegulae, wing venation, and anterior half of metasoma. Dark to black: antennae, mesoscutum, scutellum, T3 and the following T. Mesopleuron brownish. Hind tibiae and hind tarsi slightly darkened.

FEMALE. – Unknown.

*Chorebus fragilosus* sp. n.

Fig. 5

*Holotype female:* España, Valencia, El Saler (Viveros), T.M. 29-X-1991, leg. F. Luna - J.V. Falcó (MHNG).

*Etymology:* The name fragilosus is an abbreviation for fragilipilosus. It refers to the very weak pubescence of the propodeum and metapleuron.

*Taxonomic position:* The species runs in keys of Griffiths (1968b) and Tobias (1986) to *Chorebus canariensis* Griffiths, 1967 from which it can be distinguished as follows:

1. Precoxal sulcus narrow, crenelated, reaching from anterior edge to near the middle coxa. Propodeum with white, felt-like setae. Mesosoma and metasoma black, the latter only medially yellow. Ovipositor sheaths not projecting. Canary Islands . . . . . *canariensis* Griffiths, female/male
- Precoxal sulcus smooth, nearly absent (Fig. 5). Propodeum not white, felt-like setose, but scarcely pubescent. Mesosoma and anterior half of metasoma predominantly yellow. Ovipositor sheaths long, somewhat projecting (Fig. 5). Iberian Peninsula . . . . . *fragilosus* sp. n., female

FEMALE. – Body length: 1.3 mm.

*Head:* 1.9-times as wide as long, 1.5-times as wide as mesoscutum, 1.8-times as wide as face; eyes as long as temples; between eyes as wide as between temples; occiput moderately bent inwards; distance between antennal sockets and their distance from eyes as great as their diameter; upper side only with some inconspicuous setae laterally and on occiput; epicranial suture faint, with a longitudinal depression in front

of anterior ocellus; OOL greater than width of ocellar area; IOL greater than diameter of one ocellus. Face 1.5-times as wide as high, evenly convex, without delimited central elevation, with some inconspicuous setae only. Clypeus of ordinary shape, clearly arched. Tentorial pits round, their diameter smaller than distance from eyes. Mandible as wide as medially long, parallel-sided; denticle 1 blunt; denticle 2 pointed and projecting; denticles 3 and 4 blunt and retracted; small incisions between denticles; outer surface weakly rugose; palpi rather short. Antennae as long as body, 20-articulated; F1 3-times as long as wide, the following slightly shorter; Fm and Fp twice as long as wide; setae shorter than width of F; sensilla hardly visible.

*Mesosoma*: Mesoscutum 1.3-times as wide as long, with short, white setae evenly distributed over surface, hard, with a small bare area on lateral lobes behind; notauli only on declivity, anteriorly delimited by a weak carina, which passes into the lateral carina; only one very small dorsal pit. Prescutellar furrow deep, divided by a keel. Axillae and scutellum with a few white setae. Postaxillae smooth. Lateral areas of metascutum smooth, narrow, delimited by faint carinae, with a central lamella and a blunt tooth. Propodeum somewhat rugose, with short, white setae, which do not hide the surface. Precoxal sulcus (Fig. 5) absent. Metapleuron with numerous white setae, which do not hide the surface; seta points visible; central elevation present, but weakly developed. Hind femur 5- times as long as wide, hind tibia only slightly longer than its tarsus.

*Wings*: st nearly parallel-sided, distal part twice as long as metacarp, proximal part shorter than r1; r2 nearly straight in distal half; R ending before tip of wing; nr antefurcal, d 1.2-times as long as nr; b and nr parallel; nv clearly postfurcal; culb absent; B therefore open on lower outer corner.

*Metasoma*: T1 1.1-times as long as apically wide, evenly narrowed towards base; stigmata on small tubercles, converging dorsal carinae on basal half; central stripe slightly arched and rugose; lateral areas uneven, shiny, the setae do not hide the surface; a few laterally projecting setae on sides. Tip of metasoma pointed; hypopygium not reaching tip of metasoma. Ovipositor sheaths (Fig. 5) three quarters as long as hind tibia (lateral view), projecting somewhat beyond tip of metasoma.

*Colouration*: Yellow: scape, pedicel, anellus, mouth parts, legs, tegulae, wing venation, anterior half of metasoma, and hypopygium. Dark: head, antennae, the rest of the metasoma, and ovipositor sheaths. Hind tibiae and hind tarsi weakly infuscated.

MALE. – Unknown.

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## Nouvelles considérations sur la systématique et la biogéographie du genre *Butheoloides* Hirst (Scorpiones, Buthidae) avec description d'un nouveau sous-genre et de deux nouvelles espèces

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**New considerations on the taxonomy and biogeography of the genus *Butheoloides* Hirst (Scorpiones, Buthidae) with the descriptions of a new subgenus and two new species.** - One new sub-genus and two new species belonging to the genus *Butheoloides* Hirst, 1925 are described from Morocco and Algeria. With the description of *Butheoloides* (*Gigantoloides*) *aymerichi* sp. n., and *Butheoloides* (*Butheoloides*) *schwendingeri* sp. n., the total number of known species is raised to ten. A Perisaharian pattern of distribution is confirmed for this genus.

**Key-words:** *Butheoloides* - Buthidae - Morocco - new species - North Africa - scorpion.

### INTRODUCTION

Le genre *Butheoloides* fut décrit pour la première fois par Hirst (1925). Il a été fondé sur l'espèce *Butheoloides maroccanus*, habitant les flancs des montagnes de l'Atlas dans la région d'Amizmiz au sud de Marrakech au Maroc. Le genre demeure monotypique jusqu'à la description par Vachon (1948) de *Butheoloides milloti* de la région des falaises de Bandiagara au sud de Tombouctou au Mali. Une troisième espèce, *Butheoloides monodi* a également été décrite par Vachon (1950) de Fissel à l'ouest du Sénégal.

Plus récemment, cinq nouvelles espèces ont été décrites: *Butheoloides annieae* Lourenço de la région du Lamto en Côte d'Ivoire, *Butheoloides wilsoni* Lourenço de la région d'Ouessa au Burkina Faso, *Butheoloides polisi* Lourenço de la basse vallée de l'Omo, près de Kelan en Ethiopie, *Butheoloides hirsti* Lourenço de Mvolo au Soudan et *Butheoloides charlotteae* Lourenço de Pandam State au Nigéria (Lourenço, 1986, 1995, 1996, 2000). Avec ces nouvelles descriptions, l'aire globale de répartition du genre a été considérablement élargie.

Le genre *Butheoloides* demeure néanmoins discret, avec un nombre peu élevé d'espèces, lesquelles, à l'exception de *B. annieae*, peuvent être considérées comme rares; ceci sans doute en raison des très faibles densités des populations.

<sup>1</sup> Etude subventionnée par le Département municipal des affaires culturelles de la Ville de Genève.

A présent l'étude de deux exemplaires collectés respectivement au Maroc et en Algérie, amène à la description d'un nouveau sous-genre et de deux nouvelles espèces. Les descriptions sont suivies de quelques considérations sur le type de répartition géographique du genre *Butheoloides*. Les holotypes sont déposés au Muséum d'histoire naturelle de Genève.

***Butheoloides (Gigantoloides)* subgen. n.**

*Diagnose:* Scorpion de taille moyenne, avec une longueur totale d'environ 46/47 mm, bien supérieure à celles des espèces du sous-genre *Butheoloides*, qui varie de 17 à 20 mm. Par sa morphologie générale et pour certains caractères, tels la forme du sternum et des peignes, les anneaux du metasoma arrondis, le nouveau sous-genre se rapproche du genre *Butheoloides*. Carènes des pédipalpes et du corps faiblement marquées. Une seule carène axiale sur les tergites, peu marquée; tergite VII avec cinq carènes. Carènes des anneaux I-II du metasoma bien marquées; celles de l'anneau III moyennement marquées; anneaux IV-V arrondis, avec des carènes faiblement marquées. Peignes petits avec fulcres. Eperons tibiaux aux pattes III et IV, mais réduits sur la III. Chélicères avec la dentition caractéristique des Buthidae (Vachon, 1963); les deux dents basales du doigt mobile très réduites et fusionnées. Pincés des pédipalpes très fines et allongées; tranchant des doigts fixe et mobile des pédipalpes avec 11/12 séries de granulations presque obliques; extrémité des doigts avec un gros granule spinoïde dirigé vers l'intérieur. Trichobothriotaxie du type A, disposition  $\alpha$  pour les trichobothries de la face dorsale du fémur (Vachon, 1974, 1975).

Le nouveau sous-genre *Gigantoloides* rappelle le sous-genre *Butheoloides*, par différents aspects de sa morphologie (voir ci avant). Il peut néanmoins être distingué de celui-ci (i) une taille globale nettement plus importante (ii) les dents basales du doigt mobile des chélicères très réduites et fusionnées (iii) 12/11 séries presque obliques de granules sur le tranchant des doigts mobile et fixe des pédipalpes (iv) présence d'une épine sous-aiguillonnaire spinoïde et bien développée (v) vésicule granulée, et par (vi) stigmates courts-linéaires. Chez le sous-genre *Butheoloides* (i) la taille globale est réduite (ii) les dents basales du doigt mobile des chélicères ne sont pas fusionnées (iii) les doigts des pédipalpes présentent généralement 8-9 séries de granules (iv) l'épine sous-aiguillonnaire est réduite avec une forme de mamelon ou absent (v) la vésicule est lisse (vi) les stigmates sont semi-ovales.

*Espèce type du sous-genre nouveau: Butheoloides (Gigantoloides) aymerichi* sp. n.

***Butheoloides (Gigantoloides) aymerichi* sp. n.**

Figs 1-6

Holotype femelle: Maroc, 7 km de Tinerhir, Camping Atlas, région de Palmeraie (1360 m), VIII/2000 (M. Aymerich coll.).

Étymologie: Le nom spécifique est créé en hommage à M. Michel Aymerich (Montpellier, France) collecteur du spécimen type.

*Diagnose:* la même que pour le sous-genre *Gigantoloides*.

*Description basée sur l'holotype femelle.* Mensurations dans le Tableau I.

Coloration générale jaunâtre avec seuls les anneaux IV et V du metasoma rougâtres. Plaque prosomienne jaunâtre avec quelques taches foncées très estompées sur

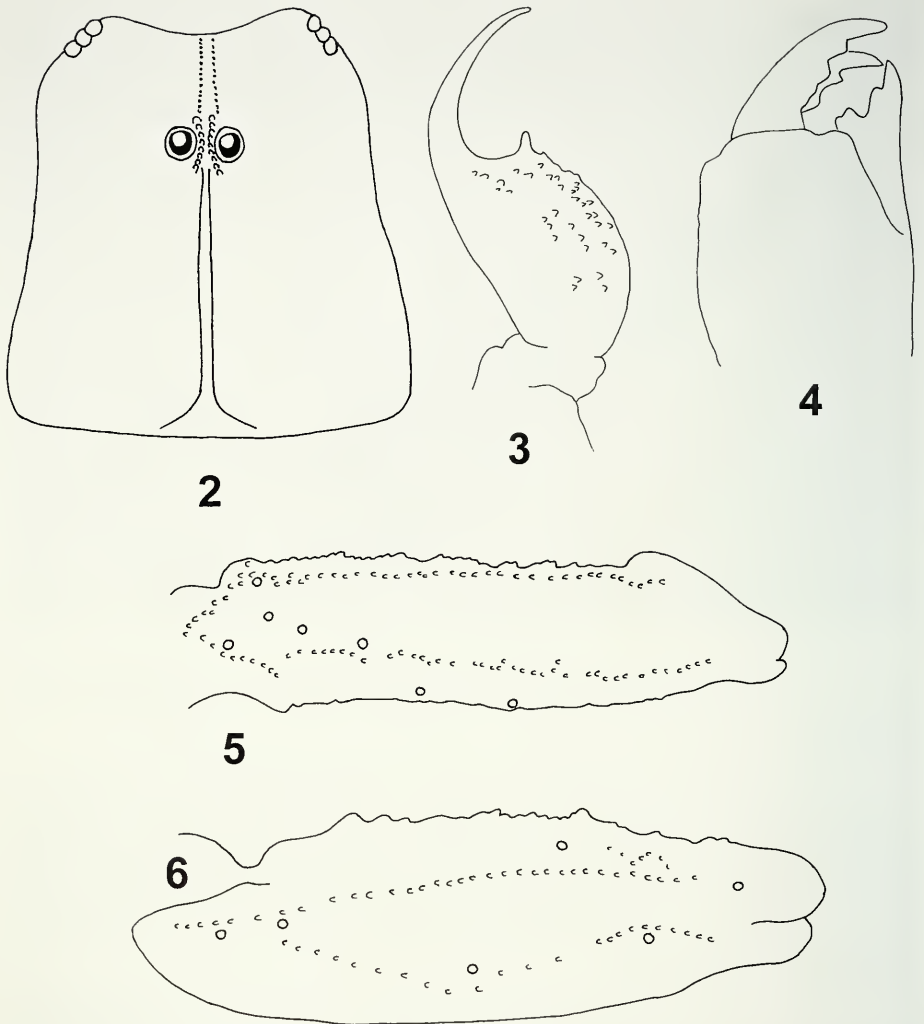


FIG. 1

*Butheoloides (Gigantoloides) aymerichi* sp. n., femelle holotype dans son habitat naturel (photo M. Aymerich).

la région antérieure; yeux noirâtres. Mesosoma jaunâtre. Anneaux metasomiaux I-II jaunâtres; III jaune rougeâtre; IV-V rougeâtres. Telson: vésicule jaune rougeâtre; aiguillon jaune rougeâtre à la base et rougeâtre à l'extrémité. Peignes, opercule génital, sternum, hanches et processus maxillaire jaune pâle. Pattes jaunâtres. Pédipalpes jaunâtres; pinces à main jaunâtres et doigts plus sombres. Chélicères jaune clair dépourvues de toute tache ou trame.

Morphologie. Prosoma: plaque prosomienne avec concavité frontale moyennement prononcée; tubercule oculaire nettement antérieur par rapport au centre de la plaque prosomienne; yeux médians de taille moyenne, séparés par un diamètre oculaire environ; trois paires d'yeux latéraux. Carènes pratiquement absentes; granulations moyennement à faiblement marquées. Mesosoma: tergites faiblement granulés, presque lisses; carène axiale présente sur les tergites I à VII, mais faiblement marquée; tergite VII avec 5 carènes. Metasoma: anneaux arrondis avec des granulations éparées et des carènes moyennement marquées. Telson: vésicule pourvue de gros granules; une carène présente sur la face ventrale; aiguillon plus court que la vésicule, très incurvé, pourvu d'une épine sous-aiguillonnaire spinoïde, bien développée. Sternites à stigmates petits et linéaires. Peignes avec 18-18 dents. Pédipalpes: fémur à 5 carènes; tibia avec carènes dorsales et internes pourvues de nombreux granules, face interne avec plusieurs granules spiniformes; pince lisse. Tranchant des doigts fixe et mobile avec 11-12 séries de granules. Chélicères avec la dentition caractéristique des Buthidae



FIGS 2-6

*Butheoloides (Gigantoloides) aymerichi* sp. n. (femelle holotype). 2. Carapace, vue dorsale. 3. Telson, vue latérale. 4. Chélicère, vue dorsale. 5. Fémur du pédipalpe, vue dorsale. 6. Tibia du pédipalpe vue dorsale.

(Vachon, 1963), cependant deux dents basales du doigt mobile très réduites et fusionnées. Trichobothriotaxie du type A- $\alpha$ . orthobothriotaxique (Vachon, 1974, 1975).

*Butheoloides (Butheoloides) schwendingeri* sp. n.

Figs 7-11

Holotype femelle: Algérie, Sidi Moussa Oued (canyon), 8/V/1973 (Cl. Girard).

Etymologie: Le nom spécifique est créé en hommage au Dr Peter Schwendinger conservateur de la collection des Arthropodes au Muséum d'histoire naturelle de Genève.



*Diagnose:* *Butheoloides (Butheoloides) schwendingeri* sp. n. est une espèce voisine de *Butheoloides maroccanus*, elle peut cependant être distinguée de cette dernière par une pigmentation plus claire. Chez *B. (B.) schwendingeri* sp. n. les pédipalpes et les pattes sont globalement jaune-clair dépourvus de taches, tandis que chez *B. maroccanus* les pédipalpes sont plus foncés, rougeâtres et les pattes sont jaune ocre avec des pigments sombres. Par ailleurs, chez *B. (B.) schwendingeri* sp. n., la plaque prosomienne présente une concavité frontale plus profonde que chez *B. (B.) maroccanus*. De plus, les granules spiniformes de la face interne du fémur et du tibia des pédipalpes sont nettement moins marqués chez la nouvelle espèce, et les valeurs morphométriques diffèrent (cf. Tableau I).

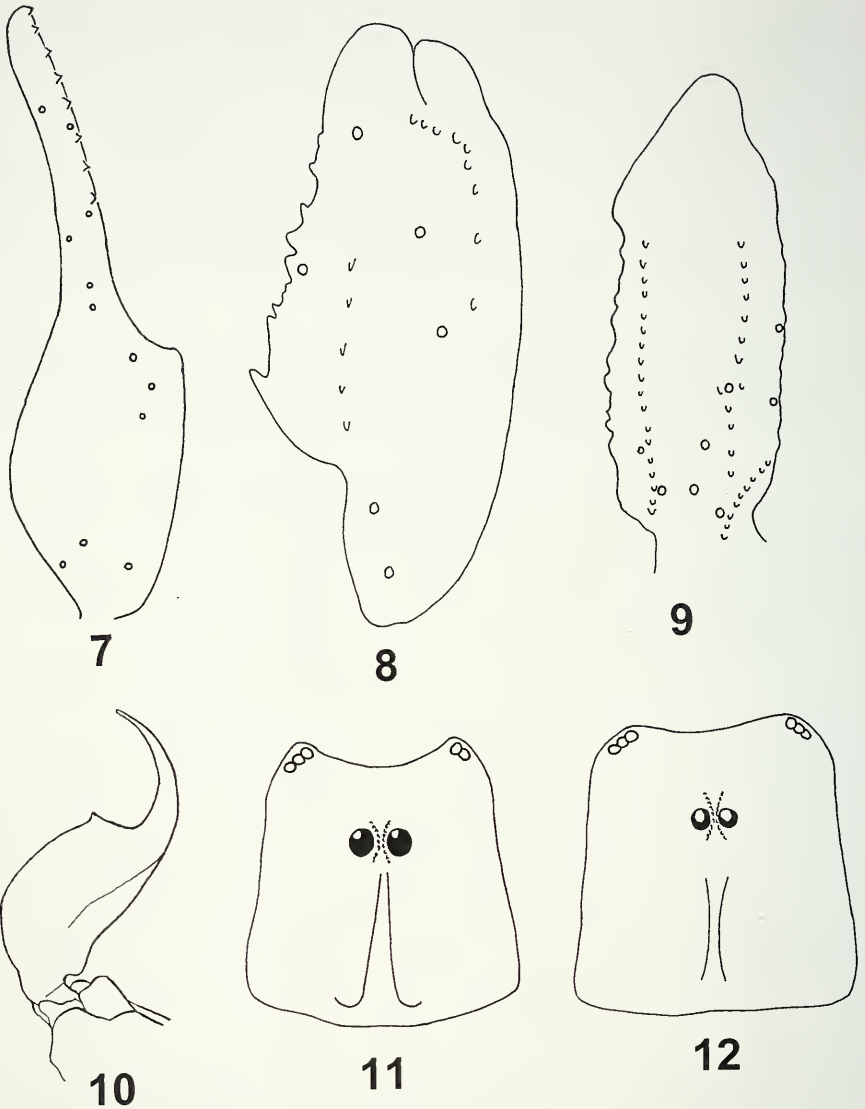
TABLEAU I. Mensurations (en mm) des holotypes de *Butheoloides (G.) aymerichi* sp. n. et *Butheoloides (B.) schwendingeri* sp. n., et d'un topotype femelle de *B. (B.) maroccanus* <sup>2</sup>

	<i>B. (G.) aymerichi</i>	<i>B. (B.) schwendingeri</i>	<i>B. (B.) maroccanus</i>
Longueur totale	46,9	18,8	22,3
Prosoma			
- Longueur	4,6	2,3	2,6
- Largeur antérieure	3,1	1,6	2,0
- Largeur postérieure	4,7	2,2	2,7
Anneau caudal I			
- Longueur	3,4	1,8	2,0
- Largeur	2,4	1,4	1,6
Anneau caudal V			
- Longueur	5,2	2,8	3,0
- Largeur	2,3	1,4	1,5
- Hauteur	2,0	1,2	1,3
Vésicule			
- Largeur	1,8	1,1	1,2
- Hauteur	1,5	1,0	1,1
Pédipalpe			
- Fémur longueur	4,9	2,0	2,4
- Fémur largeur	1,2	0,7	0,9
- Tibia longueur	5,7	2,4	2,8
- Tibia largeur	1,7	1,0	1,2
- Pince longueur	9,5	4,1	4,7
- Pince largeur	1,7	1,2	1,3
- Pince hauteur	1,6	0,9	1,1
- Doigt mobile longueur	6,3	2,0	3,0

<sup>2</sup> Deux exemplaires topotypes sont également déposés au Muséum d'histoire naturelle, Genève

*Description basée sur l'holotype femelle.* Mensurations dans le Tableau I.

Coloration générale jaunâtre. Plaque prosomienne jaunâtre avec quelques petites taches brunâtres estompées; yeux noirs. Mesosoma jaunâtre avec des taches brunâtres estompées, plus marquées sur les quatre premiers tergites. Anneaux I-II du metasoma jaunâtres; III-V rougeâtres. Telson: vésicule rougeâtre, plus claire que l'anneau V; aiguillon jaunâtre à la base et rougeâtre à l'extrémité. Peignes, opercule



FIGS 7-12

FIGS 7-11. *Butheoloides* (*Butheoloides*) *schwendingeri* sp. n. (femelle holotype). 7. Pince, vue externe-dorsale. 8. Tibia du pédipalpe, vue dorsale. 9. Femur du pédipalpe, vue dorsale. 10. Telson, vue latérale. 11. Carapace, vue dorsale. FIG. 12. Idem, *B. (B.) maroccanus* (femelle).

général, sternum, hanches, processus maxillaire et sternites jaune pâle. Pattes jaune pâle. Pédipalpes jaunâtre; pinces avec les doigts foncés dans leur région basale. Chélicères jaune clair dépourvues de toute tache ou trame.

Morphologie. Prosoma: plaque prosomienne avec une concavité frontale profonde; tubercule oculaire nettement antérieur par rapport au centre de la plaque pro-

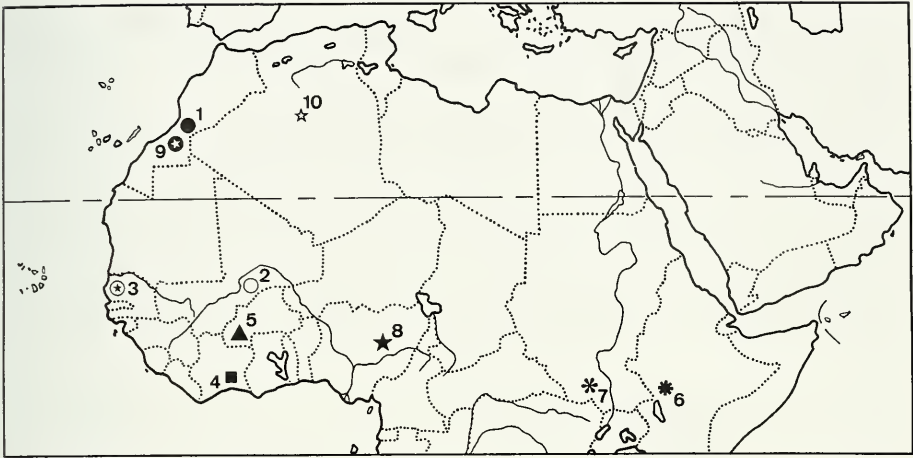


FIG 13

Répartition connue des espèces du genre *Butheoloides*. 1. *Butheoloides* (*B.*) *maroccanus*. 2. *Butheoloides* (*B.*) *milloti*. 3. *Butheoloides* (*B.*) *monodi*. 4. *Butheoloides* (*B.*) *anniae*. 5. *Butheoloides* (*B.*) *wilsoni*. 6. *Butheoloides* (*B.*) *polisi*. 7. *Butheoloides* (*B.*) *hirsti*. 8. *Butheoloides* (*B.*) *charlotteae*. 9. *Butheoloides* (*G.*) *aymerichi* sp. n. 10. *Butheoloides* (*B.*) *schwendingeri* sp. n.

somienne; yeux médians de taille moyenne, séparés par plus d'un diamètre oculaire; trois yeux latéraux du côté gauche et deux à droite (tératologie fréquente chez les Buthidae; cf. Lourenço, 1984). Carènes pratiquement absentes; granulations très fines et peu marquées. Mesosoma: tergites faiblement granulés; carène axiale très faiblement marquée. Metasoma: anneaux arrondis; quelques granulations éparses sur les anneaux I-II; anneaux III-V lisses; carènes peu marquées sur les anneaux I-II, absentes ou très réduites sur les anneaux III-V; carènes ventrales et latéro-ventrales absentes. Telson: vésicule faiblement granulée, presque lisse; aiguillon plus court que la vésicule, incurvé, pourvu d'une épine sous-aiguillonnaire faiblement développée, en forme de mamelon. Sternites à stigmates très petits, semi-ovales. Peignes avec 13-13 dents. Pédipalpes: fémur à 5 carènes; tibia lisse à carènes peu définies, carènes interne et dorso-interne plus marquées, face interne avec quelques granules spiniformes; fémur finement granulé; pince lisse; tranchant des doigts fixe et mobile avec 8-9 séries de granules. Chélicères avec la dentition caractéristique des Buthidae (Vachon, 1963); doigt mobile à deux dents basales et une sub-distale. Trichobothriotaxie du type A- $\alpha$ , orthobothriotaxique (Vachon, 1974, 1975).

#### CONSIDÉRATIONS BIOGÉOGRAPHIQUES ET ÉCOLOGIQUES

Vachon (1950) signalait déjà une répartition particulièrement localisée des trois espèces connues à l'époque pour le genre *Butheoloides* (*B. maroccanus* du Maroc, *B. milloti* du Mali et *B. monodi* du Sénégal).

Plus récemment, cinq nouvelles espèces ont été décrites (*B. anniae* de la Côte d'Ivoire, *B. wilsoni* du Burkina Faso, *B. polisi* de l'Éthiopie, *B. hirsti* du Soudan et *B.*

*charlotteae* du Nigéria). La découverte de ces nouveaux taxa a considérablement élargi l'aire globale de répartition du genre, et permit de mettre en évidence un modèle de répartition typiquement périsaharien. La présente description de deux espèces nouvelles du Maroc et d'Algérie semble confirmer ce modèle.

Une question déjà posée par Vachon (1950) peut une nouvelle fois être soulevée: Comment expliquer la présence de formes apparentées tant au nord qu'au sud du Sahara? D'après Braestrup (1947), un mécanisme d'échanges à travers le Sahara, a souvent été utilisé comme argument pour expliquer la répartition des faunes sahariennes. Il mentionne des traversées du domaine déserticole soit par des éléments méridionaux (éthiopiens) qui auraient gagné les régions septentrionales, soit par des éléments septentrionaux (paléarctiques) dispersés jusque dans des régions du sud du Sahara.

Une telle hypothèse est plausible pour des organismes dotés d'une grande capacité de dispersion, capables de parcourir des longues distances et d'établir de nouvelles colonies loins de leur territoire. Or, les Scorpions constituent une faune d'autochtonie stable, en général très ancienne et individuellement très localisée, peu encline à de telles migrations. De ce fait, les répartitions géographiques actuelles des différents groupes de scorpions doivent être associées à une situation plutôt relictuelle qu'à la conséquence d'une expansion dynamique.

Le genre *Butheoloides* a certainement présenté une distribution plus vaste colonisant des régions aujourd'hui remplacées par le Sahara. A cause du phénomène complexe de désertification amorcé depuis seulement quelques milliers d'années, la répartition du genre s'est probablement rétrécie à des régions périphériques écologiquement plus favorables.

La suite des études sur les Scorpions d'Afrique pourra encore dévoiler d'autres espèces appartenant au genre *Butheoloides*.

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## ***Heterothops besucheti* sp. n. und *H. orientalis* sp. n. aus der Türkei (Coleoptera: Staphylinidae)**

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***Heterothops besucheti* sp. n. and *H. orientalis* sp. n. from Turkey (Coleoptera: Staphylinidae).** - Two new species of the genus *Heterothops* Stephens, 1829 (*Heterothops besucheti* and *H. orientalis*) from Turkey are described, illustrated and compared to related species.

**Key-words:** Taxonomy - faunistics - new species - Coleoptera - Staphylinidae - Turkey.

### EINLEITUNG

Die Gattung *Heterothops* Stephens, 1829 ist in der Welt durch zirca 150 Arten vertreten. Sie sind nicht nur aus der paläarktischen, sondern auch aus der neotropischen, nearktischen, orientalischen und australischen Region bekannt. Die Vertreter dieser Gattung fehlen wahrscheinlich in der afrotropischen Region.

Paläarktische Arten (über 50) leben gewöhnlich unter faulenden Stoffen, abgefallenem Laub, in Baumhöhlen oder auch an Ufern stehender und fließender Gewässer. Das Vorkommen einiger Arten ist an unterirdische Nester verschiedener kleiner Säugetiere gebunden.

Eine neue Art von *Heterothops* wurde vor Kurzem aus den Sammlungen des Muséum d'histoire naturelle Genève beschrieben (Štourac̃, 2001). Weiteres studiertes *Heterothops*-Material aus den Sammlungen dieses Museums brachte ausser interessanten faunistischen Angaben (*H. minutus* Wollaston, 1860 aus Iran) und weiteren Erkenntnissen über die Variationsbreite der äusseren Merkmale von *H. minutus* (Portugal, Spanien) auch zwei neue Arten aus der Türkei, deren Beschreibungen ich im folgenden bringe. Die Proportionen in den Beschreibungen und die Messwerte in der Diskussion sind in Millimetern angegeben.

Das Typenmaterial ist überwiegend in den Sammlungen des Muséum d'histoire naturelle Genève, Schweiz (MHNG) aufbewahrt, einige Paratypen sind auch in den Sammlungen von L. Hromádka, Prag, Tschechische Republik (LH) und des Verfassers (PS).

Ich danke Herrn Dr. I. Löbl für die Möglichkeit, weiteres *Heterothops*-Material durchzuschauen.

## TAXONOMISCHER TEIL

*Heterothops besucheti* sp. n.

Abb. 1-3

*Typenmaterial.* Holotypus ♂ und Allotypus ♀: "Turquie, Izmir, Bahçeliköy, 16.VII.69, Cl. Besuchet" (MHNG). Paratypen 15 ♂♂ - gleiche Angaben wie bei Holotypus (10 MHNG, 2 LH, 3 PS).

*Beschreibung.* Männchen. Länge 3,8-4,5 mm. Färbung ziemlich variabel. Kopf und Hinterleib dunkelbraun; Halsschild heller braunrot bis braunrot; Flügeldecken braun, ihre Schultern und Hinterränder gewöhnlich rötlich gelb, manchmal überwiegt aber die helle Färbung und nur die Umgebung des Schildchens ist düster gefärbt; Beine gelbbraun mit schwach getrübter Innenseite der Mittel- und Hinterschienen; Fühler und Taster braunrot, an beiden das 1. und Basis des 2. Gliedes, sowie Apikalränder der Hinterleibstergite gelbbraun.

Kopf rundlich (Länge/Breite=0,54/0,51), Augen ziemlich gross, aus der Seitenwölbung des Kopfes kaum hervorragend, Schläfen von oben gesehen geringfügig kürzer als der Längsdurchmesser der Augen (0,21/0,23). Zwischen dem vorderen und hinteren Stirnpunkt befinden sich gewöhnlich zwei Punkte (selten einerseits oder auch beiderseits drei Punkte), der hintere von diesen liegt knapp hinter dem Niveau des Augenhinterrandes. Der Schläfenpunkt liegt kaum näher zum Augenhinterrand als zur Halsabschnürung. Die ganze Kopfoberfläche mit feiner querwelliger Mikroskulptur.

Fühler zur Spitze kaum erweitert, das 2. und 3. Glied gleichlang, die vorletzten Glieder etwa so lang wie breit, das 11. Glied kürzer als die beiden vorhergehenden Glieder zusammengenommen.

Halsschild quer (Länge/Breite=0,73/0,79), hinten breit abgerundet, fast im hinteren Viertel am breitesten, von dort zu Vorderecken deutlich und besonders im zweiten Drittel gerade verengt. In der Chaetotaxie sind keine Unterschiede gegen andere *Heterothops*-Arten vorhanden. Ganze Oberfläche ähnlich wie auf dem Kopf mikroskulpturiert.

Schildchen punktiert und behaart.

Flügeldecken quer (Länge/Breite=0,88/1,00), an der Basis etwas schmaler als die grösste Halsschildbreite und nach hinten gewöhnlich erweitert. An den Seiten länger (0,87/0,73), an der Naht (einschliesslich des Schildchens) kaum kürzer (0,72/0,73) als der Halsschild entlang der Mittellinie. Punktierung fein und etwas unregelmässig, Punktabstände in der Querrichtung durchschnittlich einmal, in der Längsrichtung zwei- bis dreimal so gross wie der Durchmesser der Punkte.

Hinterleib mit weissem Hautsaum am Apikalrand des 7. Tergites, Punktierung der Tergite kaum feiner und nur auf ihrer Vorderhälfte etwas dichter als auf den Flügeldecken, zum Ende des Hinterleibes wird die Punktierung geringfügig lockerer. Der 8. Sternit in der Mitte des Hinterrandes ziemlich tief, scharf dreieckig ausgeschnitten (Abb. 3).

Die anliegende Behaarung der Flügeldecken und des Hinterleibes bräunlich.

Vordertarsen deutlich erweitert, das 2. Glied breiter als die Spitze der Schiene.

Der Aedoeagus mit Medianlobus ziemlich lang und Richtung Spitze fast allmählich verschmälert, die äusserste Spitze kurz abgerundet (seine Form und Sklerite des Innensackes siehe Abb. 1-2).

Weibchen. Grösse, Färbung und äussere Merkmale wie beim Männchen, nur Fühler durchschnittlich etwas kürzer und mit geringfügig queren vorletzten Gliedern. Vordertarsen schlanker, das 2. Glied kaum schmaler als die Spitze der Schiene.

*Differentialdiagnose.* Die neue Art ähnelt am meisten *H. minutus*. Von dieser Art unterscheidet sich *H. besucheti* durch den fast runden Kopf (der Kopf von *H. minutus* ist länglich oval, manchmal sogar mit angedeutet eckigen Schläfen) und eindeutig durch die Aedoeagus- und Skleritenform (vergleiche mit präzisen Abbildungen in Israelson 1979).

*Etymologie.* Die neue Art widme ich dem bekannten Kenner der Pselaphiden, Herrn Dr. Claude Besuchet, der alle Exemplare dieser Art, zusammen mit weiteren Koleopteren, im Laufe seiner Studienreise in die Türkei im Jahre 1969 aufgesammelt hat.

### *Heterothops orientalis* sp. n.

Abb. 4-5

*Typenmaterial.* Holotypus ♂ und Allotypus ♀: "TURQUIE: Kars, Kagizman, fleuve Aras, 1200 m, 18.VI.1986": "Besuchet-Löbl-Burckhardt" (MHNG). Paratypen 5 ♂♂ 4 ♀♀ - gleiche Angaben wie bei Holotypus (7 MHNG, 2 PS).

*Beschreibung.* Männchen. Länge 4,2-4,7 mm. Färbung ziemlich variabel. Kopf und Hinterleib dunkelbraun; Halsschild heller braunrot bis braunrot; Flügeldecken gelbbraun mit unscharfer gemeinsamer bräunlicher Makel entlang der Naht, die in der Länge und Breite etwas variiert; Fühler und Taster braunrot, an beiden die 2-3 basalen Glieder, Beine und Apikalränder der Hinterleibstergite gelbbraun.

Kopf länglich oval (Länge/Breite=0,55/0,50), Augen mittelgross, aus der Seitenwölbung des Kopfes nicht hervorragend, Schläfen von oben gesehen kaum länger als der Längsdurchmesser der Augen (0,24/0,23). Zwischen dem vorderen und hinteren Stirnpunkt befinden sich gewöhnlich zwei Punkte (nur bei einem Männchen an beiden Seiten drei Punkte), der hintere von diesen liegt hinter dem Niveau des Augenhinterrandes. Der Schläfenpunkt liegt etwas näher zum Augenhinterrand als zur Halsabschnürung. Die ganze Kopfoberfläche mit feiner querwelliger Mikroskulptur.

Fühler zur Spitze kaum erweitert, das 2. und 3. Glied gleichlang, die vorletzten Glieder etwa so lang wie breit oder geringfügig länger, das 11. Glied kürzer als die beiden vorhergehenden Glieder zusammengenommen.

Halsschild schwach quer (Länge/Breite=0,71/0,75), hinten breit abgerundet, etwa im hinteren Drittel am breitesten, von dort zu Vorderecken deutlich und besonders im zweiten Drittel gerade verengt. In der Chaetotaxie sind keine Unterschiede gegen andere *Heterothops*-Arten vorhanden. Ganze Oberfläche ähnlich wie auf dem Kopf mikroskulpturiert.

Schildchen fein punktiert und behaart.

Flügeldecken quer (Länge/Breite=0,90/0,98), an der Basis kaum schmaler als die grösste Halsschildbreite und nach hinten erweitert. An den Seiten deutlich länger (0,88/0,71), an der Naht (einschliesslich des Schildchens) kaum kürzer (0,70/0,71) als der Halsschild entlang der Mittellinie. Punktiertung fein und etwas unregelmässig, Punktabstände in der Querrichtung durchschnittlich einmal, in der Längsrichtung zweimal so gross wie der Durchmesser der Punkte.

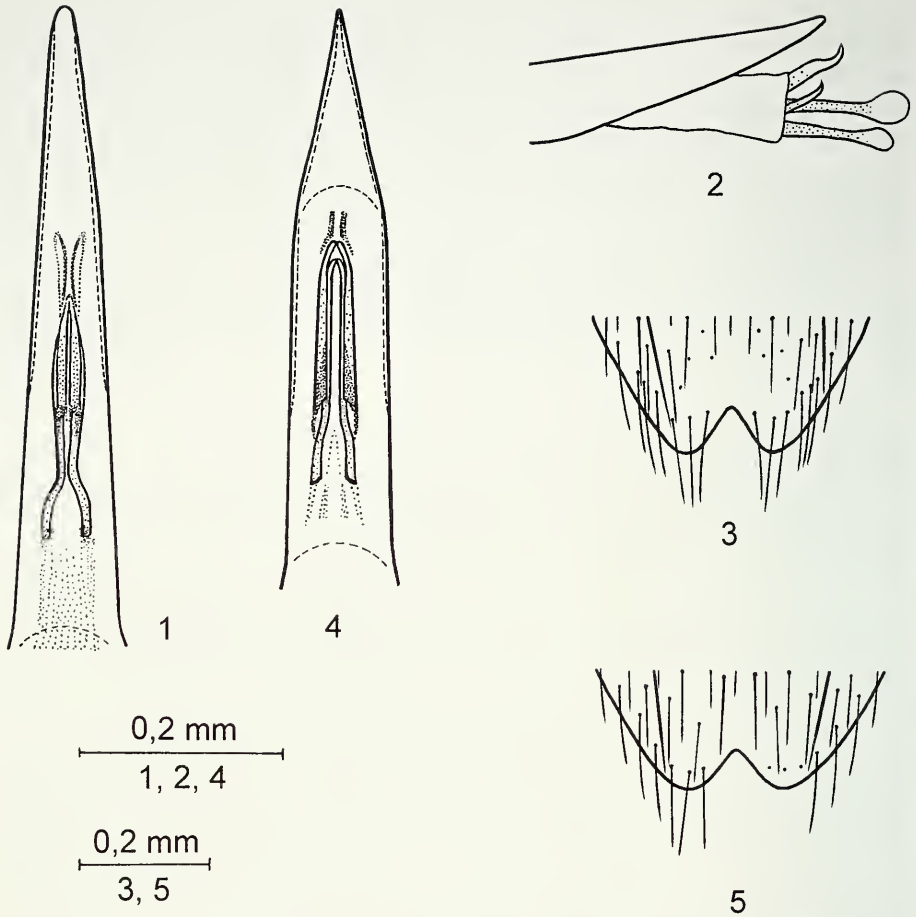


ABB. 1 - 5

1 - 3: *Heterothops besucheti* sp. n. 1, 3. Holotypus ♂. 1 - Medianlobus ventral; 2 - Aedoeagus mit vorgetretenem Innensack lateral (Paratypus ♂); 3 - Ausschnitt am Apikalrand des 8. Sternites. 4 - 5: *Heterothops orientalis* sp. n., Holotypus ♂. 4 - Medianlobus ventral; 5 - Ausschnitt am Apikalrand des 8. Sternites.

Hinterleib mit weißem Hautsaum am Apikalrand des 7. Tergites, Punktionierung der Tergite etwas feiner und nur auf ihren Vorderhälften dichter als auf den Flügeldecken, zum Ende des Hinterleibes wird die Punktionierung geringfügig lockerer. Der 8. Sternit in der Mitte des Hinterrandes stumpf dreieckig ausgeschnitten (Abb. 5).

Die anliegende Behaarung der Flügeldecken und des Hinterleibes bräunlich.

Vordertarsen schwach erweitert, das 2. Glied geringfügig schmaler als die Spitze der Schiene.

Der Aedoeagus mit Medianlobus im mittleren Teil parallelseitig und dann allmählich in scharfe Spitze vereigt (seine Form und Anordnung der Sklerite im Innensack siehe Abb. 4).



Weibchen. Grösse, Färbung und äusserliche Merkmale wie beim Männchen, nur Fühler durchschnittlich etwas kürzer und mit eher quadratischen vorletzten Gliedern. Vordertarsen schlank, das 2. Glied deutlich schmaler als die Spitze der Schiene.

*Differentialdiagnose.* *Heterothops orientalis* unterscheidet sich von *H. minutus* und *H. besucheti* hauptsächlich durch den scharf zugespitzten Aedoeagus, äusserlich durch die etwas kleineren Augen und von *H. besucheti* auch durch den schmaleren Kopf.

*Etymologie.* Die neue Art ist nach ihrer geographischer Verbreitung benannt.

## DISKUSSION

Wie aus den Beschreibungen folgt, bilden *H. besucheti* und *H. orientalis*, zusammen mit *H. minutus*, eine Gruppe ähnlicher Arten, die man folgenderweise charakterisieren kann: robustere Gestalt (Kopfbreite=0,50-0,58, Halsschildbreite=0,75-0,89, Flügeldeckenbreite=0,98-1,08); gewöhnlich zwei Punkte zwischen dem vorderen und hinteren Stirnpunkt auf dem Kopf; grössere Augen (0,23-0,27), die etwa so lang wie die Schläfen sind; mittellange und nicht zu schlanke Fühler, die bis auf 1-3 basale Glieder verdunkelt sind; ziemlich lange (0,88-1,04) und variabel gefärbte Flügeldecken. Die Variabilität äusserlicher Merkmale kann besonders bei der Weibchenbestimmung Schwierigkeiten verursachen.

In diese Gruppe kann man auch *H. canariensis* Israelson, 1979 einreihen, weil die in Israelsons Beschreibung angeführten 3-4 zusätzlichen Kopfpunkte nicht immer anwesend sind (ich sah ein Männchen von Tenerife, das auf der linken Seite des Kopfes nur zwei Punkte zwischen dem vorderen und hinteren Stirnpunkt hatte). Diese Art ist aber begrenzt verbreitet (Kanarische Inseln, Marokko) und deshalb sind die Weibchen nur mit jenen von *H. minutus* verwechselbar.

Im westlichen paläarktischen Gebiet kommt noch eine Art vor, *H. dissimilis* (Gravenhorst, 1802), die durch die Färbung manchmal den oben angeführten Arten etwas ähnelt. Sie hat aber eine schlankere Gestalt (Kopfbreite=0,43-0,48, Halsschildbreite=0,66-0,75, Flügeldeckenbreite=0,77-0,91), kleinere Augen (0,19-0,21) und kürzere Flügeldecken (0,72-0,81).

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**The New World Eupariini: Revision of the genus *Auperia* Chevrolat, 1864 (= *Phalangochaeta* Martinez, 1952) (Coleoptera: Scarabaeidae: Aphodiinae)**

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**The New World Eupariini: Revision of the genus *Auperia* Chevrolat, 1864 (= *Phalangochaeta* Martinez, 1952) (Coleoptera: Scarabaeidae: Aphodiinae).** - Sixteen species of the Neotropical genus *Auperia* are recognized, including 8 species described as new: *Auperia domingo* sp. n., *A. guayara* sp. n., *A. iquitosae* sp. n., *A. loretoensis* sp. n., *A. panaueensis* sp. n., *A. puyoensis* sp. n., *A. roudoniae* sp. n., and *A. teutoniae* sp. n. A lectotype of *Ataenius arator* Harold is designated, and the following new synonyms are proposed: *Auperia* Chevrolat (= *Phalangochaeta* Martinez syn. n.); *A. transversaria* (Schmidt) (= *Euparia bolivari* Petrovitz syn. n.); *A. denoninata* Chevrolat (= *Ataenius arator* Harold syn. n. = *Ataenius benjaminbanderaei* Islas syn. n. = *Ataenius englyptus* Bates syn. n. = *Ataenius sciurus* Cartwright syn. n. = *Phalangochaeta grandis* Petrovitz syn. n.). A key is provided, each taxon is diagnosed and illustrated, available biological information and distribution data are given. A taxonomic background of the genus is included and phylogenetic hypothesis is presented for the relationship among discussed taxa.

**Key-words:** Coleoptera - Scarabaeidae - Aphodiinae - *Auperia* - Neotropical Region - taxonomy - new species - new synonyms - phylogeny.

INTRODUCTION

The present revision is one of the series of comprehensive papers dealing with the New World genera and species of Aphodiinae (Stebnicka, 1999a, 1999b, 2000, 2001a, 2001b). The work treats the genus *Auperia* Chevrolat, long known as *Phalangochaeta* Martinez, *Euparia* Le Peletier de St Fargeau & Serville or *Ataenius* Harold, and clarifies its status and identity of species previously described in various genera. This remarkable genus is noteworthy because of its apparent rarity and strikingly peculiar morphological characters. It consists presently of the sixteen, mostly forest-dwelling and litter-inhabiting species from the Central and South America, West Indies and Florida, including eight species described herein as new. All taxa are diagnosed, keyed and illustrated, a cladistic analysis determines the monophyly of the genus and its species relationships. Sufficient data were available to outline the major patterns of the species distribution, which will change only slightly with addition of the yet unworked material and of the future field collections.

## TAXONOMIC BACKGROUND

The following historical outline is based on a careful study of the original literature and on the type species of all species involved.

*Scarabaeus stercorator* Fabricius, 1775, was the first euparine species described from South America (Brazil, Rio de Janeiro). The unique type specimen of that species preserved in Banks Collection in London was never studied by subsequent authors until its redescription by Landin (1956) and Stebnicka (1998). In the course of over hundred years, most authors have applied Fabricius' name to the various species. A misidentification of *S. stercorator* has been initiated by Jacquelin du Val (1856) in her contribution to the Coleoptera of Cuba, in which she introduced without any description (nomen nudum) a new generic name "*Auperia*" in combination with specific name *stercorator* Fabricius. Since the true *stercorator* does not occur in Cuba or anywhere in the West Indies, Jacquelin du Val unintentionally used Fabricius' name to any other undescribed species. Even if the name "*Auperia*" resulted from a misspelling of the existing name *Euparia* Le Peletier (1828), it has been applied in its original spelling by Chevrolat (1864) for a number of new species described by him from Cuba. Chevrolat (1864: 413) also listed "*Auperia stercorator*" with a brief Latin diagnosis that is far from being adequate to the true Fabricius' species, and seems to concern a variety of his species *terniuialis* var. *ciliata* (1864: 414) or another unknown species. However, just below the mentioned diagnosis, Chevrolat (1864: 413) continued as follows [original citation]:

"J'ai reçu sous le même no d'envoi, un insecte qui n'est peut-être que l'autre sexe de l'*A. stercorator* et qui présente des différences assez notables: taille plus élevée et corps élargi, ponctuation en général plus fine et plus serrée: prothorax nettement coupé droit sur les côtés, offrant près du bord une teinte rougeâtre assez étendue en largeur et en hauteur; élytres à stries légères, sillonnées, étroites, renfermant chacune une ligne mince peu élevée, interrompue par une série de petits points peu profonds et réguliers, interstices relativement larges, peu élevés; angle huméral aigu, creusé en dedans; pattes couleur de poix. (*A. deuouiuata* Nob.) – Long. 6 mill., lat. 3 mill. Cuba. Deux exemplaires. Coll. de l'auteur." The lectotype of *deuouiuata* fits into cited description in all the essential features characterizing the genus *Auperia*.

In 1867(a), Harold established the genus *Ataenius* using formula "new genus" in his description of *Ataenius scutellaris* from "Columbia". Since then, all authors considered *A. scutellaris* to be the type species of the genus *Ataenius* by indirect original designation (fixed by Cartwright, 1974). Afterwards, Harold (1870) transferred *Scarabaeus stercorator* Fabricius to *Ataenius* together with all species described by Chevrolat (1864) except *Auperia deuouiuata*, and he commented *Ataenius* and *Auperia* as follows [original citation]:

„Jacquelin Duval (1856) erwähnt dieselbe ebenfalls in Ramon de la Sagra's Geschichte von Cuba, indem er den *Scarab. stercorator* Fabr. als Einwohner dieser Insel nachweist; zugleich ändert er den Gattungs-Namen in *Auperia* ab, weil derselbe in der Botanik (Primulaceae) schon in Gebrauch ist, worin ich ihm jedoch nicht gefolgt bin, da ich keinen Collisionsfall hierin erkenne. Seine *Auperia stercorator* ist schwerlich die Art des Fabricius, jedenfalls aber ein *Ataenius*. Zu dieser Gattung gehören auch

die von Chevrolat in Ann. Soc. France, 1864 beschriebenen *Auperia stercorator* Fabr., *rhyticephala*, *sulcatula* and *terninalis*...". In this quotation a binomen "*Auperia denominata*" has been omitted, being regarded by Harold as synonymous with *Auperia stercorator*. Furthermore, in 1867(b) Harold described the true *stercorator* under the name *Ataenius opacus* from Brazil, and in 1875 he followed a misidentification of Fabricius' species presenting its putative "redescription" that fits to at least three various species excluding the true *stercorator*.

As may be concluded from the aforesaid statements, a misidentified species *Scarabaeus stercorator* Fabricius, 1775 (presently *Ataenius stercorator*) can not be considered as type species of any existing genus, such as *Auperia*, *Ataenius* nor *Euparia*, in the meaning of Art. 70.3 of the 'Code' (ICZN, 1999). The generic name *Auperia* Chevrolat, 1864 used in a single combined description with indicated species-group name does not contravene a provision of Art. 27 – 31 of the 'Code' and should be considered as valid (in the meaning of Art. 12.2 of the 'Code'). The nominal species *Auperia denominata* Chevrolat, 1864 should be fixed as type species of the genus *Auperia* (in the meaning of Art. 67.2, 69.2A.3 of the 'Code').

## COLLECTIONS STUDIED

Approximately 700 representatives of *Auperia* have been selected from the material consisting of the over 20000 euparine specimens identified at present, including all the type specimens available in various collections. The following institutions and private collections kindly contributed material for this study. The abbreviations cited below are used in all text citations:

- BMNH British Museum of Natural History, London
- CAS California Academy of Sciences, San Francisco
- CFC Carlos Flechtmann Collection, Brasilia (Brazil)
- CMN Canadian Museum of Nature, Ottawa
- DEIE Deutsches Entomologisches Institut, Eberswalde
- FSCA Florida State Collection of Arthropods, Gainesville
- HAHC Henry & Anne Howden Collection, Ottawa
- HNHM Hungarian Natural History Museum, Budapest
- IBMZ Instituto de Biología y Museo de Zoología, Mexico City
- IRSNB Institut Royal des Sciences Naturelles de Belgique, Bruxelles
- ISEA Institute of Systematics and Evolution of Animals PAS, Krakow
- JSC Joachim Schulze Collection, Berlin
- MCZC Museum of Comparative Zoology, Harvard University, Cambridge
- MHNG Muséum d'histoire naturelle, Geneva
- MMU The Manchester Museum, University of Manchester
- MZUSP Museu de Zoologia, Universidade de São Paulo
- NRS Naturhistoriska Riksmuseet, Stockholm
- PSC Paul Skelley Collection, Gainesville
- RTC R. Turnbow Collection, Gainesville
- SMTD Staatliches Museum für Tierkunde, Dresden



- UNSM University of Nebraska State Museum, Lincoln, Nebraska  
 USNM United States National Museum of Natural History, Washington DC  
 WWC William Warner Collection, Arizona  
 ZMHB Zoologisches Museum für Naturkunde der Humboldt Universität, Berlin

## TAXONOMY AND PHYLOGENY

### *Auperia* Chevrolat

*Auperia* Chevrolat, 1864: 413.

*Euparia* Le Peletier St.-Fargeau & Serville, 1828: 357 (partim).

*Atenius* Harold, 1867a: 82 (partim).

*Phalangochaeta* Martinez, 1952: 92-94. – Petrovitz, 1973: 179-180; Dellacasa, 1988: 271 (catalogue); Stebnicka, 1998: 200, fig. 1, 3. **New synonymy.**

*Type species*: now fixed (under Article 70.3 of the Code) as *Auperia denominata* Chevrolat, 1864, misidentified as *Scarabaeus stercorator* Fabricius, 1775.

*Description.* Length 3.0 – 8.0 mm. Body variously shaped and sculptured; dorsum usually unicolorous, dark castaneous to black, elytra on apical declivity and/or at apex frequently covered with minute setae. Head broad, usually as wide as pronotum, moderately to strongly gibbose medially, frontal suture often indicated by small convexities at eyes. Clypeus emarginate anteriorly or slightly truncate; surface punctate, punctures of median area of head usually elongate in shape. Eye well developed, partially visible or not visible from directly above. Pronotum transverse with punctate fovea on each side of disc; base usually without marginal line, crenate by close punctures, more or less excised near posterior angles; lateral margin usually thickened, minutely crenate-fimbriate; anterior angles rounded, often produced forwards, posterior angles right-angled, rarely truncate. Scutellum triangular, relatively small, in some species foveate or carinate. Elytra with basal bead, single or double humeral denticles and 10 striae and intervals including marginal one; striae punctate, in some species partially margined by lines, intervals smooth or punctate, rarely lateral intervals granulate. Flight wings functional. Ventral thoracic sclerites variously shaped; prosternal process widely triangular, often carinate medially; mesosternum lower than metasternum with short or long intercoxal carina (Figs 15-17, 36, 40) or with callosity (Figs 18-19, 33-35, 37); meso-metasternal suture usually visible, metasternum convex, often with diagonal fossulae or pits; lateral metasternal triangle distinct, rarely vague; mesocoxae separate; abdomen with 5-6 visible, coalesced sternites, sternites fluted (longitudinally strigose) along sutures, first sternite margined by line; pygidium with median transverse carina, often with longitudinal carina on scabrous disc. Legs usually moderate in length; profemur anteriorly with perimarginal groove; meso- and meta-femur usually narrow, parallel-sided rarely mesofemur fusiform; protibia relatively short and narrow with three small teeth on outer side; mesotibia and metatibia slightly widened toward apex with longitudinal, setaceous lines; apex of metatibia with small accessory spine and with or without fringe of few setae; apical spurs located close together below tarsal insertion; tarsus short to moderate in length, hind tarsus usually covered with close pale setae. External sexual differences usually slight, apparent mostly on ventral sclerites.

Male genitalia (Figs 6-14, 26-32) generally homogenous in shape, relatively small, moderately sclerotized; phallobase without hump, equal to length of parameres or longer; phallobase and parameres fused; apical portion of internal sac (Fig. 13) usually very large, furnished with sclerites and spicules. Labro-epipharyngeal complex (Figs 38-39) adapted to soft saprophagy.

*Affinity.* The closest relatives of this genus are the two monotypic genera such as the Panamanian *Batesiana* Chalumeau and Ecuadorian *Napoa* Stebnicka. Both these genera are distinctly modified, associated with termites and/or ants and share with *Auperia* the general characters of the head, legs and the male genitalia, also a similar structure of meso-metasternum found in some species of *Auperia*.

*Bionomy.* Based on information taken from labels, adult specimens of *Auperia* have been collected frequently in Central and South America in lowland and montane tropical forests from 100-1520 m by flight interception traps, malaise traps, sifting leaf litter and detritus remnants, in burrows of small mammals and nests of ants and termites, and to a lesser extent under bark.

#### PHYLOGENETIC HYPOTHESIS

The Eupariini are difficult for cladistic analysis, because in most of their representatives the number of parallel characters is distinctly higher than the number of unique synapomorphies. This analysis concerns a phyletic sequence of taxa within the tribe. Species of the genus *Auperia* form the ingroup, *Ataenius perforatus*-group of species (Stebnicka 2001b) is consistently the basal outgroup, with *Airapus parvispinus* (Schmidt) as the more immediate outgroup to *Auperia*. The Asian-Australian genus *Airapus* Stebnicka & Howden contains a heterogeneous assemblage of 22 species sharing with *Auperia* some similar character states. While this may not show relationship, it is suitable for the comparison of characters. The 21 binary characters are defined in matrix and coded in Table 1. The cladogram displaying character state changes was

TABLE 1  
Matrix of taxa and character states used in the cladistic analysis

Taxa	Characters:	01234	56789	11111	11111	2
				01234	56789	0
<i>Ataenius perforatus</i> -group		00000	00000	00000	00000	0
<i>Airapus parvispinus</i>		00000	00000	00001	01000	0
<i>Auperia amazonica</i>		01101	11000	11110	11111	0
<i>A. angusticollis</i>		11001	11000	10110	00011	1
<i>A. capitosa</i>		11000	10100	00111	00010	0
<i>A. denominata</i>		11001	01000	10110	00001	1
<i>A. domingo</i> sp. n.		01001	11000	00110	10101	0
<i>A. guayara</i> sp. n.		01001	11010	00110	10001	1
<i>A. huebneri</i>		01101	11000	11111	11111	0
<i>A. iquitosae</i> sp. n.		01000	10100	00111	00000	0
<i>A. loretoensis</i> sp. n.		01011	11000	00111	11111	0
<i>A. minuta</i>		01011	11000	00111	11111	0
<i>A. panamensis</i> sp. n.		11001	11000	10110	00001	1
<i>A. puyoensis</i> sp. n.		01001	11000	00111	11101	0
<i>A. rondoniae</i> sp. n.		11001	01000	10110	00001	1
<i>A. squamosa</i>		01101	11001	01110	11101	0
<i>A. teutoniae</i> sp. n.		01001	11000	00111	11111	0
<i>A. transversaria</i>		01001	11000	10111	11101	0

prepared using WINCLADA 0.9.9 (Nixon 1999) under accelerated transformation (ACCTRAN) that accounts for homoplasy in terms of reversals to the plesiomorphic condition. Using the heuristic search with random addition sequence, the two equally parsimonious trees were generated, each with a length of 33 steps and consistency and retention indices 63 and 83 respectively.

Character states used in the cladistic analysis. Scores for character states: plesiomorphic = 0; apomorphic = 1.

0. Average body size – medium (0), large (1). 1. Head size – medium (0), large (1). 2. Anterior clypeal emargination – distinct (0), indistinct (1). 3. Clypeal carina – absent (0), present (1). 4. Pronotal shape – subquadrate (0), transverse (1). 5. Basal marginal line of pronotum – present (0), absent (1). 6. Side of pronotum – not explanate (0), explanate (1). 7. Posterior angle of pronotum – prominent (0), truncate (1). 8. Basal lobe of pronotum – absent (0), present (1). 9. Elytral striae 8-9 – smooth (0), granulate (1). 10. Elytral interval 10<sup>th</sup> – convex shining (0), flattened opaque (1). 11. Elytral preapical umbone – not indicated (0), indicated (1). 12. Prosternal process – small (0), broad (1). 13. Space between mesocoxae –  $\leq$  to width of mesofemur (0),  $>$  than width of mesofemur (1). 14. Surface of mesosternum – carinate (0), calloused (1). 15. Metasternal lateral triangle – wide (0), narrow (1). 16. Metasternal fossulae – absent (0), present (1). 17. Profemur surface – scabrous opaque (0), punctate shiny (1). 18. Metafemur posterior line – complete (0), incomplete (1). 19. Basal tarsomere of metatarsus –  $\leq$  to four tarsomeres (0),  $>$  than four tarsomeres (1). 20. Setae of metatarsus – short scarce (0), long close (1).

Synapomorphies that conclusively establish the monophyly of *Auperia* are discussed relative to the presented cladogram (Fig. 1) as follows: Character 1 – head large. This state is shared by members of some specialized euparine genera, e.g. those associated with social insects, and it occurs rarely in the genus *Ataenius*. Character 5 – lack of basal marginal line of pronotum; this state is variable and occurs in various genera and species of Aphodiinae; synapomorphy for the clade with subsequent change to margined pronotum in *denominata* + *panamensis* line. Character 12 – prosternal process broad. Plesiotypically, the prosternal process is small or medium sized. This state usually depends on the mesosternal structures and as the synapomorphy for *Auperia* it is widely triangular and often carinate medially. Character 13 – widely separate mesocoxae. Although this state is variable and more or less remarkably manifested among Eupariini (Stebnicka 2001c), it is synapomorphic for *Auperia*. Character 7 – posterior angles of pronotum truncate. Synapomorphy for lineage *capitosa* + *iquitosae*; the remaining species of *Auperia* have the posterior angles of pronotum prominent.

Synapomorphies for the following two main lineages of *Auperia* are: Characters 4, 6 – pronotum transverse with explanate sides. These states are also shared by members of some specialized euparine genera, e.g. *Batesiana* Chal. Plesiotypically, pronotum is subquadrate and its sides are steep. Character 15 – lateral metasternal triangle narrow. This state with subsequent change to wide triangle is variable and usually correlated with more or less elevated metasternal disc. Character 19 – metatarsal basal tarsomere longer than four tarsomeres. This state occurs occasionally among members

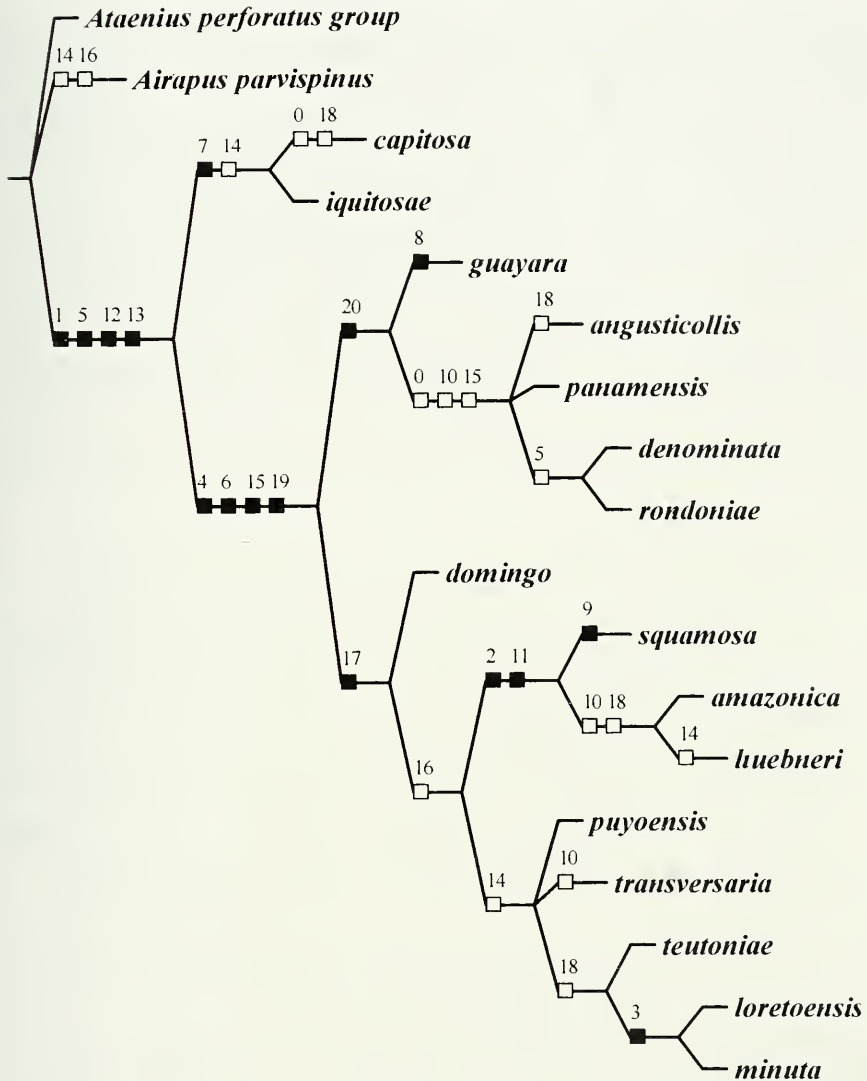


FIG. 1

Cladogram depicting hypothetical relationships among members of the genus *Auperia* Chevrolat, with *Ataenius perforatus*-group and *Airapus parvispinus* (Schmidt) as outgroups. Numbering of characters corresponds to that in the character matrix (Table 1).

of various genera including *Ataenius*, however, most of the euparine species have the first tarsomere of hind tarsus equal to or shorter than following tarsomeres combined. Character 20 – metatarsus with long close setae, synapomorphy for nodes formed by *guayara* and *angusticollis* + *panamensis* + *denominata* + *rondoniae*. The latter four nodes are not supported by synapomorphy and show reversals to the plesiomorphic condition, though this group of closely related species is very distinct within *Auperia*.



Character 17 – surface of profemur shining punctate. This state supports the nodes formed by species characterized by mosaic of characters, but satisfactorily combined in this clade according to their external similarity. Characters 2, 11 – clypeal emargination indistinct and elytra with indicated preapical umbone support the nodes with *squamosa* + *amazonica* + *huebneri*. These species differ each other and from the remained congeners by some unique characters such as size, colour, structures of the elytra and of under surface of body. Character 3 – presence of clypeal carina unites *loretoensis* + *minuta*. Both these species are similar in overall appearance to *puyoensis* + *transversaria* + *teutoniae* and to *domingo* as well. The latter species differs in having the meso-metasternal carina instead of callosity. There are characters 14 and 16 defining the structures of meso-metasternum. Plesiotypically, in most of the euparine species meso-metasternum is furnished with carina, while the mesosternal callosities and metasternal fossulae occur rarely. Structures such as these are most probably adaptive, shared by 8 species of *Auperia* and by outgroup taxon *Airapus parvispinus*. Under the accelerated transformation, these character states are reversed to the plesiomorphic condition for this clade.

#### KEY TO THE SPECIES OF *AUPERIA*

- 1 Colour black; pronotum subquadrate, posterior angle widely truncate, side steep, not explanate; mesosternum with cordate callosity . . . . . 2
- Colour castaneous or piceous; pronotum transverse, posterior angle right-angled, prominent, side more or less explanate; mesosternum with carina or with semioval callosity . . . . . 3
- 2(1) Length 6.0 - 8.0 mm; metafemur parallel-sided, posterior marginal line incomplete . . . . . *A. capitosa* (Har.)
- Length 4.0 – 5.0 mm; metafemur fusiform, posterior marginal line complete . . . . . *A. iquitosae* sp. n.
- 3(1) Length 6.0 – 7.5 mm; scutellum smooth or finely punctate; disc of elytra convex . . . . . 4
- Length 3.0 – 5.2 mm; scutellum foveate or carinate; disc of elytra slightly deplanate . . . . . 7
- 4(3) Pronotal base with fine marginal line . . . . . 5
- Pronotal base lacking marginal line . . . . . 6
- 5(4) Elytral striae in posterior half delimited on each side by fine lines; intervals usually distinctly punctate, apically carinate, 10<sup>th</sup> interval with median row of minute granules . . . . . *A. denominata* Chevr.
- Elytral striae impressed, without marginal lines; intervals usually impunctate, 10<sup>th</sup> interval without granules . . . . . *A. rondoniae* sp. n.
- 6(4) Pronotum short, side widely explanate . . . . . *A. angusticollis* (Schm.)
- Pronotum moderate in length, side explanate in anterior half . . . . . *A. panamensis* sp. n.
- 7(3) Mesosternum with carina . . . . . 8
- Mesosternum with callosity . . . . . 9
- 8(7) Lateral area of pronotum with deep punctures forming large pits, pronotal base lobed at middle . . . . . *A. guayara* sp. n.



- Lateral area of pronotum with punctures moderate in size and depth; pronotal base unlobed at middle . . . . . *A. domingo* sp. n.
- 9(7) Length 4.8 – 5.2 mm . . . . . 10
- Length 3.8 – 4.0 mm . . . . . 12
- 10(9) Head on each side of median convexity with large, round punctures separated by about one diameter; mesosternal callosity narrow with carina inside . . . . . *A. teutoniae* sp. n.
- Head on each side of median convexity with moderate punctures separated by less than one diameter; mesosternal callosity wide without carina inside . . . . . 11
- 11(10) Pronotal punctures on each side of disc same size as those on clypeal disc; elytra slightly widened in posterior third . . . . . *A. transversaria* (Schm.)
- Pronotal punctures on each side of disc larger than those on clypeal disc; elytra strongly widened in posterior third . . . . . *A. puyoensis* sp. n.
- 12(9) Clypeus with distinct median emargination, surface with slight transverse carina; elytral preapical umbone not indicated; colour rusty brown to dark castaneous . . . . . 13
- Clypeus truncate anteriorly or median emargination indistinct, surface without transverse carina; elytral preapical umbone indicated; colour piceous . . . . . 14
- 13(12) Disc of pronotum with moderate in size, deep punctures separated by one diameter; elytra elongate, about 3 times as long as pronotum . . . . . *A. minuta* (Petr.)
- Disc of pronotum with fine, shallow punctures separated by more than one diameter; elytra oval, about 2.5 times as long as pronotum . . . . . *A. loretoensis* sp. n.
- 14(12) Length 4.8 – 5.0 mm; anterior angle of pronotum widely rounded, strongly produced forwards, side widely explanate; mesosternum with semioval callosity . . . . . *A. huebneri* (Petr.)
- Length 3.0 – 4.5 mm; anterior angle of pronotum obtuse, slightly prominent, side narrowly explanate; mesosternum with carina . . . . . 15
- 15(14) Elytra microreticulate, discal intervals minutely punctate, lateral intervals as wide as striae without granules or tubercles . . . . . *A. amazonica* (Petr.)
- Elytra shining, discal intervals with distinct rows of punctures, lateral intervals wider than striae with granules or tubercles . . . . . *A. squamosa* (Petr.)

*Auperia denominata* Chevrolat

Figs 2, 6, 15, 20

*Auperia denominata* Chevrolat, 1864: 413.*Auperia stercorator*: Chevrolat, 1864: 413 (nec Fabricius, 1775).*Ataenius arator* Harold, 1869: 102; Schmidt, 1922: 441; Dellacasa, 1988: 89 (catalogue). **New synonymy.***Ataenius stercorator*: Harold, 1870: 22 (non Fabricius, 1775, nec Chevrolat, 1864); 1875: 70-71 (non Fabricius, 1775).*Ataenius euglyptus* Bates, 1887: 97; Schmidt, 1922: 457; Dellacasa, 1988: 126 (catalogue). **New synonymy.***Ataenius denominatus*: Schmidt, 1922: 422 (as synonym of *stercorator*); Chalumeau, 1980: 85 (nota).

*Ataenius brevinotus* Chapin, 1940: 39-40; Woodruff, 1973: 114; Chalumeau, 1980: 90, 91 (as synonym of *denominatus*); Dellacasa, 1988: 273 (catalogue) (as synonym of *stercorator*).

*Ataenius benjaminbanderaei* Islas, 1955: 497-499, fig. 3. **New synonymy.**

*Ataenius sciurus* Cartwright, 1974: 65; Dellacasa, 1988: 343 (catalogue). **New synonymy.**

*Phalangochaeta grandis* Petrovitz, 1973: 179-181; Dellacasa, 1988: 287 (catalogue). **New synonymy.**

*Type material.* *Auperia denominata*: described from Cuba. Lectotype designated by Cartwright (1973) with 5 labels 'Cuba', 'Coll. C. Felsche Kauf 20, 1918', 'Cuba Poey', '*denominatus* Chevr. *stercoraria* L Laval K 118 Inl Cuba Havan D. Poey 449', '*Ataenius denominatus* (Chevrolat) det. O.L. Cartwright', in SMTD.

Invalid lectotype designated by Chalumeau (1980), with large white label "*Auperia denominata* Ch. M.n.s. 2 Zar. III 193/449", "Cuba Gundlach", "*Ataenius denominatus* (Chevr.), lectotype des. F. Chalumeau '79", in ZMHB.

*Ataenius arator*: described from Brazil. Lectotype (here designated), labelled 'arator Typ', '*Ataenius arator*/Brasil' with green labels 'Brasilien', '27', 'Coll. C. Felsche Kauf 20, 1918', in SMTD.

*A. euglyptus*: described from Mexico. Lectotype designated by Cartwright (1964) labelled 'Las Vigas Mexico Hoeg', '*Ataenius euglyptus* Bates', 'B.C.A. Col. II (2) *Ataenius*', '*Ataenius euglyptus* Bates, det. Cartwright 64', in BMNH.

*A. brevinotus*: described from Cuba. Type Nr 23554 labelled 'Baragua Cuba May 7, 1926' 'T.P.R.F.Ent.457', *At. denominatus* (Chevrolat) det. O.L. Cartwright', in MCZC (not seen by the author).

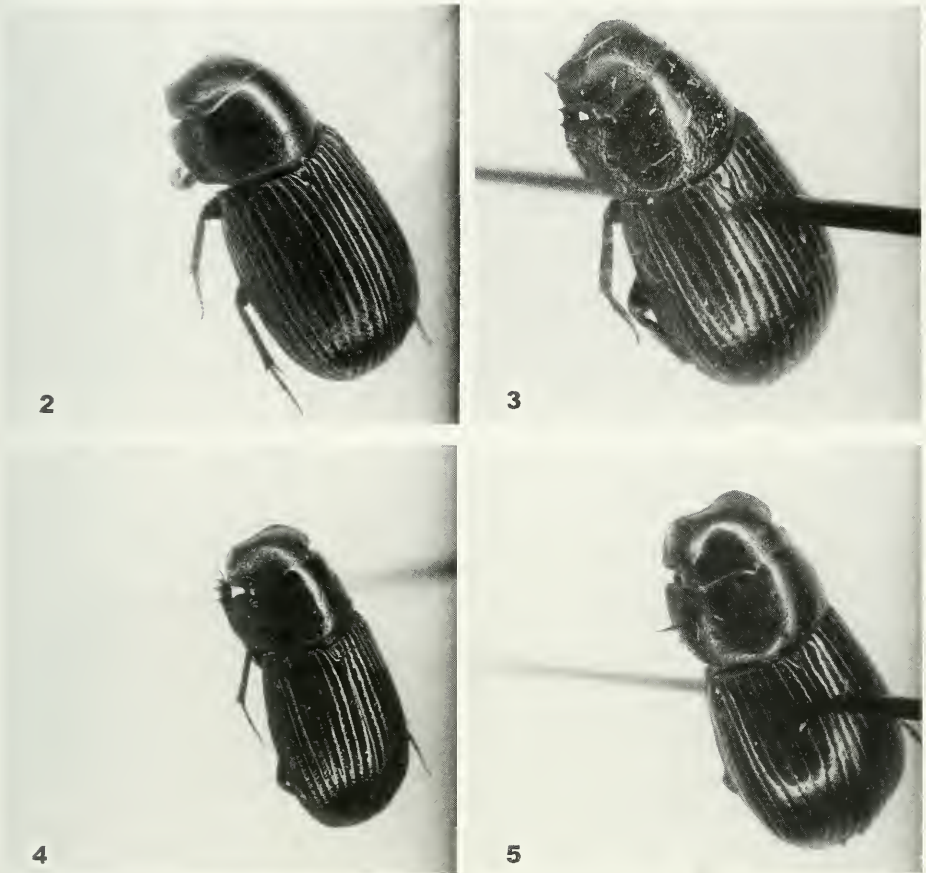
*A. sciurus*: described from Florida. Holotype male, labelled "Florida, 7 mi N Gainesville, 22.I.1947. J.C. Moore", No 71745 USNM. Paratype, labelled 'Welaka Fla, Putnam Co. J.C. Moore', '*sciurus* nest 25.VII. 46', '*Ataenius sciurus* Cartwright', in MHNG.

*Phalangochaeta grandis*: described from Brazil. Holotype male, labelled 'Brasilien, SP, Barueri, 15.XII.1970, K. Lenko', '*Phalangochaeta grandis* Petrovitz', "*Phalangochaeta arator* det. Chalumeau '81", in MHNG.

*Ataenius benjaminbanderaei*: Holotype (unicum) Mexico, San Luis Potosi, cd. Valles, 3.X.1954, leg. Islas, in IBMZ (not seen by the author, see under Remarks).

*Other specimens* (92). **Belize**: Belmopan, 25.VIII.1972, S.& J. Peck (HAHC-CMN). **Bolivia**: La Paz, Yolosa nr Rio Coroico, 15.XI.1998, V. Tichy (JSC). **Brazil**: (Ro) Rondonia, 62 km SW Ariqueemes nr Fzda Rancho Grande, 5-17.X.1993, black light trap, J.E.Eger (WWC); (Sc) Nova Teutonia, XII.71, leg. Plaumann (ISEA, USNM); **Colombia** (no additional data) (ZMHB). **Ecuador**: Limoncocha, 0.23S, 76.38W, 300 m, leg. Stockwell (CMN). **Guatemala**: Péten, Tikal Ruins, 12-28.V.1991, L. Limoges (CMN); Zacapa, 12 km S San Lorenzo 510 m, 16.VI.1993, H. & A. Howden (ISEA). **French Guyana**: Mt Grand Matoury, 2-11.X.1995, M. Kocian (ISEA); Cayenne (20 km SW), 4.48N, 52.28W, 26-28.V.1887, J. Ashe & R. Brooks (HAHC-CMN). **Honduras**: Morazan, 4 km W Zamorano, El Macuelis, 17.VI. 1994, H.& A. Howden. **Mexico**: San Luis Potosí, cd. Valles, Palma Hotel, 8-23.VIII.1969, S. Peck (CMN); 10 km E cd. Valles, 21.VIII.1988, R. Turnbow (FSCA); Mexico (no additional data) Coll. C. Felsche Kauf 20, 1918 (ZMHB); Veracruz: Motzorongo Sta at Veracruz, R. Becker (MHNG); Jalcomulco, Hoeg, G. Kolze (ZMHB); Oaxaca, 9.VII-3.VIII.1965, G. Nelson (ISEA). **Panama**: Colon Prov., Santa Rita Ridge, 10.VI.1977, H.&A. Howden (CMN). **Venezuela**: Bolivar, 15 km E Caicara, 12.VI.1996, H. & A. Howden (CMN). **USA** Florida: Levy Co. 3-8 mi SW Archer, 6.II, 10.II.1989, Thomas & Skelley (ISEA, PSC). **Cuba**: Oho (no additional data) (ZMHB).

*Description.* Length 6.4-7.0 mm. Body (Fig. 2) elongate oblong, convex, moderately shining, colour dark castaneous to black. Head convex medially, slightly reflexed clypeal margin broadly rounded on each side of moderate median emargination, sides arcuate to obtusely rounded gena; clypeus minutely transversely wrinkled just above emargination, punctures gradually fine to moderate and slightly elongate upward over median convexity to vertex, separated by one diameter or less, punctures



FIGS 2-5

Habitus: 2 – *Auperia denominata* Chevrolat; 3 – *A. panamensis* sp. n.; 4 – *A. puyoensis* sp. n.; 5 – *A. capitosa* (Harold).

on vertex round, usually separated by one diameter, in some specimens closer. Pronotum short and wide, sides visible from directly above, more or less explanate in anterior half; anterior angles rounded, side straight or slightly arcuate toward obtuse or slightly acutely prominent posterior angle; base with distinct marginal line, more or less deeply excised on sides; lateral edge very finely crenate, fringed with minute, close setae; pronotal punctures variable, disc with scattered, very fine to fine punctures becoming quite dense, larger and coarser toward sides and here separated by less than one diameter, in some specimens contiguous and rugose. Elytra convex, sides arcuate, humeral denticle sharply pointed, sculpture variable; discal striae 1-3, 4, usually finer than remaining with shallow punctures, in most specimens lateral and apical striae margined by very fine, alutaceous lines and with deep, slightly crenating punctures; lateral and apical intervals convex to carinate, punctures of intervals 8-9 distinct, closer at shoulders, 10<sup>th</sup> interval flattened, opaque with median row of minute granules



bearing extremely fine setae. Mesosternum low, shagreened, meso-metasternal carina (Fig. 15) shining, wide between mesocoxae; metasternum relatively long, fine punctures scattered on disc, midline distinct, sometimes deeper at ends, lateral triangle broad, scabrous inside; abdominal sternites finely fluted along sutures, fluting of sternite 5<sup>th</sup> longer and coarser; surface punctures variable, moderate in size to coarse, in some specimens elongate, usually concentrated on sides being less close medially; disc of pygidium deeply eroded, wide and coarsely punctate apical lip connected to basal cusp by shining longitudinal carina. Profemur scabrous; mesofemur nearly same width as metafemur, closely punctate; metafemur with complete posterior line; tarsi setaceous, basal tarsomere of posterior tarsus about one-third longer than upper tibial spur.

Male. Pronotal disc less closely punctate, basal emargination usually deeper than in female, 5th abdominal sternite shorter, disc of pygidium longer, posterior tarsus thicker; genitalia as in Fig. 6.

Female. Elytra usually more widely arcuate and more convex on disc than in male.

*Remarks.* Although the type specimen of *Ataenius benjaminbanderai* Islas was not seen by the author, the original description and illustration of that species together with a series of specimens from the type locality are sufficient to consider it conspecific with *Auperia denominata* Chevrolat.

The material examined forms a confusing complex in which variation is notable, as indicated in the description. The specimens from various localities exhibit differences in the shape of body and in the pronotal and elytral sculpture and may at first glance appear to be a separate species. Such variation is most likely due to the different environmental conditions. *Auperia denominata* occurs over a wide range being associated with fox squirrel nests and sciurus (*Sciurus niger*) nests, occasionally taken in horned owl nest and commonly collected at light.

Distribution as in Fig. 20. Woodruff (1973) recorded this species under the name *Ataenius brevinotus* and Cartwright (1974) under the name *A. sciurus* from the following Florida localities: Highlands Co. near Lake Placid; Merritt Island; Manatee Co. Oneco; Dade Co., Matheson Hammock; Hillsborough Co. Plant City; Alachua Co. vicinity of Gainesville; Pinellas Co., Dunedin.

*Auperia angusticollis* (Schmidt) comb. n.

Figs 7, 20

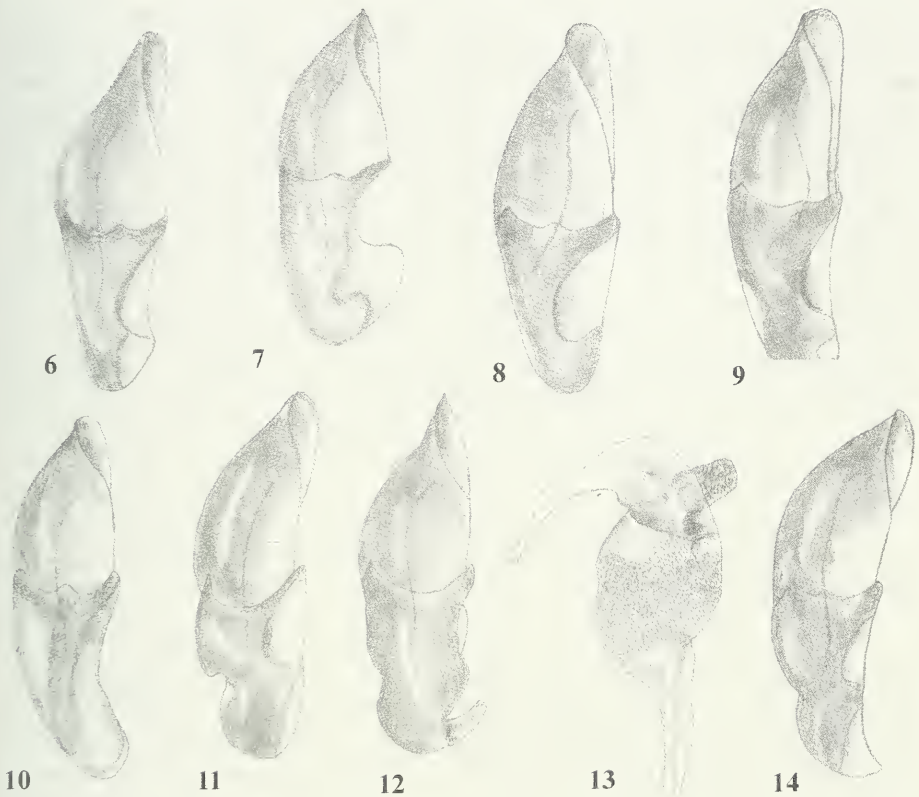
*Ataenius angusticollis* Schmidt, 1909: 19-21; 1910, tb.2, fig. 31; 1922: 441.

*Phalangochaeta angusticollis*: Martinez, 1952: 95-99, figs 18-27, 49; Dellacasa, 1988: 314 (catalogue).

*Type material.* Holotype (sex not determined) labelled 'Typus' 'Bolivia', *At. angusticollis* in NRS. Paratypes not designated, 3 female specimens labelled 'Syntypes', 'Bolivia, Coll. Kraatz', '*Ataenius angusticollis* Schmidt, Cartw. 71', in DEIE.

*Other specimens* (42). **Bolivia:** Prov. Sara, Dep. Santa Cruz de la Sierra, 500 m, 1.IV.1904, J. Steinbach (ZMHB); Ichilo, Buena Vista, coll. Martinez (CMN); Santa Cruz, 3.7 km SSE Buena Vista, Hotel Flora & Fauna, 430 m, 14-19.X.2000, B.K. Dozier (FSCA, ISEA); Santa Cruz, vicinity of Buena Vista, 28.X.1998, V. Tichy (JSC).

*Description.* Length 6.0 - 7.5 mm. Body strongly convex, glabrous, moderately shining, colour dark castaneous. Head large, deflexed, nearly as wide as pronotum, strongly gibbose medially; clypeal margin widely rounded on each side of wide, shal-



FIGS 6-14

6-11: Aedeagus in lateral view: 6 - *Auperia denominata* Chevrolat; 7 - *A. angusticollis* (Schmidt); 8 - *A. panamensis* sp. n.; 9 - *A. rondoniae* sp. n.; 10 - *A. guayara* sp. n.; 11 - *A. domingo* sp. n. 12-13: *A. transverseria* (Schmidt): 12 - aedeagus in lateral view; 13 - penis, saccus internus. 14: *A. puyoensis* sp. n.: aedeagus in lateral view.

low median emargination, edge deflexed at middle, ended by triangular process, sides of clypeus arcuate to obtuse, prominent gena; surface narrowly smooth just above median emargination, median area from side to side with moderate, longitudinal punctures blending into vertical band of round punctures separated by one diameter or less. Pronotum strongly transverse, slightly converging posteriorly; anterior angles obtusely rounded, slightly produced forward, side margin thickened, reflexed, finely crenate by punctures; posterior angles right-angled, base slightly excavate near posterior angles, marginal line lacking; surface deplanate near anterior angles with diagonal depression laterally; punctures mixed minute and moderate, anterior median area with finer punctures gradually increasing in size and density toward sides, becoming very dense and confluent along lateral margin. Scutellum triangular, convex at middle, impunctate. Elytra strongly arcuate, widest just behind the middle, slightly deplanate apically; humeral denticles moderate in size, acute, elytral base finely margined; striae



narrow, deep with moderate punctures distinctly crenating inner margins of intervals; intervals slightly convex on disc and here with minute scattered punctures, lateral intervals 8-9 convex and distinctly punctate, interval 10<sup>th</sup> flat, shagreened. Mesosternum convex, scabrous; meso-metasternal area with long, shining carina; metasternal plate convex, midline impressed, surface minutely punctate, lateral metasternal triangle broad, finely punctate inside; abdominal sternites 1-4 finely fluted along sutures, sternite 5 with longer and deeper fluting; abdominal surface shiny with moderate punctures. Profemur wide, perimarginal groove fine, surface scabrous; meso- and metafemora scabrous in anterior half and punctate posteriorly, metafemur with incomplete posterior line; protibia relatively small; meso- and metatibiae with fine longitudinal lines, apex with external spiniform edge and small accessory spine, apical spurs thin; hind tarsus robust covered with yellowish hairs, segments 2-4 short, triangular, basal segment 1/3 longer than upper tibial spur. External sexual differences slight; sternite 5<sup>th</sup> in male usually shorter than in female; male genitalia as in Fig. 7.

*Remarks.* *Auperia angusticollis* may be recognized by the combination of the range (Fig. 20) coupled with size and strongly transverse, short pronotum; meso-metasternal structure is similar to that of *A. denominata* and *A. guayara* (Figs 15, 16). The specimens were collected mostly at light in the tropical transition forest.

*Auperia panamensis* sp. n.

Figs 3, 8, 21

*Type material.* Holotype male: Panama, Prov. Cerro Campana 2800', 13-14.V.1996, Wappes, Huether & Morris, in UNSM. Paratypes (9): 2 - Panama, Canal Zone, Black Tank Road NW Gatun Locks, 17-31.V.1980, B.C. Ratcliffe; 1 - Canal Zone, Ft. Gulick, 28-31.V.1981, at light, H.J. Harlan; 1 - same locality, 17.V.1976, at light; 1 - Canal Zone, Barro Colorado Is. 9.10V. 79.50W, 15.VI.1977, H.A. Hespeneheide; 1 - Camino del Oleoducto, 26.V.1997, R. Turnbow; 2 - Chiriqui, Chiriquicito, 16.V.1996, R. Turnbow; 1 - Panama Prov. 13-18 km W El Llano, 29.V-3.VI.1983, J.E.Wappes. Paratypes are in: CMN, FSCA, ISEA, PSC, RTC, UNSM.

*Description.* Length 6.5 - 7.0 mm. Body (Fig. 3) elongate oblong, convex, shining, reddish black. Head convex medially, slightly reflexed clypeal margin broadly rounded on each side of moderate median emargination, sides arcuate to widely rounded gena; clypeus minutely transversely wrinkled just above emargination, punctures gradually fine to moderate and slightly elongate upward over median convexity to vertex, separated by one diameter or less, punctures on vertex coarse, round, separated by less than one diameter. Pronotum short and wide, explanate in anterior half; anterior angles rounded, produced, side straight or slightly arcuate toward obtuse posterior angle; base slightly excised laterally without marginal line, lateral edge very finely crenate, fringed with minute, close setae; pronotal disc with scattered, very fine to fine punctures becoming quite dense, larger and coarser toward sides with intermixed fine punctures and here separated by less than one diameter. Elytra convex, sides arcuate, humeral denticle raised in sharp vertical carina; discal striae 1-3 finer than remained with shallow punctures, lateral and apical striae deep with slightly crenating punctures; lateral and apical intervals convex, punctures of intervals 8-9 and those on shoulders scattered, 9<sup>th</sup> interval convex, 10<sup>th</sup> interval flattened, subopaque; apical margin of elytra distinctly reflexed and transversely wrinkled. Mesosternum low, shagreened, mesometasternal carina wide between mesocoxae, shining; metasternum relatively long, fine punctures scattered on disc, midline distinct, lateral triangle broad, scabrous

inside; abdominal sternites finely fluted along sutures, fluting of sternite 5 longer and coarser; surface punctures rather coarse, extending from side to side; disc of pygidium deeply eroded and longitudinally wrinkled, apical lip wide, coarsely punctate and connected to basal cusp by shining longitudinal carina. Profemur scabrous; mesofemur fusiform, widest at middle, nearly same width as metafemur, closely punctate; metafemur with almost complete posterior line; tarsi setaceous, basal tarsomere of posterior tarsus about one-third longer than upper tibial spur.

In male, the pronotal disc is less closely punctate, basal emargination usually deeper than in female, 5<sup>th</sup> abdominal sternite shorter, disc of pygidium longer, posterior tarsus thicker; genitalia as in Fig. 8.

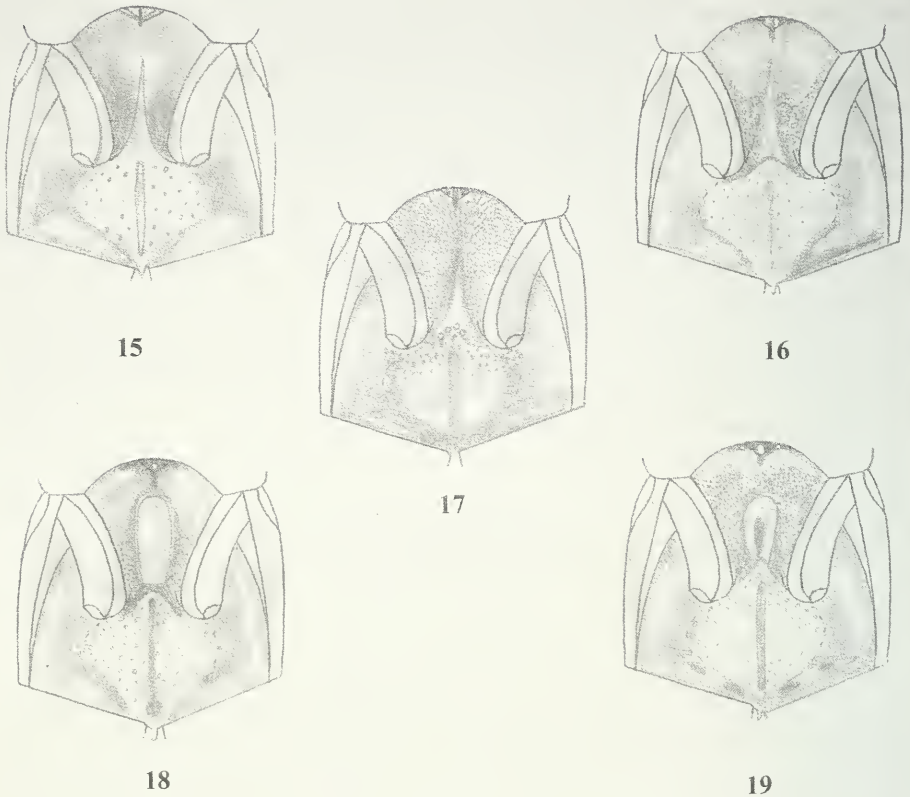
*Remarks.* *Auperia panamensis* belongs to the cluster (Fig. 1) of very closely related and externally similar species which can be recognized by the shape of sclerites of the male genitalia and by the characters given in the key. The meso-metasternal structures are similar to those in *A. denominata* (Fig. 15).

#### *Auperia rondoniae* sp. n.

Figs 9, 21

*Type material.* Holotype male; Brazil, Rondonia (Ro) 62 km S Ariquemes, Faz. Rancho Grande 10.32S, 62.48W, 5-15.X.1993, C.K. Messenger, in UNSM. Paratypes (6). 3 - same data as holotype; 1 - same locality, 11-22.XI.1991, tropical evergreen forest, B.C. Ratcliffe; 1 - same locality, 5-19.X.1993, black light trap, J.E. Eger; 1 - same locality, 23-24.VIII.1996, U. Schmitz. Paratypes are in CMN, ISEA, UNSM.

*Description.* Length 6.5-7.0 mm. Body elongate oblong, convex, shining reddish black. Head convex medially, slightly reflexed clypeal margin broadly rounded on each side of moderate median emargination, sides arcuate to rounded gena; clypeus minutely transversely wrinkled just above emargination, punctures gradually fine to moderate and slightly elongate upward over median convexity to vertex, separated by one diameter or less, punctures on vertex round, separated by one diameter. Pronotum short and wide, explanate in anterior half; anterior angles rounded, produced, side straight or slightly arcuate toward obtuse posterior angle; base excised laterally with fine marginal line, lateral edge very finely crenate, fringed with minute, close setae; pronotal disc with scattered, very fine to fine punctures becoming quite dense, larger and coarser toward sides and here separated by less than one diameter. Elytra convex, sides arcuate, humeral denticle raised in sharp vertical carina; discal striae 1-3 finer than remained with shallow punctures, lateral and apical striae deep with slightly crenating punctures; lateral and apical intervals convex, punctures of intervals 8-9 and those on shoulders scattered, 9<sup>th</sup> interval convex to subcarinate, 10<sup>th</sup> interval flattened, subopaque. Mesosternum low, shagreened, meso-metasternal carina wide between mesocoxae, shining; metasternum relatively long, fine punctures scattered on disc, midline distinct, lateral triangle broad, scabrous inside; abdominal sternites finely fluted along sutures, fluting of sternite 5<sup>th</sup> longer and coarser; surface punctures moderate in size, vanishing at middle; disc of pygidium deeply eroded, apical lip wide, coarsely punctate and connected to basal cusp by shining longitudinal carina. Profemur scabrous; mesofemur and metafemur fusiform, closely punctate; metafemur with complete posterior line; tarsi setaceous, basal tarsomere of posterior tarsus about one-third longer than upper tibial spur.



Figs 15-19

Meso-metasternum: 15 - *Auperia denominata* Chevrolat; 16 - *A. guayara* sp. n.; 17 - *A. domingo* sp. n.; 18 - *A. transversaria* (Schmidt); 19 - *A. teutoniae* sp. n.

In male, the pronotal disc less closely punctate, basal emargination usually deeper than in female, 5<sup>th</sup> abdominal sternite shorter, disc of pygidium longer, posterior tarsus thicker; genitalia as in Fig. 9.

*Remarks.* Externally, *Auperia rondoniae* is closest to *A. panamensis*. It can be distinguished with certainty by the characters of the male genitalia which are most similar to those of *A. denominata*, however, the latter species differs by having the apical declivity of elytra with more elevated intervals and with striae margined by lines. The meso-metasternal structures are similar to those in *A. denominata* (Fig. 15)

#### *Auperia guayara* sp. n.

Figs 10, 16, 21

*Type material.* Holotype, male: Bolivia, Guayaramerin (Beni), 23.XI.1966, np. 399 lamping, Balogh & Mahunka & Zicsi, in HHNM. Paratypes (3), same data as holotype, in HHNM, ISEA.

*Description.* Length 4.2-5.0 mm. Body elongate oval, convex, moderately shining, colour dark castaneous. Head convex medially, slightly reflexed clypeal margin



FIG. 20

Known distribution of *Auperia denominata* Chevrolat and *A. angusticollis* (Schmidt).

broadly rounded on each side of moderate median emargination, sides arcuate to obtuse gena; clypeal surface narrowly shiny just above emargination, punctures gradually fine to moderate and slightly elongate upward over median convexity to vertex, generally separated by one diameter. Pronotum wide, slightly diverging toward base, sides visible from directly above, narrowly explanate in anterior half; anterior angle rounded, side arcuate toward right-angled posterior angle, side margin finely crenate and fringed with minute setae; base without marginal line, on sides more or less deeply excised and distinctly lobed medially; pronotal punctures on anterior disc moderate in size, increasingly larger toward base, separated by about one diameter, on sides very coarse, pitted and contiguous. Elytra relatively short, convex, sides arcuate, humeral denticle small; discal striae 1-3 finer than remaining with shallower punctures moderately crenating margins of intervals; intervals 1-3 convex, lateral and apical intervals subcarinate, microreticulate with scattered fine punctures and minute setae, 10<sup>th</sup> interval flattened, opaque. Mesosternum low, rugosely shagreened with rather long pale hairs; meso-metasternal carina (Fig. 16) shining, long, wide between mesocoxae; metasternum relatively long, punctures grouped at mesocoxae, midline shallow, lateral triangle broad, scabrous inside; abdominal sternite 3 with short deep fluting, sternites 4-5 coarsely fluted along sutures; surface punctures moderate in size, extending from side to side; disc of pygidium deeply eroded and finely granulate. Profemur scabrous, rugose; mesofemur shorter and wider than metafemur, with setigerous punctures at knee, metafemur with almost complete posterior line; metatarsus relatively short, densely setaceous, basal tarsomere about one-third longer than upper tibial spur.



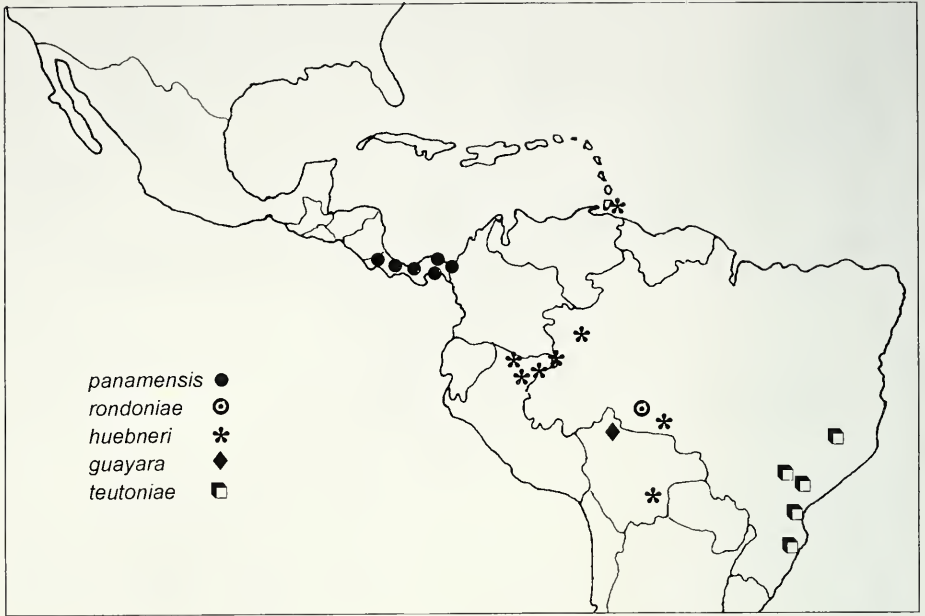


FIG. 21

Known distribution of *Auperia panamensis* sp. n., *A. rondoniae* sp. n., *A. huebneri* (Petrovitz), *A. guayara* sp. n. and *A. teutoniae* sp. n.

In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 10.

*Remarks.* *Auperia guayara* is most closely related to the cluster of species including *A. angusticollis*. It can be easily distinguished from all these species by its smaller size and the coarse pronotal punctures forming large pits.

#### *Auperia domingo* sp. n.

Figs 11, 17, 22

*Type material.* Holotype male, Ecuador, Pich 500 m, 4 km SE Sto Domingo, 8.VI.1976, Ber. 342 forest litter. S. & J. Peck, in HAHC(CMN). Paratype female, Costa Rica, Hamburg Farm nr Siquirres, E. Reimoser, in MHNG.

*Description.* Length 4.8-5.0 mm. Body elongate, widest at apical third of elytra, shining, colour castaneous. Head gibbose medially, clypeal margin widely rounded on each side of shallow median emargination, side arcuate toward obtuse, protruding gena; clypeal surface anteriorly with wide, smooth area extending from gena to gena, middle of head with fine, slightly elongate punctures separated by one diameter, closer and slightly confluent at eyes, blending into vertical band of round punctures separated by one diameter. Pronotum transverse, base without marginal line, excavate laterally, crenate by fine close punctures; anterior angle broadly rounded, posterior angle right-angled, side slightly explanate, edge minutely crenate and fringed with minute setae visible under high magnification; pronotal disc distinctly convex, punctures scattered, mixed fine and moderate, those on each side of disc larger, sepa-



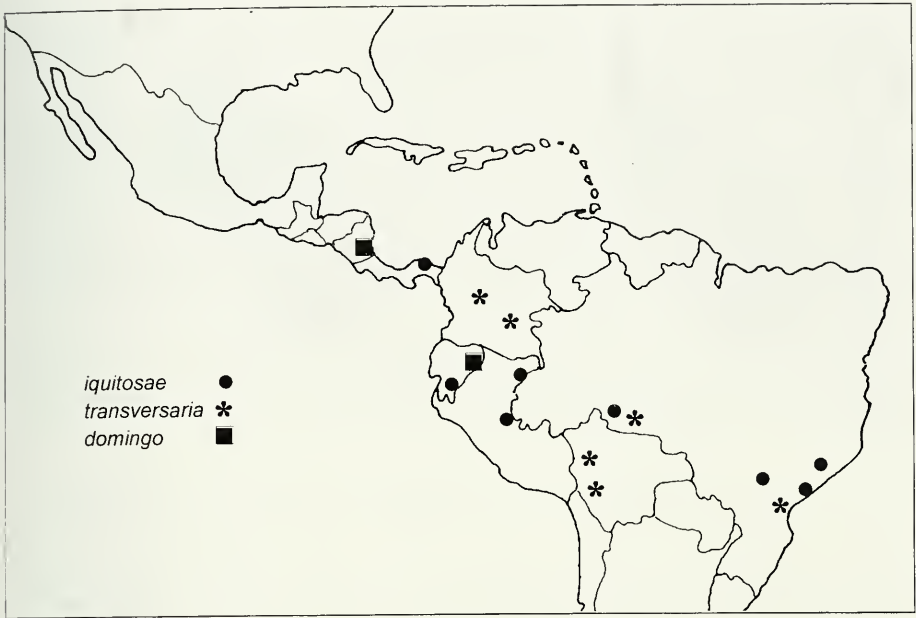


FIG. 22

Known distribution of *Auperia iquitosae* sp. n., *A. transversaria* (Schmidt) and *A. domingo* sp. n.

rated by one diameter becoming increasingly larger and denser toward lateral margin and here strongly rugose. Elytra arcuate, edge minutely crenate and setigerous like as pronotal side, humeral denticle conical, acute; striae deep, strial punctures close each other, crenating margins of intervals; intervals convex, discal intervals 1-4 minutely punctate, intervals 5-9 from base to apex with 2 irregular rows of fine, shallow punctures separated by 2-3 diameters, minutely setigerous at apex of elytra. Mesosternum flattened, shagreened, median carina (Fig. 17) wide basally, shining, meso-metasternal suture distinct, 6-8 large punctures just below suture; metasternal midline deep, surface punctures fine to moderate, grouped near mesocoxae, lateral metasternal triangle narrow, shagreened inside; abdominal sternites at middle with very short fluting increasingly longer to sides; longest on sternite 5<sup>th</sup>; abdominal surface shining with moderate, minutely setigerous punctures extending from side to side, coarser and denser near epipleura; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina lacking. Profemur shining with coarse, confluent punctures; mesofemur as wide as metafemur, punctate; metafemur with almost complete posterior line; metaibia with longitudinal, setigerous lines and small accessory spine apically; metatarsus very long, basal tarsomere 1/3 longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 11.

*Remarks.* Externally, *Auperia domingo* is very similar to the remaining three species of the group, namely *transversaria*, *puyoensis* and *teutoniae*. It differs from all these species by having the mesosternum with carina.

*Auperia transversaria* (Schmidt) comb. n.

Figs 12, 13, 18, 22

*Ataenius transversarius* Schmidt, 1909: 43-44; Dellacasa, 1988: 282 (catalogue); Stebnicka, 1998: 200, figs 1, 3.

*Euparia bolivari* Petrovitz, 1973: 183-184. **New synonymy.**

*Phalangochaeta bolivari*: Chalumeau & Howden, 1984: 87; Dellacasa, 1988: 284 (catalogue).

*Type material.* *Ataenius transversarius*: lectotype (Bolivia, Songo) designated by Stebnicka (1998), in NRS. *Euparia bolivari*: holotype (sex undetermined), labelled "Bolivia, Cochabamba", "*Euparia bolivari* Petrovitz m.", in MHNG.

*Other specimens* (36). **Brazil:** (SP) Agudos, 30.III.1993, C. Flechtmann (CFC); (Ro) Rondonia, 62 km SW Ariquemes nr Fzda Rancho Grande, 8-20.XI.1994, J.Eger & C.O'Brien, 18.IX.1994, C.W & L.O'Brien (FSCA, ISEA). **Colombia:** Bogota, coll. O Thieme; Honda a Magdalena coll. O. Thieme (ZMHB).

*Description.* Length 4.8-5.2 mm. Body elongate, widest at apical third of elytra, shining; colour dark castaneous, anterior of clypeus, apex of elytra, under side and legs lighter. Head gibbose medially, frontal suture marked on sides by impunctate area; clypeal sides widely rounded on each side of wide, shallow median emargination, edge slightly reflexed; surface impunctate just above median emargination, median area of head from side to side with fine and moderate, slightly elongate punctures separated by more or less than one diameter, vertex with band of round, dense punctures. Pronotum strongly transverse, short; anterior angles rounded, sides explanate, parallel, slightly emarginate near obtuse posterior angles; base on each side excavate, lacking marginal line, finely crenate by close punctures; pronotal surface with shallow depression on each side, punctures fine anteriorly, gradually increasing in size toward sides and base, large and very close on sides, rugose along lateral margin. Scutellum impressed at base. Elytra margined, humeral denticles moderate; striae strongly impressed with large punctures crenating inner margins of intervals, especially at apex; intervals convex on disc, subcarinate laterally, intervals 5-9 from base to apex with irregular rows of minutely setigerous punctures. Prosternum with wide process; mesosternum with oval, shagreened callosity (Fig. 18) separated from metasternum by meso-metasternal suture, two diagonal fossulae below suture; metasternal midline strong, metasternal disc closely punctate; abdominal sternites fluted along sutures, fluting gradually longer toward sides, penultimate sternite with coarse fluting; surface punctures moderate, extending from side to side, less close at middle of abdomen. Profemur shining, closely punctate; metafemur with complete posterior line; apex of metatibia with spiniform edge and accessory spine; tarsal segments setaceous, basal segment of metatarsus long, about 1/3 longer than upper tibial spur and longer than remaining tarsal segments combined. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Figs 12-13.

*Remarks.* *Auperia transversaria* belongs to the group of four species possessing the same size, colour and, at first glance, the same appearance. It is most close to *A. puyoensis* (see Remarks under that species).

The specimens were collected in Brazil on *Pinus caribaea hondurensis* stand.

*Auperia puyoensis* sp. n.

Figs 4, 14, 25, 37

*Type material.* Holotype male, Ecuador, Pastaza 900 m, 22 km SE Puyo, 15.VII.1976, forest litter, S. & J. Peck, in CMN. Paratypes (53): 3 - same data as holotype; 13 - Panama: 4 - Maje Station, 18.V.1974, black light trap, Engelman & Ramirez; 3 - Colon, Santa Rita Ridge,



Figs 23-24

Habitus: 23 – *Auperia iquitosae* sp. n.; 24 – *A. huebneri* (Petrovitz).

10.VI.1977, H.P. Stockwell; 1 – same locality, 18-21.VI.1974, at light, B. Ratcliffe; 1 – Canal Zone, Black Tank Road, NW Gatun Lock, 17-31.V.1980, B. Ratcliffe; 2 – Darien, Estacion Ambiental Cana, 07.45N, 77.41W, 700 m, 3.VI.1996, tropical montane forest litter, R. Anderson; 2 – Panama, Chiriqui, Chiriquicito, 16.V.1996, R. Turnbow; 37 – Venezuela: 18 – Miranda, Guatopo Nat. Park, Agua Blanca, 35 km N Altagracia, 3.VI.1987, 400 m, sifted insect bait, S. & J. Peck; 10 – Sucre, 7 km S El Pilar, 29.VII.1987, rainforest remnant leaf and log litter, S. & J. Peck; 1 – Guarica, Guatopo Nat. Park S border, 24 km W Altagracia, 10.VI.1987, 300 m, forest leaf litter, S. & J. Peck; 1 – Tachira, Fundacion Presa Las Cuevas, 600 m, 14.VI.1989, rain forest log litter, S. & J. Peck; 6 – same locality, 11.VII.1989, rain forest litter, S. & J. Peck; 1 – Aragua, Maracay, Rancho Grande, 1-10.VII.1987, cloud forest, Bordon & Peck. Paratypes are in: CMN, FSCA, ISEA, UNSM.

*Description.* Length 4.8-5.0 mm. Body (Fig. 4) elongate, widest at apical third of elytra, shining, colour dark reddish brown. Head moderately convex medially, clypeal margin widely rounded on each side of shallow median emargination, side arcuate toward obtuse, protruding gena; clypeal surface just above emargination with 2-3 slight transverse rugae, median area and vertex with moderate in size, rather deep, slightly elongate punctures separated by one diameter. Pronotum transverse, nearly parallel-sided, base without marginal line, excavate laterally, crenate by fine close punctures; anterior angle broadly rounded, posterior angle right-angled, side more or less explanate, edge minutely crenate and fringed with minute setae visible under high magnification; pronotal disc weakly convex, surface punctures variable in distribution, usually fine anteriorly, separated by 2 diameters, those on posterior disc about 2 times larger, separated by one diameter, punctures become increasingly larger and denser toward lateral margin and here strongly rugose. Elytra arcuate, edge minutely crenate and setigerous like as pronotal side, humeral denticle conical, acute; striae deep strial punctures close each other, crenating margins of intervals; intervals convex, discal intervals 1-4 impunctate, intervals 5-9 from base to apex with irregular rows of fine, deep, setigerous punctures separated by one diameter or less. Mesosternum flattened, shagreened and longitudinally wrinkled, median callosity surrounded by narrow,

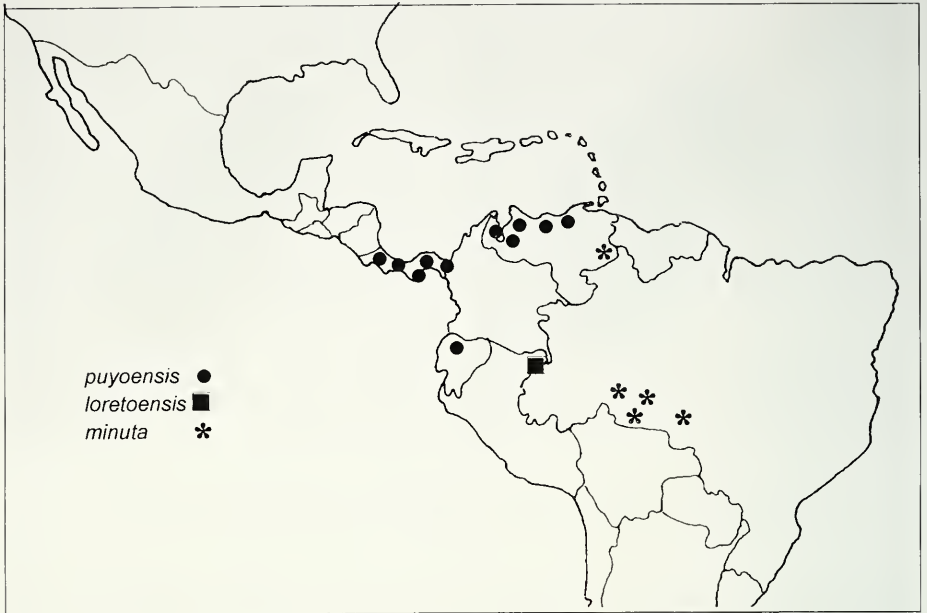


FIG. 25

Known distribution of *Auperia puyoensis* sp. n., *A. loretoensis* sp. n. and *A. minuta* (Petrovitz).

shining margin; mesometasternal suture distinct, two diagonal fossulae just below suture; metasternal midline deep, surface punctures moderate, concentrated near meso-coxae, lateral metasternal triangle narrow, shagreened inside; abdominal sternites 2-4 with fluting longest on sides, fluting of sternite 5<sup>th</sup> extending from side to side; abdominal surface at middle with fine scattered punctures, on sides punctures coarse, close, minutely setigerous; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina weak or invisible. Profemur shining with coarse, confluent punctures; mesofemur slightly wider and more closely punctate than metafemur; metafemur with almost complete posterior line; metatibia with longitudinal, setigerous lines and small accessory spine apically; metatarsus relatively long, basal tarsomere  $\frac{1}{4}$  longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 14.

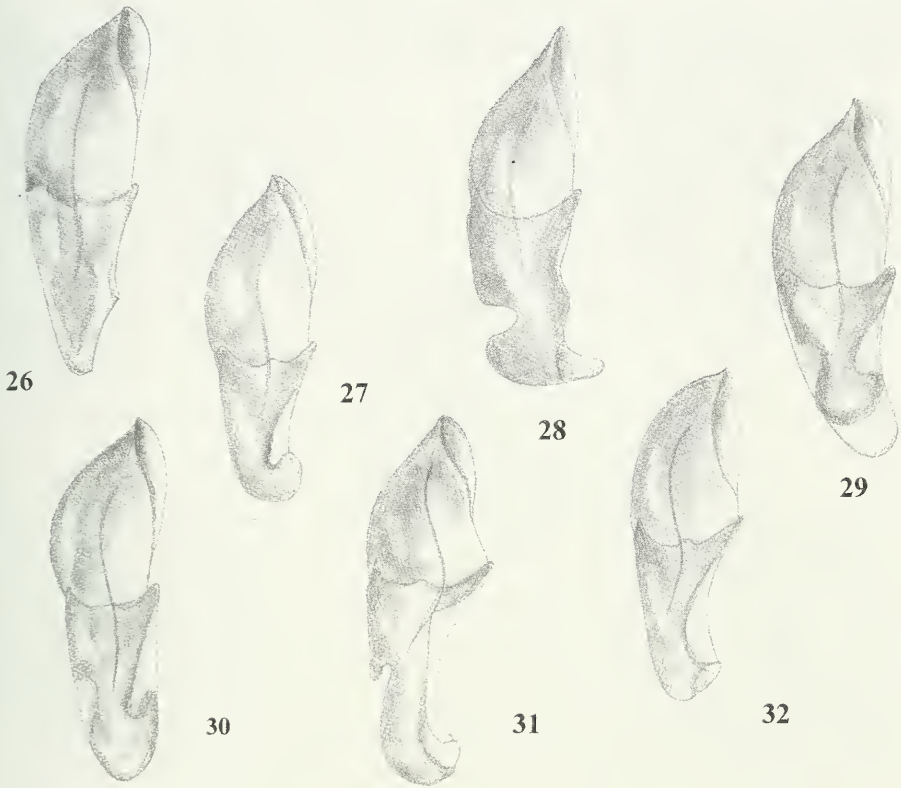
*Remarks.* *Auperia puyoensis* may represent a geographic form of *A. transversaria* to which it is most closely related, but differs from that species by having the more coarse punctures of the head, the pronotal punctures larger and the elytra more arcuate. The meso-metasternal structures are similar to those in *A. transversaria* (Fig. 18).

#### *Auperia teutoniae* sp. n.

Figs 19, 21, 26

*Type material.* Holotype male, Brazil: (Sc) Nova Teutonia, Santa Catarina, IX.1972, F. Plaumann, in CMN. Paratypes (8): 2 - Brazil (RJ), Nova Friburgo, XI.1999, P. E. Grossi; 2 - Brazil (MG), Vicoso, 15.XII.1982, P.S.Fiuza; 1 - Brazil (MG), Lambary, XI.1924, coll. Halik; 2 - Brazil (Ba) Bahia, Encruzilhada, 980 m. XI.1972, M. Alvarenga; 1 - Brazil (no other data). Paratypes are in: FSCA, ISEA, MHNG, USNM.



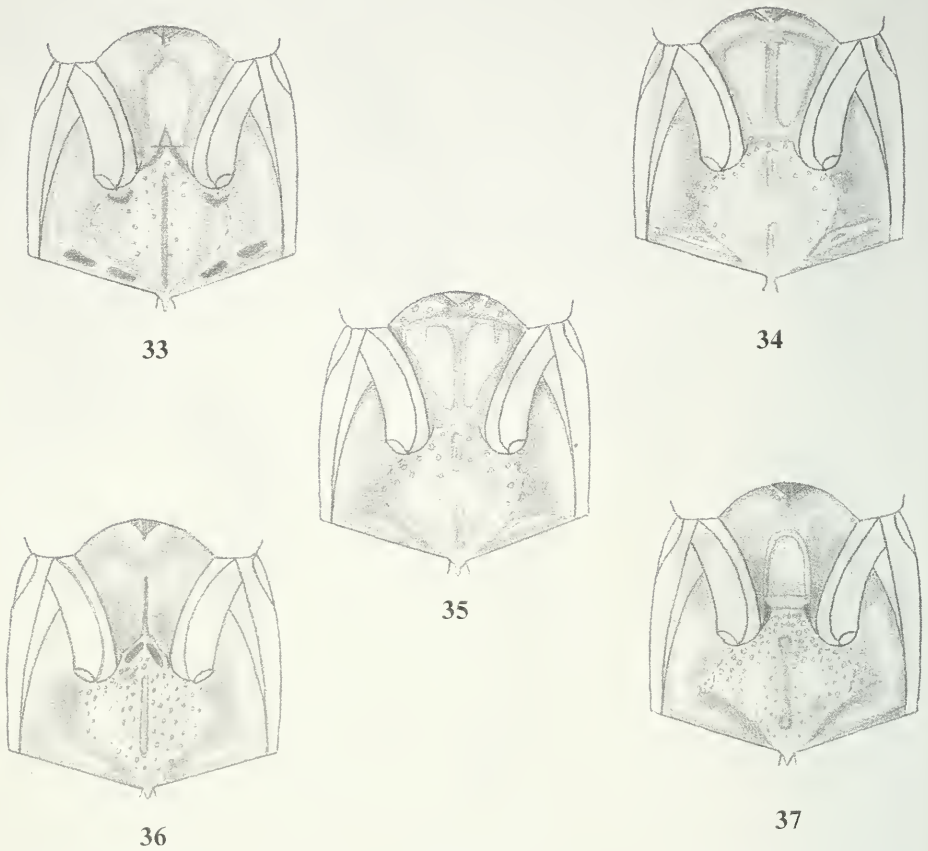


FIGS 26-32

Aedeagus in lateral view: 26 – *Auperia teutoninae* sp. n.; 27 – *A. minuta* (Petrovitz); 28 – *A. loretoensis* sp. n.; 29 – *A. capitosa* (Harold); 30 – *A. iquitosae* sp. n.; 31 – *A. huebneri* (Petrovitz); 32 – *A. squamosa* (Petrovitz).

*Description.* Length 4.8-5.0 mm. Body elongate, widest in apical third of elytra, shining, colour dark reddish brown. Head moderately convex medially, clypeal margin widely rounded on each side of shallow median emargination, side arcuate toward obtusely rounded gena; clypeal surface just above emargination with minute granules, median area upward to vertex with large, round and deep punctures separated by one diameter, vertex with regular band of two times smaller punctures separated by less than one diameter. Pronotum transverse, parallel-sided, base without marginal line, deeply excavate laterally, crenate by close punctures; anterior angle broadly rounded, posterior angle right-angled, protruding laterally when viewed from directly above; side explanate, edge minutely crenate and fringed with minute setae visible under high magnification; pronotal disc weakly convex, punctures anteriorly scattered, fine with intermixed larger ones, the latter closer at base, separated by 1-2 diameters, those on sides twice larger, denser toward lateral margin and here strongly rugose. Elytra arcuate, humeral denticle conical acute; striae deep, strial punctures close each other, crenating margins of intervals, 10<sup>th</sup> stria with row of elongate tubercles; intervals





FIGS 33-37

Meso-metasternum: 33 – *Auperia minuta* (Petrovitz); 34 – *A. capitosa* (Harold); 35 – *A. iquitosae* sp. n.; 36 – *A. amazonica* (Petrovitz); 37 – *A. huebneri* (Petrovitz).

convex, discal intervals 1-4 impunctate, intervals 5-9 from base to apex with irregular rows of fine, distinctly setigerous punctures separated by one diameter or less. Mesosternum flattened, shagreened, median callosity (Fig. 19) in form of loop with shining carina inside of scabrous area; meso-metasternal suture distinct, two diagonal fossulae just below suture; metasternal midline deep, surface punctures moderate, concentrated near mesocoxae, lateral metasternal triangle narrow, shagreened inside; abdominal sternites 2-4 with fine fluting, sternite 5<sup>th</sup> concave with coarser fluting; abdominal surface at middle with fine scattered punctures, on sides punctures larger but shallow, minutely setigerous; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina invisible. Profemur shining with coarse, confluent punctures; mesofemur as wide as metafemur but more closely punctate; metafemur with incomplete posterior line visible in apical half; metatibia with longitudinal, setigerous lines and small accessory spine apically; metatarsus relatively long, basal tarsomere 1/3 longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 26.

*Remarks.* *Auperia teutoniae* is most close to *puyoensis* and *transversaria*, but it differs from both these species by the shape of mesosternal callosity and by the male genitalia.

*Auperia minuta* (Petrovitz) comb. n.

Figs 25, 27, 33

*Euparia minuta* Petrovitz, 1973: 188-190.

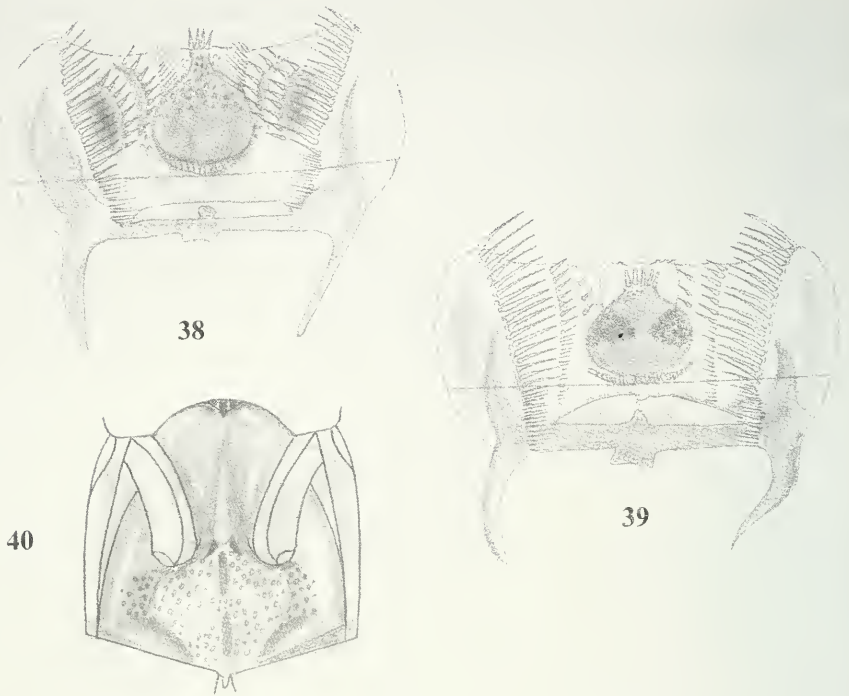
*Phalangochaeta minuta*: Chalumeau & Howden, 1984: 87; Dellacasa, 1988: 284 (catalogue).

*Type material.* Holotype (sex not determined) labelled "Brasilien, Utiariti, Rio Papagaio, MT (Kl. 477), 26.X.1966, Lenko & Pereira", "*Euparia minuta* m. Petrovitz", in MHNG.

*Other specimens* (28). **Brazil:** (Ro) Rondonia, 62 km SW Ariquemes nr Fzda Rancho Grande, 18.IX.1994, K. Vulinec, 18.IX, 8-20.X.1994, J. Eger, 6-20.XI.1994, J. Eger & C.O'Brien (PSC); (Ro) 9 km NE Cacauplandia, XII.1996 - I. 1997, K. Vulinec. **Venezuela:** Bolivar, Rio Sipao 110 km E Caicara, 17.VI-4.VIII.1987, S. & J. Peck (HAHC-CMN, ISEA, PSC).

*Description.* Length 3.8-4.0 mm. Body elongate, widest at apical third of elytra, shining, colour rusty brown to castaneous. Head transversely gibbose in anterior third (when viewed from side) with slight carina in front of gibbosity, clypeal margin widely rounded on each side of shallow median emargination, side arcuate toward obtuse, protruding gena; clypeus between emargination and gibbosity minutely punctate, strongly shiny, surface of head from shining area to vertex with close punctures separated by less than one diameter, slightly confluent on sides; frontal suture indicated by shining lines near eyes. Pronotum transverse, base with very fine marginal line, narrowly excavate laterally, crenate by fine close punctures; anterior angle broadly rounded, posterior angle right-angled, side slightly explanate, edge minutely crenate and fringed with minute setae visible under high magnification; pronotal punctures variable in distribution, fine along anterior margin, moderate but deep at middle and here separated by about one diameter, larger and denser on sides, rugose along lateral margin. Scutellum concave at middle. Elytra relatively long, slightly arcuate with relatively strong humeral denticle; striae deep, striae punctures close each other, crenating margins of intervals; intervals convex, discal intervals 1-4 very finely punctate, intervals 5-9 from base to apex with 1-2 irregular rows of fine, not close punctures. Mesosternum flattened, shagreened, median callosity (Fig. 33) opaque, meso-metasternal suture distinct, two diagonal fossulae just below suture and two small transverse pits at metacoxae; metasternal midline deep, surface punctures fine to moderate, scattered, lateral metasternal triangle narrow, shagreened inside; abdominal sternites at middle with very short fluting increasingly longer to sides; longest on sternite 5<sup>th</sup>; abdominal surface shining with moderate, minutely setigerous punctures extending from side to side, coarser and denser near epipleura; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina lacking. Profemur shining with coarse punctures; mesofemur as wide as metafemur, punctate; metafemur with incomplete posterior line; metatibia with longitudinal, setigerous lines and small accessory spine apically; metatarsus very long, basal tarsomere 1/5 longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 27.

*Remarks.* The species is most closely related to *A. loretoensis* sp. n. (see Remarks under that species), both species have similar meso-metasternal structures (Fig. 33). Specimens were collected to light traps in forest.



FIGS 38-40

38, 39: epipharynx: 38 – *Auperia puyoensis* sp. n.; 39 – *A. capitosa* (Harold). 40: *A. squamosa* (Petrovitz): meso-metasternum.

*Auperia loretoensis* sp. n.

Figs 25, 28

*Type material.* Holotype male, Peru, Loreto 1.5 km N Teniente López, 2.35S, 76.06W, 230-305 m, 18-26.VII.1993, R. Leschen, in HAHC-CMN. Paratype female, same data as holotype, in ISEA.

*Description.* Length 3.8-4.0 mm. Body oblong oval, widest at middle of elytra, shining, colour reddish black. Head transversely gibbose in anterior third (when viewed from side) with slight carina in front of gibbosity, clypeal margin widely rounded on each side of shallow median emargination, side arcuate toward obtuse, protruding gena; clypeal surface just above emargination narrowly shiny, minute punctures gradually increase in size upward to vertex, at middle of head slightly elongate, separated by one diameter, vertical band with round punctures separated by less than their diameter. Pronotum transverse, slightly diverging toward base, base without marginal line, narrowly excavate laterally, crenate by fine close punctures; anterior angle broadly rounded, posterior angle right-angled, side slightly explanate, edge minutely crenate and fringed with minute setae visible under high magnification; pronotal punctures fine along anterior margin, moderate and shallow at middle and here separated by more than one diameter, larger and denser on sides, rugose along lateral margin. Scutellum concave at middle. Elytra arcuate with relatively strong humeral denticle;



FIG. 41

Known distribution of *Auperia capitosa* (Harold).

striae deep, strial punctures close each other, crenating margins of intervals; intervals convex, discal intervals 1-4 finely punctate, intervals 5-9 from base to apex with 2 irregular rows of fine, close punctures. Mesosternum flattened, shagreened, median callosity opaque, meso-metasternal suture distinct, two diagonal fossulae just below suture and two small transverse pits at metacoxae; metasternal midline deep, surface punctures fine to moderate, scattered, lateral metasternal triangle narrow, shagreened inside; abdominal sternites at middle with very short fluting increasingly longer to sides; longest on sternite 5<sup>th</sup>; abdominal surface shining with moderate, minutely setigerous punctures extending from side to side, coarser and denser near epipleura; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina lacking. Profemur shining with coarse punctures; mesofemur as wide as metafemur, punctate; metafemur with incomplete posterior line; metatibia with longitudinal, setigerous lines and small accessory spine apically; metatarsus very long, basal tarsomere 1/5 longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 28.

*Remarks.* *Auperia loretoensis* is most close to *A. minuta*, but it differs from that species by having the pronotum more transverse and less densely punctate and the elytra relatively shorter with punctures on lateral intervals more pronounced than in *minuta*; the meso-metasternal structures are almost the same in both species (Fig. 33).

*Auperia capitosa* (Harold) comb. n.

Figs 5, 29, 34, 39, 41

*Ataenius capitosus* Harold, 1867: 83.- Schmidt, 1922: 440; Petrovitz, 1976: 289-290; Dellacasa, 1988: 105 (catalogue).



*Type material.* Lectotype (Columbia) designated by Cartwright (1973), in MNHN.

*Other specimens* (112). **Bolivia:** Cochabamba, Pcia Chapare S.F. del Chipiriri 400 m; Chaparo. 400 m. **Brazil:** (Ro) Rondonia. **Colombia:** Pichinda, Dagua, Paramba. **Costa Rica:** Puntarenas, Est. Biol. Las Cruces 4 km S San Vito, 1150 m; Estrella Valley, Hitory-Cerere. **Ecuador:** Pich. Napo, Aguamo, 400 m; Napo, Limoncocha; Los Rios. Quevedo: La Chiquita, 11 km SE San Lorenzo; Rio Palenque, 47 km Sto Domingo. **El Salvador:** Los Chorrros, 3 km S Santa Tecla. **Guatemala:** Quezalten, 25 km S Zunil; Izabal, Cerro San Gil, 8 km S San Escobar, 800 m. **Mexico:** Motzorongo Sta nr Veracruz; Chiapas, 20 mi W Huixtla. **Panama:** Bocas del Toro, Miramar, Ft. Sherman; Chepo, Altos de Maje; Canal Zone, 8 km SW Gatun; El Llano-Carti. **Peru:** Junin, Satipo; Loreto; Ayacucho La Mar, Santa Rosa; Cuzco, Quince Mil. Specimens are in: CMN, DEIE, FSCA, HAHC, ISEA, JSC, MHNG, PSC, RTC, SMTD, UNSM, USNM, WWC, ZMHB.

*Description.* Length 6.0-8.0 mm. Body (Fig. 5) elongate oval, strongly convex, shining, colour carbon black. Head unusually large, strongly gibbose, clypeus rounded on each side of more or less deep median emargination, side arcuate or straight, gena obtuse, prominent; surface punctures fine to moderate, evenly spaced, those of vertical area coarser, generally separated by one diameter. Eye large. Pronotum convex, base slightly tumid without marginal line, side short, posterior angle widely truncate, lateral margin thickened, punctate; discal punctures same size as those of head, becoming slightly larger toward sides, separated by one diameter. Elytra relatively short, arcuate, convex; striae moderately deep, stria punctures separated by one diameter or more; intervals flat or weakly convex on disc, elevated apically, 10<sup>th</sup> interval convex, shining; surface of intervals smooth, almost impunctate, in some specimens extreme apex of elytra with minute setae. Mesosternum very low, broad callosity (Fig. 34) shagreened, opaque; metasternum elevated, disc long, midline usually broken at middle, ended by pits, lateral triangle broad, shagreened; abdominal sternites 2-4 finely fluted along sutures, fluting of sternite 5 longer and coarser, surface of sternites with evenly spaced, moderate punctures; disc of pygidium deeply eroded and longitudinally wrinkled, median longitudinal carina and basal cusp shining, apical margin thick, punctate. Profemur scabrous, punctate; mesofemur slightly wider than metafemur with fine punctures concentrated in anterior apical half; metafemoral posterior line incomplete, usually visible in apical 1/3 or in apical half; metatibia as long as metafemur; basal tarsomere of hind tarsus equal in length to upper tibial spur. Epipharynx as in Fig. 39.

Male. Fifth abdominal sternite shorter than in female, disc of pygidium longer, tarsomeres of metatarsus thicker; genitalia as in Fig. 29.

Female. Pronotum usually more convex than in male, punctures coarser.

*Remarks.* Variation in the series of specimens of this common species is not great and does not seem to affect the characters that distinguish *A. capitosa* from other species in the genus. The size of the black shining body combined with characters of the head, pronotum and metasternum remain sufficiently constant for species recognition. The specimens examined were collected through the year, taken from basal debris of *Bactris* palm and commonly collected at light at altitude 400-1200 m.

*Auperia iquitosae* sp. n.

Figs 23, 30, 35

*Type material.* Holotype male, Peru, Prov. Loreto, 160 km NE Iquitos, Explorama Lodge, Rio Yanamono 1 km from Amazon River, 1-5.IX.1992, window trap, P.E. Skelley, in FS-CA. Paratypes (11): 1 - same data as holotype; 3 - Brazil: (Ro) Rondonia, 62 km S Ariquemes, Faz. Rancho Grande, 5-15.X.1993, C.& K. Messenger; 2 - same locality, 8-20.XI.1994, J. Eger



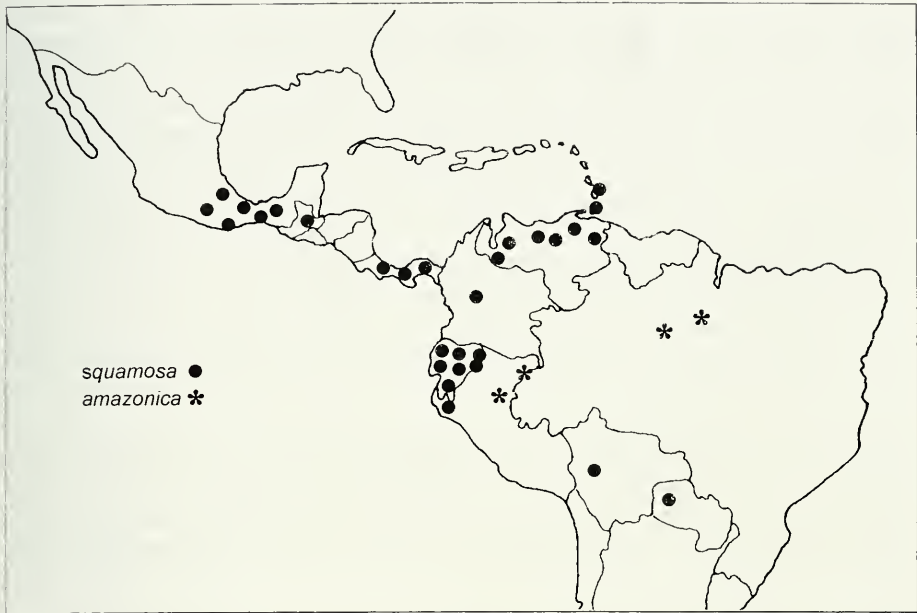


FIG. 42

Known distribution of *Auperia squamosa* (Petrovitz) and *A. amazonica* (Petrovitz).

& C.O'Brien; 1 - Brazil (MG), Ipatinga, IX.1993, E. Grossi; 1 - Brazil (ES), Linhares, XI.1988; 1 - Ecuador, Napo, Limoncocha 250 m, 18.VI.1976, forest litter, *Ficus* fruits, S.& J. Peck; 1 - Panama, Bocas d. Toro, Miramar, 9N, 82.15W, VII.1979, H. Wolda; 1 - Peru, Madre do Dios, Rio Tambopata Res. 30 km SW Pto Maldonado, 290 m, 2-5.XI.1979, subtropical moist forest, J.B. Heppner. Paratypes are in: FSCA, ISEA, MZUSP, UNSM, USNM.

*Description.* Length 4.0-5.0 mm. Body (Fig. 23) oblong oval, strongly convex, shining black, legs usually reddish. Head unusually large, strongly gibbosè, clypeus rounded on each side of more or less deep median emargination, side arcuate to obtuse, prominent gena; frontal suture marked by slight elevation near eye, minute punctures of clypeal surface become more evident at middle of head, those of vertical area fine to moderate, evenly spaced, generally separated by one diameter. Eye moderate in size. Pronotum subquadrate, convex, base without marginal line; anterior angles obtusely rounded, produced, side short, straight toward widely truncate posterior angle, lateral margin thickened, punctate; pronotal punctures variable in size and density, usually very fine punctures along anterior margin become increasingly larger to base and to sides, everywhere separated by two diameters or less. Elytra relatively short, arcuate, convex, humeral denticle relatively small; striae moderately deep, strial punctures separated by 2-3 diameters; intervals flat or weakly convex on disc, elevated apically, 10<sup>th</sup> interval convex, shining; sculpture of intervals variable, in most specimens intervals smooth, almost impunctate, in some minutely punctate or distinctly punctate, sometimes extreme apex of elytra with minute setae. Mesosternum very low, broad callosity (Fig. 35) shagreened, opaque; metasternum elevated, disc long with moderate

to coarse punctures in anterior half, midline usually broken at middle, lateral triangle wide, shagreened; abdominal sternites 2-4 finely fluted along sutures, fluting of sternite 5<sup>th</sup> longer and coarser, surface of sternites with moderate, evenly spaced, minutely setigerous punctures; disc of pygidium deeply eroded and longitudinally wrinkled, median longitudinal carina and basal cusp shining, apical margin thick, punctate. Profemur scabrous, punctate, perimarginal groove deep; mesofemur fusiform, equal in width to metafemur, metafemur with fine punctures concentrated in anterior apical half; metafemoral posterior line complete; metatibia as long as metafemur; basal tarsomere of hind tarsus equal in length to upper tibial spur.

Male. Fifth abdominal sternite shorter than in female, disc of pygidium longer, tarsomeres of metatarsus thicker; genitalia as in Fig. 30.

Female. Pronotum usually more convex than in male, punctures coarser, elytra more arcuate.

*Remarks.* The few specimens in the series show noticeable variation as indicated in the description. *Auperia iquitosae* and its closest species *A. capitosa* form a distinct group within the genus, based on general appearance and a number of shared character states. Differences between these two species are subtle, and both frequently occur in the same areas but size difference is fairly reliable and males differ in the genitalic characters.

*Auperia huebneri* (Petrovitz) comb. n.

Figs 21, 24, 31, 37

*Euparia huebneri* Petrovitz, 1970: 232-233.

*Phalangochaeta huebneri*: Chalumeau & Howden, 1984: 87; Dellacasa, 1988: 284 (catalogue).

*Type material.* Holotype (sex not determined), labelled 'Brazil, Manaus, Amazonas, leg. Huebner', 'Euparia huebneri m. Petrovitz', in MZUSP. Paratype, same data as holotype, in MH-NG.

*Other specimens* (26). **Bolivia**: Santa Cruz, 4-6 km SSE Buena Vista, Hotel Fauna & Flora, 14-16.X.2000, J. Wappes (FSCA). **Brazil**: (Am) Amazonas, Rio Demiti nr Little Homestead, 0.35N, 66.41W, 4.IX.1978, K.E.Ball; (Ro) Rondonia, 9 km NE Cacauplandia, XII.1996-I.1997, K. Vulinec & D. Mellow; (Ro) 62 km S Ariquemes, Fzda Rancho Grande, 18.IX.1994, C.W. & L. O'Brien (PSC). **Colombia**: Leticia, Amazonas, 700 ft, 25.II.1974, H. & A. Howden, 28.II.1974, S. & J. Peck (CMN). **Peru**: Prov. Loreto, Rio Yarapa, Puerto Miguel 200 m, 16-23.XII.1994, G. Holzinger (ISEA); Loreto, 160 km NE Iquitos, Explor.Camp on Rio Sucusari 2 km from Rio Napo, 27-31.VIII.1972, P. Skelley (ISEA, PSC); Loreto, Ramon Castilla, 24.II.1972, H. & A. Howden (CMN). **Trinidad**: 13 km S Arima, 2 km W Taiparo, Quesnell Farm, 50 m, 22.VI-8.VII.1993, S. & J. Peck (CMN).

*Description.* Length 4.8-5.0 mm. Body (Fig. 24) oblong oval, microreticulate, moderately shiny, colour piceous black. Head strongly gibbose medially, clypeal emargination indistinct, side widely rounded toward obtuse gena; clypeal surface in front of gibbosity narrowly shiny, smooth, median area with fine, very close punctures tending laterally to coalesce, punctures of vertical band round, nearly contiguous; frontal suture slightly elevated near eye. Pronotum strongly transverse, slightly diverging basally, sides widely explanate, edge minutely crenate and fringed with minute setae visible under high magnification; base without marginal line, excavate laterally, crenate by fine close punctures; anterior angle broadly rounded, and produced forward, posterior angle right-angled, prominent; pronotal disc weakly convex, punctures moderate, separated by one diameter, those on sides twice larger, almost contiguous and strongly

rugose along lateral margin. Scutellum opaque with longitudinal carina medially. Elytra arcuate with indicated preapical umbone, edge minutely crenate and setigerous like as pronotal side, humeral denticle conical acute; striae deep, strial punctures close each other, sharply crenating margins of intervals especially on sides of elytra; intervals strongly convex, carinate apically, interval 10<sup>th</sup> flat opaque, all intervals with fine scattered punctures minutely setigerous on apical declivity. Prosternal process very wide. Mesosternum flattened, shagreened, median callosity (Fig. 37) opaque, surrounded by narrow, shining margin; meso-metasternal suture distinct, two diagonal fossulae just below suture; metasternal midline deep, ended by pits, surface punctures coarse, concentrated on sides of disc, lateral metasternal triangle narrow, shagreened inside; abdominal sternites opaque, fluting of sternites 4-5 coarse, surface with moderate, shallow punctures; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina weak or invisible. Profemur shining with coarse, confluent punctures; mesofemur slightly wider and more closely, setigerously punctate than metafemur; metafemur with incomplete posterior line visible in apical half or in apical 2/3; metatibia with longitudinal, setigerous lines and small accessory spine apically; metarsus relatively short, basal tarsomere 1/3 longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 31.

*Remarks.* This species is most closely related to *A. amazonica* and similar externally; it differs from that species by having the body significantly larger, the anterior angle of pronotum strongly produced forwards and mesosternum with callosity. Examples of *A. huebneri* were collected to UV light in *Varzea* forest.

*Auperia amazonica* (Petrovitz) comb. n.

Figs 36, 42

*Phalangochaeta amazonica* Petrovitz, 1961: 148-149; Dellacasa 1988: 287 (catalogue).

*Type material.* Holotype (sex not determined), labelled 'Braz. Amazonia, Manaus II.1955. leg. Cappelletto, "*Phalangochaeta amazonica* Petrovitz", in MHNG. Paratype "Amazonas, Nhamunda 1959, Cappelletto", in MHNG.

*Other specimens* (6). **Brazil:** Amazonas (Am) Nhamunda 1959, Cappelletto (MHNG). **Peru:** Prov. Loreto, Yacumama Lodge near junction of Rio Marañon and Rio Ucayali, 73.5W, 54.8S, 6-20.VIII.1994, P. Skelley (PSC); Loreto, 160 km NE Iquitos, Explor. Camp on Rio Sucusari 2 km from Rio Napo, 27-31.VIII.1992, P. Skelley (ISEA, PSC).

*Description.* Length 3.0-3.2 mm. Body oblong oval, microreticulate, moderately shiny, colour piceous black. Head moderately gibbose medially, clypeus truncate anteriorly, side widely rounded toward rounded gena; clypeal surface in front of gibbosity microreticulate and minutely granulate, median area with fine, very close punctures tending laterally to coalesce, separated by less than one diameter, punctures of vertical band round, nearly contiguous; frontal suture slightly elevated near eye. Pronotum strongly transverse, sides explanate, edge minutely crenate and fringed with minute setae visible under high magnification; base without marginal line, excavate laterally, crenate by fine punctures; anterior angle rounded, side arcuate toward prominent posterior angle; pronotal disc weakly convex, punctures fine, evenly distributed, separated by one diameter, those on sides twice larger, almost contiguous and strongly rugose along lateral margin. Scutellum opaque with longitudinal carina medially. Elytra weakly widened in apical third with indicated preapical umbone, edge minutely



crenate and setigerous like as pronotal side, humeral denticle conical acute; striae deep, stria punctures close each other, slightly crenating margins of intervals; intervals 1-4 convex, intervals 5-9 carinate, interval 10<sup>th</sup> flat opaque, all intervals with fine scattered punctures minutely setigerous on apical declivity. Mesosternum weakly convex, shagreened, meso-metasternal carina (Fig. 36) fine, suture distinct, two diagonal fossulae just below suture; metasternal midline deep, broken at middle, surface punctures coarse, lateral metasternal triangle narrow, shagreened inside; abdominal sternites opaque, fluting of sternites 3-5 fine, longer on sides than at middle; surface with moderate, shallow punctures; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina weak or invisible. Profemur shining with coarse, confluent punctures; mesofemur slightly wider and more closely setigerously punctate than metafemur; metafemur with incomplete posterior line; metatibia with longitudinal, setigerous lines and small accessory spine apically; metarsus relatively short, basal tarsomere 1/3 longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; aedeagus similar to that of *A. huebneri*.

*Remarks.* *A. amazonica* is the smallest member of the genus being most close to *A. huebneri* and slightly less so to *A. squamosa*. It differs from both these species by the characters given in the key. A small series of specimens were taken to UV & black-light on sheet.

*Auperia squamosa* (Petrovitz) comb. n.

Figs 32, 40, 42

*Euparia squamosa* Petrovitz, 1976: 280-282.

*Phalangchaeta squamosa*: Dellacasa, 1988: 287 (catalogue).

*Type material.* Holotype (sex undetermined), labelled 'Ecuador, Archidona Oriente', "*Euparia squamosa* Petrovitz", in IRSNB. Paratype 'Ecuador, Verst.O. des Andes Santo Domingo 600 m', 'J. & N. Leleup', in MHNG.

*Other specimens* (242). **Bolivia:** Cochabamba, 177 km E Cochabamba at Lagunitas, 100 m, R. Anderson (CMN). **Colombia:** Ibaque (ISEA). **Ecuador:** Pich 16 km S Sto Domingo, Tinalandia 680 m, 15.VI.1975; 47 km S Sto Domingo, Rio Palenque Sta. 18-30.V.1975; Napo 500 m, 12 km SW Tena, 10.VIII.1976; Napo 250 m, Limoncocha, 18.VI.1976, S. & J. Peck (CMN); Limoncocha, 40 km E Puerto Francisco de Orellana (La Coca), Rio Napo, 21-27.IX.1979, J. Balogh (HNHM); Cotopaxi, Volcan Cotopaxi NNE Latacunga, 23.VI.1975; Manabi 450 m, 78 km NE Chone, 85 km WSW Sto Domingo, 9.VI.1976, S. & J. Peck (CMN, ISEA). **Guatemala:** Isabal, 1 km SE Mariscos, 200 m, 26.VI.1993, R. Anderson (CMN). **Mexico:** Chiapas, 6 km SW Ocosingo, 1400 m, 22.IX.1991, R. Anderson; Bonampak Rd, 100 km SE Palenque 230 m, 8.VII.1982, 8.VI.1993, S. & J. Peck; Veracruz, 33 km NE Catemaco, 160 m, Los Tuxtlas Biol.Sta., 1.VIII.1983, S. & J. Peck, 18-22.VII.1984, D.H. Lindemann; Fortin, 5.VIII.1969, S. & J. Peck; Cordoba, 4.VIII.1969, S. & J. Peck (HAHC-CMN, ISEA); Oaxaca, 6 km S Valle Nacional, 200 ft, 19.V.1971, S. & J. Peck (CMN). **Panama:** Chiriqui, 20 km N San Felix, 950 m, 8.VI.1995, R. Anderson; Panama prov., Interamerican Hwy 3 km E Ipeti, 3.V. 1992, S. Stockwell; Cerro Campana, 800 m, 5.VI.1995, R. Anderson (CMN). **Paraguay:** Cordillera N Emboseada Rio Piribebuy, 5.IV.1985, Miss. Mus. Geneva (MHNG). **Venezuela:** Aragua, Rancho Grande, 4.VII-9.VIII.1986, B. Gill; 19-27.II.1971, S. Peck; Tiara 50 km SW Caracas, 22.II.1971; Merida, Tovar, 1000 m, 22.VI.1989; Bolivar, 10 km N Corocito, 18.VI-3.VII.1987; Rio Caura rainforest, S. & J. Peck (CMN); Aragua, PN Henri Pitier, E.B. Rancho Grande, 1150 m 12.V.1998; Tachira, PN Chorro del Indio, 10 km NE San Cristobal, 1300 m, 28.V.1998, R. Anderson (CMN, ISEA). **Trinidad:** Tunapuna, Mt St Benedict, 240 m, M. Tabor, 4.VI.1993; 19 km N Aima, Lalaja Trace, 650 m, 8.VI.1993, S. & J. Peck (CMN).

*Description.* Length 4.0-4.5 mm. Body oblong oval, shining, colour piceous black. Head moderately gibbose medially, clypeus truncate anteriorly or shallowly



emarginate, side widely rounded toward obtuse, more or less protruding gena; clypeal surface in front of gibbosity narrowly shiny, or impunctate shining area extends to front of median convexity; median area of head with fine to moderate and coarse, more or less close punctures tending laterally to coalesce, separated by less than one diameter, punctures of vertical band round, very dense to contiguous; frontal suture slightly elevated near eye. Pronotum transverse, side reflexed in anterior half, edge minutely crenate and fringed with minute setae visible under high magnification; base without marginal line, excavate laterally or not, more or less densely crenate by fine punctures; anterior angle rounded, side arcuate toward prominent or obtuse posterior angle; pronotal disc convex, punctures variably spaced, usually fine anteriorly, increasingly larger toward base and here separated by about one diameter, on sides twice larger, contiguous and rugose. Scutellum shiny with longitudinal carina medially. Elytra relatively short, arcuate, with more or less distinct preapical umbone, edge minutely crenate and setigerous, humeral denticle conical acute; elytral striae 1-3 narrow with fine punctures, striae 4-9 gradually deeper and wider with larger punctures, striae 8-9 wider than lateral intervals; intervals 1-4 convex or flat, each with irregular rows of distinct punctures, intervals 5-9 carinate, intervals 8-9 swollen or granulate or tuberculate, interval 10<sup>th</sup> flat opaque; apical declivity of elytra setigerously punctate-granulate, setae hair-like to squamous. Mesosternum weakly convex, shagreened, meso-metasternal carina (Fig. 40) long, suture distinct, two diagonal fossulae just below suture; metasternal midline deep, broken at middle, surface punctures coarse, closest in anterior half of disc, lateral metasternal triangle narrow, shagreened inside; abdominal sternites microreticulate, usually shining, fluting of sternites 3-5 long; surface punctures moderate to coarse, often longitudinal, extending from side to side; disc of pygidium deeply eroded, transverse carina elevated, longitudinal carina weak or invisible. Profemur shining with coarse, confluent punctures; mesofemur slightly wider and more closely setigerously punctate than metafemur; metafemur with complete posterior line; metatibia with longitudinal, setigerous lines and small accessory spine apically; hind tarsus moderate in length, basal tarsomere 1/4 longer than upper tibial spur. In male, penultimate abdominal sternite shorter than in female, disc of pygidium longer; genitalia as in Fig. 32.

*Remarks.* *Auperia squamosa* is characterized by very advanced variation, both geographic and ecological, affecting the punctuation of the head and elytra, the shape of pronotum and sculpture of the ventral sclerites. In some specimens, sculpture of the head and of the lateral elytral intervals and setation of elytra may all be greatly reduced. It seems to be noteworthy that such extreme forms of *A. squamosa* are similar externally to some species of *Ataenius*, e.g. to the sympatric *A. depilis* Petr. and to the unusually variable *A. scutellaris* Har. These species will be discussed in the ongoing revision of the species-groups of *Ataenius*.

*A. squamosa* occurs over a wide range and in diverse habitats; long series have been found in the wet montane forest litter, shrubs litter, coffee forest litter, buttress litter, decayed *Ficus* fruits, in paramo moss and in broken termite nests.

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**Two new species of pseudoscorpions (Arachnida, Pseudoscorpiones) from caves on Tenerife and La Palma (Canary Islands, Spain), with some new records from the Canary Islands and the Azores (Portugal)**

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**Two new species of pseudoscorpions (Arachnida, Pseudoscorpiones) from caves on Tenerife and La Palma (Canary Islands, Spain), with some new records from the Canary Islands and the Azores (Portugal). -**

The new species *Paraliochthonius mirus* sp. n. (La Palma, Cueva de los Sorprendidos) and *Calocheirus tenerifae* sp. n. (Tenerife, Cueva Hondo de Güimar) are described and figured. New localities are given for species of several families. The genus *Cheiridium* (Cheiridiidae) is recorded for the first time from the archipelago. Identifications keys are proposed for the Canarian species of the genera *Paraliochthonius*, *Tyrannochthonius* and *Lagynochthonius* and for all species of the genus *Calocheirus*. *Pseudoblothrus vulcanus* is recorded from several caves of Terceira and from the Island of Pico (Azores).

**Key-words:** Canary Islands - Azores - biospeleology - Pseudoscorpiones - new species.

INTRODUCTION

Intensive efforts in surveying the biodiversity of the Canary Islands have already yielded remarkable results (Izquierdo *et al.*, 2001). Knowledge of the pseudoscorpion fauna of the archipelago has been summarized by Mahnert (1997) and Mahnert & Oromí (2001). In the meantime, Dr Pedro Oromí (Departamento de Zoología, University of La Laguna, Tenerife: DZUL) sent me some more pseudoscorpions collected during his biospeleological and biological surveys on different islands. The Museum of Natural Sciences of Madrid has carried out a study on the National Park "Caldera de Taburiente" and the pseudoscorpions were sent to me by Mr Rafael García Becerra (La Palma). My colleague Dr Charles Lienhard (Muséum d'histoire naturelle, Geneva: MHNG) collected some epigeal pseudoscorpions during his visit to Gran Canaria in 1999. Besides new localities for some species and a first record of the genus *Cheiridium*, two new species are described here. As a result, the pseudoscorpion fauna of the Canary Islands now comprises 48 species/ subspecies. *Pseudo-*

*blothrus vulcanus* Mahnert has been collected from several caves by Dr Paulo Borges (Universidade dos Açores, Terceira) during his biospeleological survey on the Azores Islands.

## RESULTS

### NEW RECORDS

Note: Material without indication of collectors' names has been collected by Dr Pedro Oromí and his collaborators.

#### *Canary Islands*

##### *Chthonius (Ephippiochthonius) gracilimanus* Mahnert, 1997

Material: La Palma: Cueva Llano de los Caños, 25.11.2000 (MHNG); Cueva de los Palmeros, 9.12.2000 (DZUL).

##### *Tyrannochthonius setiger* Mahnert, 1997

Material: Tenerife: Sima de la Perdiz, 28.6.1999 (DZUL, MHNG), Cueva del Bucio, 18.6. 1999 (MHNG), Cueva del Mulo, 2.6.1998 (MHNG), Cueva de la Chatarra, 23.10.1991 (MHNG).

##### *Tyrannochthonius superstes* Mahnert, 1986

Material: Tenerife: Cueva de Breveritas, 10.7.1999, 18.12.1999, 17.3.2000 (DZUL, MHNG), Cueva de Belés, 19.11.1999 (MHNG)

##### *Paraliochthonius martini* Mahnert, 1989

Material: El Hierro: Cueva de los Pocitos, 8.10.2000 (DZUL, MHNG).

##### *Microcreagrina subterranea* Mahnert, 1993

Material: Tenerife: Cueva Hondo de Güimar, 26.10.1999 (MHNG), Cueva del Bucio, 21.10.1999 (MHNG).

##### *Calocheirus canariensis* (Beier, 1970)

Material: Gran Canaria, Cuesta de Silva, E of Guía, 230m, under stones, 26.2.1999, lg. Ch. Lienhard (MHNG).

##### *Geogarypus minor* (L. Koch, 1873)

Material: Tenerife, Teno Alto, 950m, 17.1. 1982, lg. A. Machado (MHNG).

##### *Cheiridium* sp.

Material: Gran Canaria: Barranco de Mogán, near Las Casillas, 200m, under bark of *Pinus canariensis*. 2.3.1999. lg. Ch. Lienhard: 2 tritonymphs (MHNG).

Remark: The genus is new for the archipelago, identification to species level of the tritonymphs is not possible.

##### *Pselaphochnes lacertosus* (L. Koch, 1873)

Material: Lanzarote. dunas de Orzola. 12.2.1993 (MHNG).

*Canarichelifer teneriffae* Beier, 1965

Material: Alegranza: Marpaís, 6.5.1993 (MHNG).

*Rhacochelifer gracilimanus* Mahnert, 1993

Material: Hierro, Hoya del Morcillo, 4.2.1992 (MHNG).

## Azores

*Pseudoblothrus vulcanus* Mahnert, 1990

Material: Island of Terceira: Gruta da Malha, Gruta Principantes; Island of Pico: Gruta da Baliza, Furna Nova: Ig. Paulo Borges.

Remark: The species has been described from Gruta da Beira (Terceira) (Mahnert, 1990).

## DESCRIPTION OF THE NEW SPECIES

*Paraliochthonius mirus* sp. n.

Figs 1-4

*Material*: Canary Islands. La Palma, Cueva de los Sorprendidos (El Paso), 19.7.2000, Ig. Rafael García Becerra: 1 ♂ (holotype) (Mus. Madrid), 1 ♂ (paratype) (MHNG).

*Etymology*: Latin adjective *mirus*: amazing.

*Description*: Carapace and pedipalps yellowish-brown, chelicerae brown; tergites whitish-yellow; sternites III and IV laterally slightly darker, otherwise whitish-yellow. Carapace 1.1 longer longer than broad, four eyespots present, the posterior ones indistinct and small; epistome slender and prominent; 16 macrosetae (4:4:4:2:2) plus one preocular microseta on each side. Tergal setae: (3-):4:4:4:6:6:6:6-7:6-7:7:4:6 (2 submedian tactile setae). Manducatory process with 2 setae, coxal setae: pedipalpal coxa 3, I 3, II 7-8 serrated coxal spines (in one row)(as figured for *P. martini* in Mahnert, 1989, fig.9), III 4-5, IV 5; intercoxal tubercle absent. Genital operculum 10-11 setae, sternal setae: 6 (+ 3-4 microsetae on each stigma):6 (+ 2x3):10:9:9:9:9:7-9 (2 tactile setae):0. Cheliceral palm with 5 setae (Fig. 1), fixed finger with 7-9 (distal ones enlarged) and movable finger with about 5-6 rounded and nearly rudimentary teeth; spinneret absent; serrula interior with 15, s. exterior with 24-25 blades; flagellum 7 setae.

Pedipalps (Figs 2-3): Hand with 3 internal spine-like setae; fixed finger with 43-47, movable finger with 45-46 triangular teeth of nearly equal length, base of movable finger not modified; a small sensillum near *sb*; trichobothria see Fig. 4, *sb* clearly nearer to *st* than to *b*; femur 6.5-6.7 times longer than broad and 2.22-2.27 times longer than patella, patella 2.4-2.6 times, hand 2.1-2.2 times, chela 6.8-6.9 times longer than broad, fixed finger 2.2-2.3 times longer than hand; movable finger slightly shorter than fixed one.

Leg I: Femur 7.1-7.2 times longer than deep and 1.9-2.1 times longer than patella, patella 3.7-4.3 times, tibia 5.3-5.9 times, tarsus 11.5-12.5 times longer than deep. Leg IV: Femur+patella 4.0-4.1 times, tibia 7.0-7.2 times, basitarsus 3.5-3.6 times, telotarsus 14.0-15.6 times longer than deep and 2.7-2.8 times longer than basitarsus, both with a tactile seta (near base or proximal of middle).

*Measurements* (in mm): Carapace 0.71-0.73/0.67-0.70; Pedipalps: femur 1.21-1.25/0.19, patella 0.53-0.57/0.20-0.24, hand 0.62-0.63/0.29-0.30, fixed finger length 1.39-1.43, chela length 1.96-2.05. Leg I: femur 0.74/0.10, patella 0.35-0.38/0.09-0.10, tibia 0.41-0.44/0.06-0.07, tarsus 0.77-0.82/0.07. Leg IV: femur+patella 1.08-1.13/0.27, tibia 0.79-0.84/0.11-0.12, basitarsus 0.33-0.35/0.10, telotarsus 0.90-0.97/0.06.

*Discussion:* Cave-dwelling species of the genus *Paraliochthonius* are already recorded from El Hierro (*martini* Mahnert) and from Tenerife (*tenebrarum* Mahnert). The new species from La Palma is clearly related to *martini* and shares with this species the presence of three spine-like setae on the internal face of the chelal hand, triangular distal teeth on the movable chelal finger and the presence of eyespots. It differs from *martini* by bigger size, by having a relatively shorter fixed finger (2.2-2.3 vs 2.6 times longer than hand) and by the presence of (very indistinct) posterior eyespots.

Relationships between the genera *Tyrannochthonius* and *Paraliochthonius* from Canary Islands with *Stygiochthonius* (Carabajal Márquez *et al.*, 2001), recently described from continental Spain (Almería), are not yet well defined. This genus from Almería shares with *Paraliochthonius* some characters, e.g. the presence of two or three spine-like setae on the internal face of the chelal hand and of the saw-like (alternatively inclined) teeth on chelal fingers, but the latter can also be observed in *Tyrannochthonius superstes*. The high number of coxal spines (12-14) may have to be reconsidered as a specific character, since the number of coxal spines ranges from 6-10 in the Canarian species of *Tyrannochthonius* and *Paraliochthonius*.

Some of the characters emphasized by Muchmore (1984) as distinctive for *Tyrannochthonius* might be found, in the concerned area, in *Paraliochthonius* species and vice versa (e.g. position of trichobothrium *sb*), some others (e.g. heterodentate chelal fingers, epistome closely flanked by the 2 central carapacial setae) do not occur in any of the Canarian species assigned actually to *Tyrannochthonius*. It might therefore be necessary to reconsider the generic status of all species from this region actually placed in the genera *Paraliochthonius*, *Tyrannochthonius*, *Stygiochthonius* and even *Lagynochthonius*.

Identification key to the species of the genera *Lagynochthonius*, *Tyrannochthonius* and *Paraliochthonius* from the Canary Islands

- 1 Chelal hand with two or three strong, spiniform internal setae . . . . . 4
- 1\* Chela hand without or with only one slightly stronger seta . . . . . 2
- 2 Base of movable chelal finger with strongly sclerotized apodeme; both fingers strongly curved in distal half . . *Lagynochthonius curvidigitatus* Mahnert
- 2\* Base of movable chelal finger without strongly sclerotized apodeme, fingers straight . . . . . 3
- 3 Pedipalps slender, chelal hand at least 2.8 times longer than broad, chela at least 10.3 times longer than broad, 5 setae on cheliceral palm . . . . . *Tyrannochthonius superstes* Mahnert
- 3\* Pedipalps stouter, chelal hand 2.0-2.2 times longer than broad, chela 7.0-7.7 times longer than broad, 6-7 setae on cheliceral palm . . . . . *Tyrannochthonius setiger* Mahnert



- 4 Chela hand with two spiniform setae . . . . . 5  
 4\* Chelal hand with three spiniform setae . . . . . 6  
 5 Four eyes with lenses present; smaller species (length of palpal femur 0.65 mm); living in upper littoral zone . . . *Paraliochthonius canariensis* Vachon  
 5\* Eyes or eyespots absent; larger species (length of palpal femur 0.86 - 1.04 mm); living in caves . . . . . *Paraliochthonius tenebrarum* Mahnert  
 6 Smaller species, length of palpal femur 0.94mm, length of chela 1.45 mm . . . . . *Paraliochthonius martini* Mahnert  
 6\* Larger species, length of palpal femur 1.21mm, length of chela 1.96 mm . . . . . *Paraliochthonius mirus* sp. n.

*Calocheirus tenerifae* sp. n.

Figs 5-7

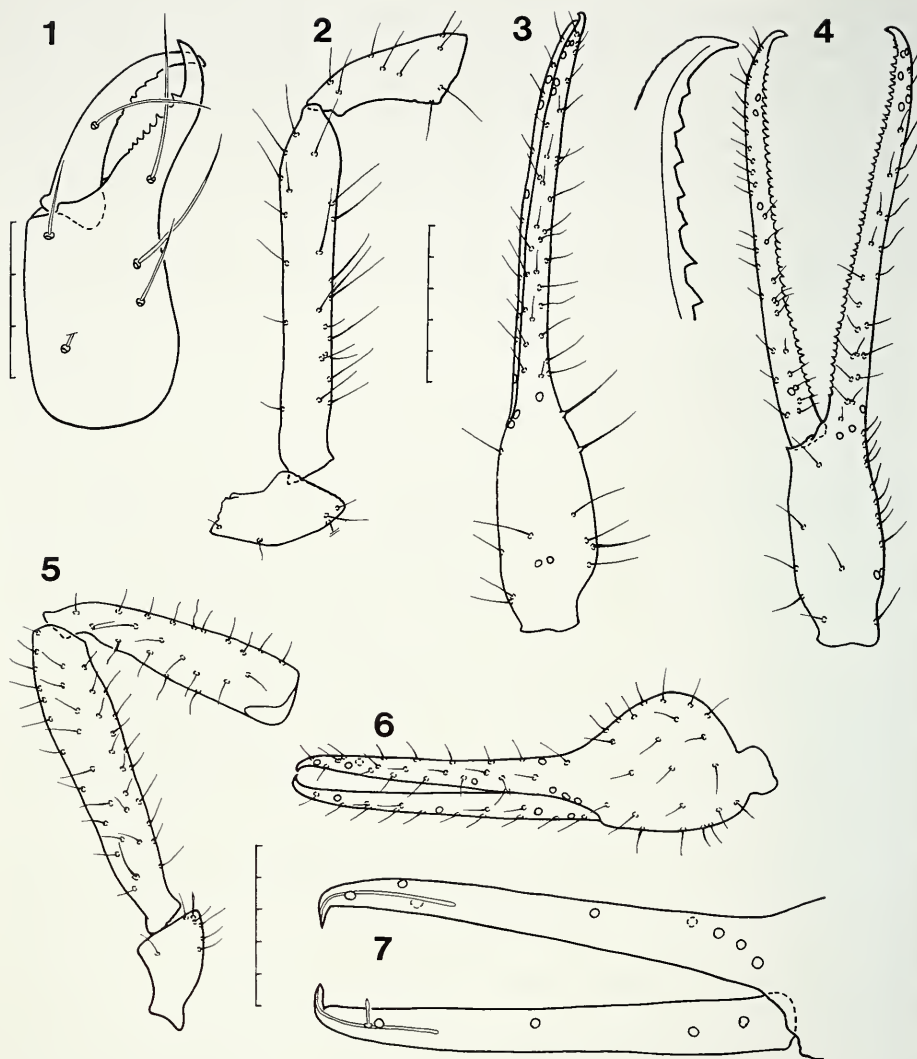
*Material:* Canary Islands, Tenerife, Cueva Hondo de Güimar, lg. M. Arechavaleta, 13.IV.1999: 1 ♀ (holotype) (DZUL).

*Description:* Pedipalps yellowish-brown, carapace olivaceous, tergites and sternites indistinctly olivaceous. Carapace 1.6 times longer than broad, smooth, with a very weak sub-basal transverse impression; cucullus relatively long; four large eyes present; 25 setae in total, of which 6 are at anterior and 5 at posterior margin; tergites undivided, chaetotaxy: I-II 4, III-VIII 6, IX 8 (2 sublateral tactile setae), X 6 (2 tactile setae), XI 8 (2 tactile setae). Manducatory process with 3 marginal and 2 discal bristles; coxae of pedipalps smooth, with 13 bristles, coxae I 7, II 9, III 10, IV 16 bristles; genital operculum with 5 central setae; sternites usually with 6 marginal setae, no suprastigmal microchaetae. Chelicera: 5 setae on palm, fixed finger with 5 basally-directed teeth, movable finger with broad tooth-like subapical lobe, galea with three apical branchlets, serrula exterior of 18 lamellae, flagellum with one large anterior and a small posterior blade.

Pedipalp (Figs 5,6): Femur smooth, with a tactile seta near base, 4.9 times longer than broad, patella 4.1 times, club 3.4 times, hand with pedicel 1.3 times longer than broad, strongly bulged medially, chela with pedicel 3.4 times longer than broad, finger 1.7 times longer than hand; fixed finger with 40 pointed teeth, movable finger with 11 pointed distal teeth and 14 large, flattened and indistinct ones, a lanceolate seta near trichobothrium *t* (Fig. 7).

Leg I: femur 5.0 times longer than deep and 2.2 times longer than patella, patella 2.4 times longer than deep, tibia 6.8 times, basitarsus 5.3 times longer than deep and 1.3 times longer than telotarsus, telotarsus 6.2 times longer than deep. Leg IV: femur+patella 2.8 times, tibia 5.7 times, basitarsus 4.8 times longer than deep and 1.3 times longer than telotarsus, telotarsus 5.3 times longer than deep; chaetotaxy of basitarsus: tactile seta + 2/3/4; arolia undivided, clearly longer than the smooth and large claws.

*Measurements* (in mm): Carapace 0.84/0.54. Pedipalps: Femur 1.04/0.21, patella 0.84/0.21, hand with pedicel 0.56/0.42, length of fixed finger 0.95, length of chela with pedicel 1.45. Leg I: Femur 0.49/0.10, patella 0.23/0.09, tibia 0.41/0.06, basitarsus 0.26/0.05, telotarsus 0.20/0.03; leg IV: Femur+patella 0.80/0.29, tibia 0.61/0.11, basitarsus 0.33/0.07, telotarsus 0.25/0.05.



FIGS 1-7

FIGS 1- 4: *Paraliocthonius mirus* sp. n.: 1: chelicera of paratype; 2-3: pedipalp of holotype (2: proximal articles, 3: chela); 4: palpal chela in lateral view, distal teeth of movable finger enlarged. FIGS 5-7: *Calocheirus tenerifae* sp. n.: 5-6 pedipalp (5: proximal articles, 6: chela), 7: trichobothrial pattern. Scale unit 0.1mm.

*Discussion:* Three species of the genus *Calocheirus* have already been described from the Canary Islands. The new species *tenerifae* sp. n. shares with *gigas* (Mahnert) the big size and slender pedipalps, but is somewhat smaller and its pedipalps are somewhat stouter. It is unlikely to be restricted to caves.

Key to the species of the genus *Calocheirus* Chamberlin

- 1 Small-sized species, length of palpal femur not exceeding 0.81 mm . . . . . 2
- 1\* Large species, palpal femur 1.24 mm long and 5.6 times longer than broad, chela 4.3 times longer than broad (length 1.86 mm). - Gran Canaria . . . . . *Calocheirus gigas* (Mahnert)
- 1\*\* Medium-sized species, palpal femur 1.04mm long and 4.9 times longer than broad, chela 3.4 times longer than broad (length 1.45 mm). - Tenerife . . . . . *Calocheirus tenerifae* n. sp.
- 2 Tergites I-VIII with 4 setae, palpal femur 4.0 times longer than broad (length 0.66 mm), chela 3.5 times longer than broad, length 1.12 mm; fixed finger with 28 teeth, movable one with 24 teeth. - Sudan . . . . . *Calocheirus atopos* Chamberlin
- 2\* Only the first two or four tergites with 2 - 4 setae . . . . . 3
- 3 Anterior tergites with 4 setae . . . . . 4
- 3\* Tergites I and II with 2 setae, palpal femur 4.6-5.0 times longer than broad (length 0.71-0.81 mm), chela 3.5-3.9 times longer than broad (length 1.16-1.39 mm), fixed finger with 37-40 teeth, movable one with 25-31 teeth. - Saudi Arabia . . . . . *Calocheirus gracilis* Mahnert
- 4 Usually only tergites I and II with 4 setae; palpal femur 3.7 times (female) - 4.7 times (male) longer than broad (length 0.69-0.81 mm), chela 2.5 times (female) - 3.4 times (male) longer than broad, length 1.08 (male) - 1.43 (female). - Gomera . . . . . *Calocheirus mirus* Mahnert
- 4\* Tergites I-IV with 4 setae; palpal femur 3.7 - 4.1 times longer than broad, (length 0.41-0.55 mm), chela 3.1 (female) - 3.7 times (male) longer than broad (length 0.72-0.84 mm). - Canary Islands . . . . . *Calocheirus canariensis* (Beier)

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## Neue und bekannte Riesenregenwürmer aus Kolumbien, Ecuador und Peru (*Oligochaeta: Glossoscolecida*). Regenwürmer aus Südamerika 35

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**New and known large-bodied Earthworms from Colombia, Ecuador and Peru (*Oligochaeta: Glossoscolecida*). Earthworms from South America 35.** - A new earthworm material containing large-bodied species from Colombia, Ecuador and Peru has been elaborated. Two new species *M. (C.) preciadoi* and *M. (C.) alarconi* spp. n. are described, furthermore a redescription of *M. (C.) pebasiensis* (Cognetti, 1914) and the first occurrences of *M. (C.) ischuros* Zicsi, 1990 and *M. (C.) magnus* (Cognetti, 1904) in Colombia are presented.

**Key-words:** Earthworms - *Oligochaeta* - *Glossoscolecida* - taxonomy - new species - redescriptions - Colombia - Ecuador - Peru.

### EINLEITUNG

In vorausgehenden Arbeiten wurde die Sammelgattung *Martiodrilus* in 4 Untergattungen geteilt (Zicsi & Csuzdi, 1997, Zicsi, 1998, Zicsi, 2000, Zicsi, 2001). Die Riesenregenwürmer aus dem Andengebiet wurden aufgrund des büschelförmigen (polystomaten) Nephrostoms des Nephridialorgans in Kombination mit der ausserordentlichen Körpergrösse, Pigmentation (von rot bis rotbraun) und der trichterförmig verdickten Dissepimente hinter dem Muskelmagen in die Untergattung *Cordilleroscolex* gestellt. Da sich diese grossen Formen durch die Ausbildung verschiedener Samentaschenformen deutlich voneinander unterscheiden, wurden innerhalb der Untergattung 3 Gruppen gebildet u. zwar Formen mit langen bandförmigen Samentaschen [*M. (C.) iserni*-Gruppe], mit kleinen tropfenförmigen Samentaschen [*M. (C.) columbianus*-Gruppe] und Formen mit winzigen Samentaschen, von denen auch mehrere in einem Segment, tief in der Muskelwand verborgen [*M. (C.) ischuros*-Gruppe] vorhanden sein können.

Bei der Einreihung der Arten zur Untergattung *Cordilleroscolex* konnte grösstenteils das Typenmaterial überprüft werden. Allein die Typen der Arten *M. pebasiensis* (Cognetti, 1914), *M. riveti* (Michaelsen, 1910), *M. olivaceus* Jamés, 1990 und *M. panamensis* James, 1990 konnten nicht eingesehen werden. Da bei den beiden letzteren

Arten das büschelförmige Nephrostom bei der Beschreibung angegeben und abgebildet wurde, lag bezüglich der Einreihung kein Zweifel vor, so dass nur *pebasiensis* und *riveti* fraglich blieben.

Die Art *M. purnio* (Michaelsen, 1900), die zu *Cordilleroscolex* gestellt und *M. monticola* (Michaelsen, 1900), die als fraglich betrachtet wurde, konnten anhand von Syntypen aus dem Zoologischen Museum Berlin überprüft und eindeutig in die Untergattung *Martiodrilus* (*Martiodrilus*) gestellt werden (Zicsi, 2000: p. 161-162).

Inzwischen wurden im British Museum, London vom Zweitautor unter Inv. Nr. 1997.1461-1463, 1997.1458-1460 mehrere Riesenregenwürmer angetroffen, die z. T. als *Martiodrilus* sp. (Kolumbien, Anden 10000-14000 Fuss, leg. Marte Latham), z. T. nur mit South America, leg. Osman Hill beschriftet sind. Ein Teil dieser Tiere konnte jetzt eingesehen werden.

Von *M. pebasiensis* (Cognetti, 1914), die in Peru bei Pebas, Rio Maranon, in einer Höhe von 200 m gefunden wurde, sind uns von Prof. Dr. M. Dzwillo, Zoologisches Museum Hamburg (ZMH), 2 weitere Exemplare übersandt worden, die auch in Peru gesammelt und mit dieser Art identisch gefunden wurden. Sie stammen ebenfalls aus dem Amazonasbecken, aus einer Höhe von 260 m, ungefähr 700 km vom typischen Fundort entfernt.

Weitere vom Drittautor zur Überprüfung übersandte, grosskörperige Regenwürmer liegen aus Kolumbien vor. Noch nicht veröffentlichte, grosskörperige Arten aus Ecuador sollen ebenfalls mit den vorausgehenden an dieser Stelle gemeldet werden.

## BESCHREIBUNG DER ARTEN

### *Martiodrilus* (*Cordilleroscolex*) *pebasiensis* (Cognetti, 1914)

Abb. 1-2

*Rhinodrilus* (*Thammodrilus*) *pebasiensis* Cognetti, 1914: 1

*Thammodrilus pebasiensis*, Michaelsen, 1918: 111

*Martiodrilus pebasiensis*, Righi, 1995: 514

*Martiodrilus pebasiensis*, Zicsi & Csuzdi, 1997: 84

Material: AF/4038 1 Ex., ZMH. 01 14255. 1 Ex Peru, Panguana (9° 37' S, 74° 56' W) am Rio Ynyapichis, Nebenfluss des Pachitea, 260 m, 18. 9. 1977, leg. Schlüte.

Die Art wurde aufgrund eines adulten Exemplares mit fehlendem Körperende beschrieben. Unsere beiden Exemplare sind vollständig und betragen eine Länge von 320 bzw. 400 mm, die Breite ist am Gürtel 26 bzw. 28 mm, hinter dem Gürtel 18 bzw. 20 mm. Segmentzahl 149 bzw. 199. Das Originalstück ist etwas kleiner, besitzt bedeutend weniger Segmente (88), soll aber nicht vollkommen gewesen sein.

Da die Originalbeschreibung ausführlich ist, werden nur die Merkmale angeführt, die bei der Beschreibung nicht berücksichtigt wurden.

Weibliche Poren liegen neben der Borstenlinie *b* auf der hinteren Seite des 14. Segments, männliche Poren auf Intersegmentalfurche 20/21, in Höhe der Pubertätsstreifen. Geschlechtsborsten beiderseits auf dem 17.-19. Segment, vom 20.-26. Segment nur in der Borstenlinie *b*. Sie stehen auf kleinen, runden Papillen. Die Geschlechtsborsten *b* sind 4 mm lang, 0,14 mm breit und besitzen 10 - 11 Kerben, am Ende schnabelförmig gebogen (Abb. 1). Die inneren Borsten *a* dieser Borstenpaare sind Hakenborsten mit Nodus, sie sind 2 mm lang, 0,19 mm breit und am Ende mit 12 Ringen ornamentiert (Abb. 2).

Nephrostome der Nephridien büschelförmig. Durch den Nachweis dieses Merkmales kann diese Art endgültig in die Untergattung *Cordilleroscolex* gestellt werden.

*Martiodrilus (Cordilleroscolex) ischuros* Zicsi, 1990

Abb. 3-4

*Martiodrilus ischuros* Zicsi, 1990: 370

*Martiodrilus ischuros*, Righi, 1995: 514

*Martiodrilus (Cordilleroscolex) ischuros*, Zicsi & Csuzdi, 1997: 101

Weiteres Material aus Ekuador: AF/ 4374 2 juv. Ex., Prov. Napo, Cosanga, 2550 m, 10. 4. 1987, leg. Zicsi, Loksa & Ponce. - Prov. Pichincha, AF/3408 1 Ex., St. Domingo de los Colorados, 1996, leg. Onore. - AF/3422 1 Ex., Astorga (Tandapi), 1700 m, 5. 9. 1991, leg. Onore. - AF/3427 1 Ex., Las Pampas, 600 m, 2. 6. 1991, leg. Onore. - Im British Museum liegen unter Inventarnummer 1997.1461-1463 und 1997.1458-1460 weitere 8 Exemplare vor.

Es liegen (AF/4376-77) 2 adulte und 2 juvenile Exemplare dieser Art mit dem Fundort Südamerika leg. Osman Hill vor. Da im gleichen Glas auch Exemplare von *Andiodrilus bogotaensis* Michaelsen, 1900 zu finden waren, die bisher nur aus Kolumbien gemeldet sind, ist es anzunehmen, dass diese grossen Tiere ebenfalls aus Kolumbien stammen.

Obwohl sie nicht vollkommen der Beschreibung von *ischuros* entsprechen, sollen sie trotzdem einstweilen unter dieser Art eingereiht werden.

In Grösse erreichen die abgetöteten Tiere die kleineren Formen von *ischuros*. Auch der Gürtel erstreckt sich bei einem Exemplar, wie bei *ischuros* vom 15.-28., dorsal auch bis auf das 1/2 29. Segment. Bei den übrigen Tieren liegt er aber nur auf dem 1/2 14., 15.-27., 1/2 28. Segment. Die Pubertätssteifen konnten abweichend von *ischuros* vom 20.- 1/2 27, 2/3 27., 27. Segment erkannt werden, während diese sich bei *ischuros* konstant vom 20.-28. Segment erstrecken. Borsten *b* der Gürtelregion zu Geschlechtsborsten verwandelt, Länge 3,75 mm, Breite 0,19, Zahl der Kerben 11-13 (Abb. 3). Borsten *a* der Gürtelregion mit Nodulus, Länge 2,75, Breite 0,25, Zahl der Ringe 11-12 (Abb. 4)

Die Lage der männlichen Poren variiert zwar bei *ischuros* zwischen den Intersegmentalfurchen 22/23, 23/24, und 24/25, eine Lage auf Intersegmentalfurche 20/21, wie dies bei den jetzigen Tieren erkannt wurde, ist bei der Ergänzung der Originalbeschreibung (Zicsi & Csuzdi, 1997) nicht angeführt worden. Die Testikelblasen schliessen Hoden und Samentrichter ein, lassen jedoch die Herzen des 10. und 11. sowie die Samensäcke des 11. Segments frei, so dass sie als oesophageale Testikelblasen angesehen werden müssen.

Samentaschenporen bei allen Exemplaren auf Intersegmentalfurche 5/6-8/9, es sind auch 2-3 Poren in einer Intersegmentalfurche zu erkennen. Die Samentaschen liegen tief in der Muskelwand verborgen und sind mit glänzenden Samenmassen gefüllt.

Nephrostom büschelförmig mit zahlreichen Rosetten versehen.

Aus Kolumbien sind bisher 2 besonders grosse, auch eine Länge von 400 mm überschreitende, Regenwurmarten bekannt geworden. Es sind dies *M. (C.) columbianus* (Michaelsen, 1900) und *M. (C.) olivaceus* James, 1990.

Die von *M. (C.) columbianus* angetroffenen Exemplare sind 260-600 mm gross (Michaelsen, 1900, 1913, Zicsi & Csuzdi, 1997), der Gürtel erstreckt sich vom 15.-27., die Pubertätsstreifen vom 20.-1/2 26. 26. Segment, sie besitzen 3 Paar Samentaschen

im 7., 8. und 9. Segment, die etwas aus der Körperwand hervorstehen und über Samenkammerchen verfügen. *M. (C.) columbianus* unterscheidet sich eindeutig von den Exemplaren, die wir als *M. (C.) ischuros* hier identifiziert haben.

Die andere grosskörperige Art, die von James (1990) als *M. (C.) olivaceus* beschrieben wurde, ist von Marte Latham 1965-66 nahe von Moscopan, Cauca, in Kolumbien gesammelt worden. Laut Originalbeschreibung sollen die Exemplare zu der Kollektion gehören über die Latham, (1966) berichtet hat und die lebend auch eine Grösse von 1090 mm erreichen können (Ayala et. al. 1972). James (1990) gibt eine Grösse von 460-560 mm, eine Lage des Gürtels vom 1/2 13.-1/2 26., die der Pubertätsstreifen vom 17.-25. Segment an. Samentaschenporen sollen auf Intersegmentalfurche 5/6-7/8 Segment liegen, (1-4 Paar je Segment). Männliche Poren liegen auf Intersegmentalfurche 20/21.

Ebenfalls konnte ein von M. Latham in den Anden Kolumbiens in einer Höhe zwischen 10000-140000 Fuss gesammeltes Exemplar im British Museum vom Zweitautor eingesehen werden. Bei diesem 500 mm langen Tier erstreckt sich der Gürtel vom 1/2 14.-27. Segment, dorsal etwas auch auf das 28. Segment übergehend, die Pubertätsstreifen vom 20.-1/2 27. Segment. Samentaschenporen liegen auf Intersegmentalfurche 6/7.-8/9. (3-5 Paar je Segment)

Es ist natürlich nicht auszuschliessen, dass die von Latham gesammelten Tiere verschiedenen Fundorten angehören und so auch verschiedene Arten sein können, es kann sich aber auch um eine Verzählung der Segmente handeln, die trotz der Grösse der Tiere auf Schwierigkeiten stösst. Allenfalls weichen beide Beschreibungen von der von uns für *M. (C.) ischuros* gegebenen ab.

Eine weitere, ebenfalls eine Länge von 400 mm erreichende Art wurde aus Ekuador (ohne nähere Fundortangaben), als *Rhinodrilus (Thamnodrilus) riveti* Michaelsen, 1910 beschrieben. Der Gürtel soll bei dieser Art vom (17 ?), 18.-28., die Pubertätsstreifen vom 1/2 20., 21.-28. Segment liegen. Es sind ebenfalls 4 Paar Samentaschen beschrieben worden, deren Samentaschenporen auf Intersegmentalfurche 5/6-8/9 erkannt wurden. In der Beschreibung wird hervorgehoben, dass die Samentaschen lang schlauchförmig bis schlank keulenförmig sind, wodurch sie sich eindeutig, von denen von uns für *M. (C.) ischuros* angegebenen, unterscheiden. Da diese Art trotz zahlreicher Aufsammlungen in Ekuador nicht erbeutet werden konnte und auch der Typus nicht ausfindig gemacht wurde, kann ein büschelförmiges Nephrostom, wie bei den anderen Riesenformen, nur vorausgesetzt werden, so dass sie einstweilen zur Untergattung *Cordillerscolex* gestellt wird.

### *Martiodrilus (Cordillerscolex) crassus* (Rosa. 1895)

*Anteus crassus* Rosa 1895a: 151

*Anteus crassus*, Rosa 1895b: 90

*Rhinodrilus (Thamnodrilus) crassus*, Cognetti. 1906: 188

*Thamnodrilus (Thamnodrilus) crassus*, Michaelsen, 1918: 112

*Thamnodrilus crassus*, Pickford. 1940: 7

*Martiodrilus crassus*, Zicsi. :1990: 369

*Martiodrilus (Cordillerscolex) crassus*. Zicsi & Csuzdi, 1997: 99

Material: Ekuador. AF/3367 1 Ex., Prov. Napo. El Reventador, 5. 1988, leg. G. Onore.



***Martiodrilus (Cordilleroscolex) columbianus*** (Michaelsen, 1900) Abb. 5-7*Anteus columbianus* Michaelsen 1900a: 53*Thamnodrilus columbianus*, Michaelsen, 1900b: 244*Rhinodrilus (Thamnodrilus) columbianus*, Michaelsen, 1913: 239*Thamnodrilus (Thamnodrilus) columbianus*, Michaelsen, 1918: 102*Martiodrilus columbianus*, Righi, 1995: 515*Martiodrilus (Cordilleroscolex) columbianus*, Zicsi & Csuzdi, 1997: 91

Material: Ekuador vor. Prov. Carchi. AF/3435 1 Ex., Paramo del Angel, 18. 2. 1989, leg. Bazante.

Es liegt ein weiteres, 250 mm langes, unvollkommenes Exemplar vor (AF/2316). Es wurde von Prof. H. Sturm aus Hildesheim in der Zeit vom Mai 1967 bis April 1969 in Kolumbien gesammelt, ein näherer Fundort ist nicht bekannt.

Wie bei den anderen grossen Arten dieser Gattung sind nur die *b* Borsten der Gürtelregion zu Geschlechtsborsten verwandelt, Länge 1,85 mm, Breite 0,12 mm, Zahl der Kerben 10 (Abb. 5). Die Borstenreihe *a* besitzt einen Nodus, Länge 1,5 mm, Breite 0,14 mm und eine Ringelung im oberen Teil mit 9-11 Ringen (Abb. 6).

Der Gürtel erstreckt sich vom 15.-27. Segment, die Pubertätsstreifen vom 20.-1/2 27. Segment.

Drei Paar Samentaschenporen auf Intersegmentalfurche 6/7-8/9. Die Samentaschen liegen im 7., 8. und 9. Segment und stehen etwas aus der Muskelwand hervor, besitzen Samenkammerchen, die mit Samenmassen gefüllt sind (Abb. 7).

***Martiodrilus (Cordilleroscolex) magnus*** (Cognetti, 1904) Abb. 8-9*Thamnodrilus magnus* Cognetti 1904: 10*Rhinodrilus (Thamnodrilus) magnus*, Cognetti, 1906: 222*Thamnodrilus (Thamnodrilus) magnus*, Michaelsen, 1918: 111*Martiodrilus magnus*, Righi, 1955: 515*Martiodrilus magnus*, Zicsi & Csuzdi, 1997: 92

Material: Kolumbien, AF/3418 1 Ex., Dep. Vale del Cauca, Palmira, Finca La Sirena 2600 m, 30. 3. 1992, leg. Feijoo.

Geschlechtsborsten der Gürtelregion sind abweichend vom Typus (OL. 433) und von den Exemplaren aus Ekuador (AF/3415, AF/3418) in der Borstenreihe *a* zu Geschlechtsborsten verwandelt. Länge 3,6 mm, Breite 0,12 mm, Zahl der Kerben 12-13 (Abb. 8). Die Borstenreihe *b* besitzt einen Nodus, Länge 2 mm, Breite 0,2 mm, Zahl der Ringe 14-15 (Abb. 9)

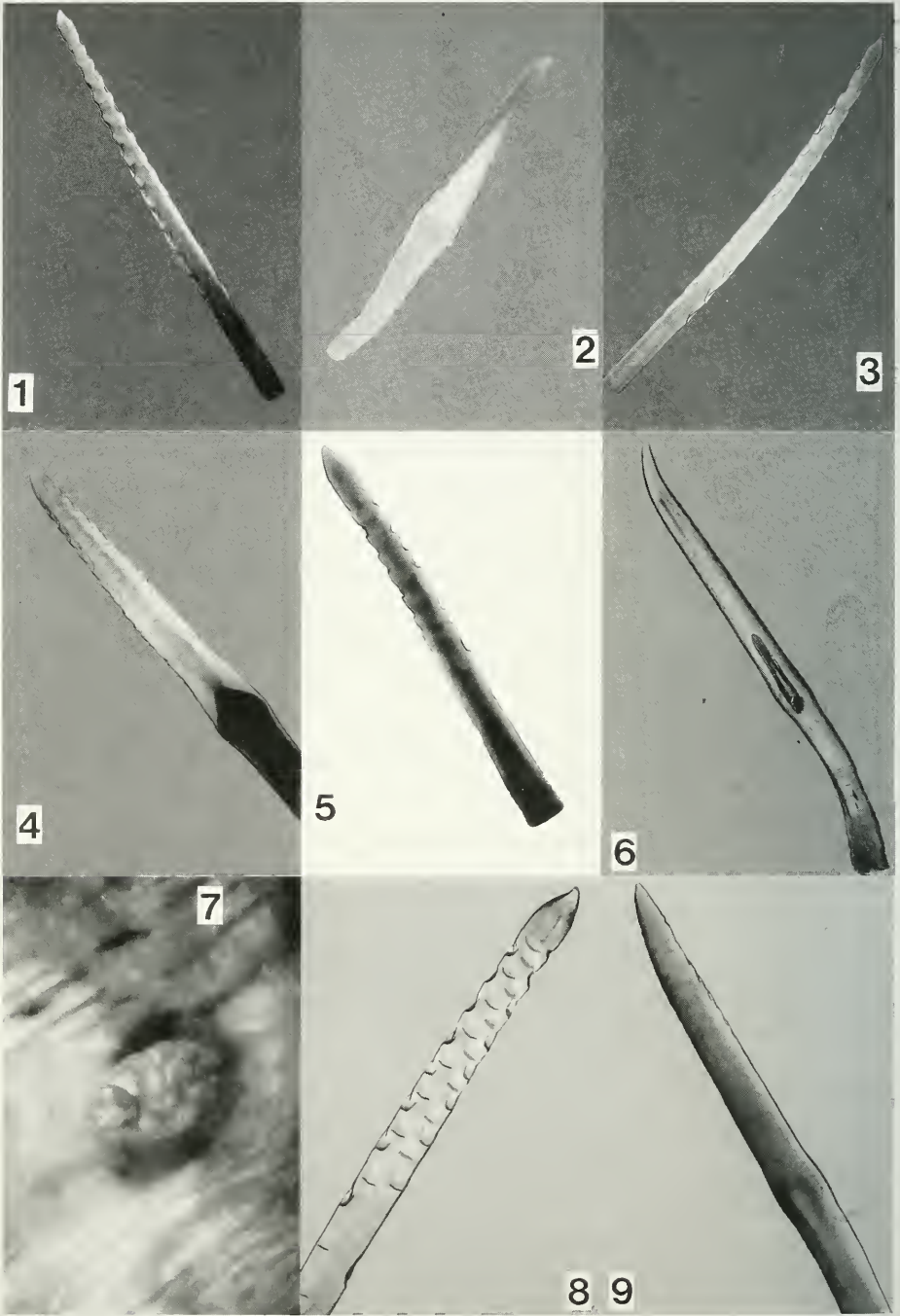
***Martiodrilus (Cordilleroscolex) preciadoi*** sp. n. Abb. 10-12, 16

Material: Holotypus. Kolumbien, AF/3474 Dept. de Casanare, Municipio Yopal vereda, Matepantano, 500 m, 15. 1. 1997, leg. Preciado.

Etymologie: Die neue Art wird zu Ehren des Sammlers, Herr Ingenieur Guillermo Preciado, Kolumbien, benannt.

Länge 155 mm, Breite 10 mm, Segmentzahl 167.

Farbe wahrscheinlich lebend rotbraun. Kopf eingezogen, 1.-2. Segment verwachsen. Segmente vor dem Gürtel nicht geringelt. Borsten am ganzen Körper eng gepaart. Borstenverhältnis hinter dem Gürtel *aa:ab:bc:cd:dd* wie 10:1:8:1:16. Borsten *ab* vom 5., *cd* vom 9. Segment zu erkennen. Borsten *ab* vom 16.-26. Segment (auf der



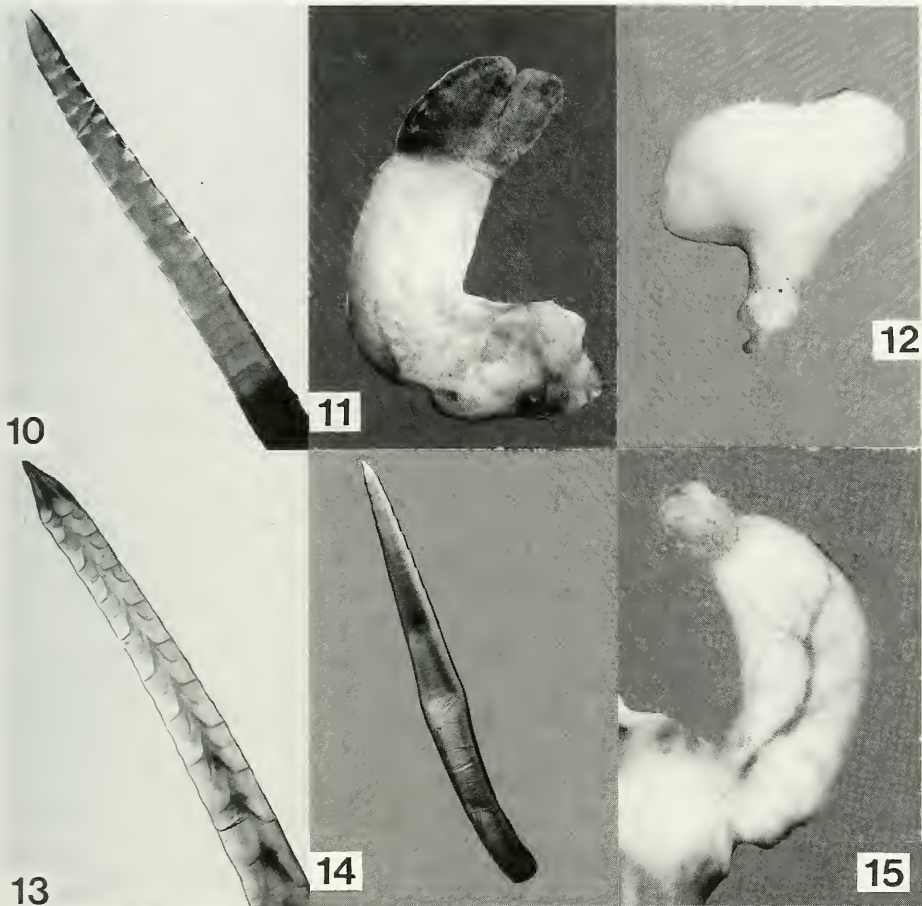


ABB. 1-15

1-2 *Martiodrilus (Cordilleroscolex) pebasiensis* (Cognetti, 1914) Geschlechtsborsten der Gürtelregion 1. Borstenlinie *b*. 2. Borstenlinie *a*; 3-4 *Martiodrilus (Cordilleroscolex) ischuros* Zicsi, 1990 Geschlechtsborsten der Gürtelregion 3. Borstenlinie *b*. 4. Borstenlinie *a*; 5-7 *Martiodrilus (Cordilleroscolex) columbianus* (Michaelsen, 1900) Geschlechtsborsten der Gürtelregion 5. Borstenlinie *b*. 6. Borstenlinie *a*; 7. Samentasche aus dem 8. Segment mit Samenkammerchen; 8-9 *Martiodrilus (Cordilleroscolex) magnus* (Cognetti, 1904), Geschlechtsborsten der Gürtelregion. 8. Borstenlinie *a*. 9. Borstenlinie *b*; 10-12 *Martiodrilus (Cordilleroscolex) preciadoi* sp. n. 10. Geschlechtsborsten ab der Gürtelregion. 11. Chylustasche aus dem 12. Segment. 12. Form der Samentasche aus dem 9. Segment; 13-15 *Martiodrilus (Cordilleroscolex) alarconi* sp. n. Geschlechtsborsten der Gürtelregion 13. Borstenlinie *b*. 14. Borstenlinie *a*. 15. Chylustasche aus dem 12. Segment.

linken Seite auch auf dem 15. Segment) stehen auf grossen, weissen Papillen und sind zu Geschlechtsborsten verwandelt. Länge 2,1 mm, Breite 0,11 mm, Zahl der Kerben 11-12 (Abb. 10). Nephridialporen in der Borstenlinie *cd*, Samentaschenporen auf Intersegmentalfurche 6/7-8/9.



Gürtel vom 14.-28. Segment, sehr kräftig entwickelt, stark drüsig. Pubertätsstreifen vom 20.-1/2 26. Segment. Weibliche Poren auf dem 14. Segment, hinter der Borstenlinie *b*. Männliche Poren sind mit Sicherheit nicht erkannt worden (19/20 ?).

Innere Organisation. Dissepimente 6/7-9/10 verdickt, 10/11-13/14 nur schwach verdickt. Schlund bis ins 5. Segment reichend. Muskelmagen im 6. Segment. Schlingenförmige Herzen im 7.-9., Intestinalherzen im 10. und 11. Segment. Chylustaschen 8 Paar im 7.-14. Segment, Wabentaschen mit zweigeteiltem, breittäfelartig abgeschnürtem Kopf (Abb. 11). Oesophageale Testikelblasen im 10. und 11., Samen-säcke im 11. und 12. Segment. Ovarien im 13. Segment, Ovarientrichter auf Dissepiment 13/14. Mitteldarm im 16. Segment beginnend, Typhlosolis vom 26. Segment vorhanden. Nephridien vom 14. Segment mit Nephridienblasen versehen, Nephrostom büschelförmig (polystomate) (Abb. 16).

Samentaschen im 7., 8. und 9. Segment, plattgedrückte, birnenförmige Gebilde (Abb. 12), die im Ausführungsgang mit Samenmassen gefüllte Samenkammerchen besitzen.

Die neue Art unterscheidet sich von *M. (C.) hamifer* (Michaelson, 1900) und *M. (C.) cognettii* (Beddard, 1921), deren Typenmaterial nicht eingesehen werden konnte, durch die perioesophagealen Testikelblasen, durch die Form der Samentaschen (bei *cognettii* nicht erkannt, sollen aber tief in der Muskelwand verborgen sein) und durch die Lage der Pubertätsstreifen.

Von den uns bekannten Arten steht die neue Art durch die Form der Samentaschen, die aus der Muskelwand deutlich hervorstehen und plattgedrückte Gebilde sind, der Art *M. (C.) validus* (Cognetti, 1904) und *M. (C.) bolivarensis* Zisci & Csuzdi, 1999 am nächsten, unterscheidet sich von diesen durch die Form der Samentaschen und die Samenkammerchen des Ausführungsganges.

### *Martiodrilus (Cordilleroscolex) alarconi* sp. n.

Abb. 13-15. 17

Material: Kolumbien. Holotypus AF/4378 Dept. de Antioquia, Cordillera Occidental, Municipio de Chigorodo, 150 m. 8. 7. 1995 leg. Alarcon. Paratypen AF/3480 2 Ex., Fundort wie beim Holotypus.- AF/3473 2 Ex., Dept. de Vichada, Puerto Soledad 480 m. 18. 3. 1991 leg. Alarcon.

Etymologie: Die neue Art wird zu Ehren des Sammlers, Herr Ingenieur Andres Alarcon, Kolumbien, benannt.

Länge des Holotypus 200 mm, Breite 9 mm, Segmentzahl 176. Paratypen Länge 113-117 mm, Breite 7-9 mm, Segmentzahl 112-182.

Farbe lebend wahrscheinlich rotbraun, abgetötet grau. Kopf eingezogen, 1.-2. Segment verwachsen. Vordere Segmente ungeringelt, nur vom 11.-14. Segment geringelt. Borsten am ganzen Körper eng gepaart. Borstendistanz hinter dem Gürtel *aa:ab:bc:cd:dd* wie 8:2:12:1:20. Borsten *ab* vom 7., *cd* vom 14. Segment zu erkennen. Borsten *ab* des 17.-19. sowie vom 20.-26. Segment von kleinen, wenig auffälligen Papillen umgeben. Die Borsten *ab* vom 17.-19. Segment sind zu Geschlechtsborsten verwandelt. Vom 20.-25. Segment ist nur die Borstenreihe *b* zu Geschlechtsborsten verwandelt, Länge 1,69 mm, Breite 0,10 mm, Zahl der Kerben 11-12 (Abb. 13). Borstenreihe *a* mit Nodus, Länge 1,62 mm, Breite 0,13 mm, am Ende mit 6-7 schwach angedeuteten Ringeln besetzt (Abb. 14). Nephridialporen in der Borstenlinie



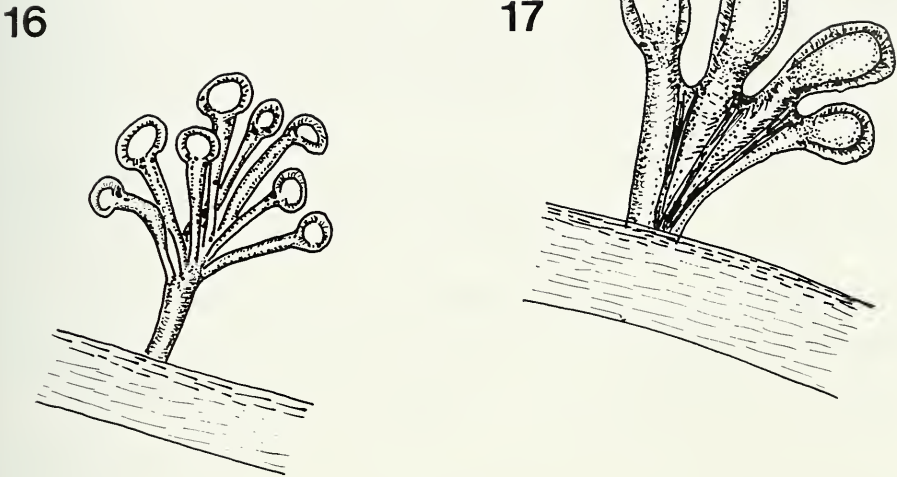


ABB. 16-17

Büschelförmiges (polystomates) Nephrostom von 16: *Martiodrilus (Cordilleroscolex) preciadoi* sp. n.; 17: *Martiodrilus (Cordilleroscolex) alarconi* sp. n.

cd. Samentaschenporen auf Intersegmentalfurche 5/6-8/9, deutliche, kleine Öffnungen mit kleinem, hellerem Hof.

Gürtel vom 1/2 14.-1/2 27. Segment, sehr stark drüsig nur vom 15.-26. Segment, die benachbarten beiden Segmentteile nur etwas verfärbt. Pubertätsstreifen vom 20.-1/2, 2/3 26. Segment. Weibliche Poren auf dem 14. Segment, hinter und neben der Borstenlinie b. Männliche Poren auf Intersegmentalfurche 20/21.

Innere Organisation. Dissepimente 6/7-9/10 stark verdickt, trichterförmig ineinandergelegt. Schlund bis ins 4. Segment reichend. Mächtige Peptonephridien im 3.-5. Segment, Nephridien bis ins 15. Segment mit langem Stiel ohne Nephridialblasen. Muskelmagen im 6. Segment. Schlingenförmige Herzen im 7.-9., Intestinalherzen im 10. und 11. Segment. Chylustaschen im 7.-14. Segment, Wabentaschen mit abgeschnürtem Kopf (Abb. 15). Perioesophageale Testikelblasen im 10. und 11. Segment, sie schliessen die Chylustaschen und Herzen sowie im 11. Segment auch die Samensäcke ein. Samensäcke im 11.-12. Segment, kleine einfache Gebilde. Mitteldarm im 16. Segment, Typhlosolis im 26. Segment beginnend. Nephridien mit büschelförmigem Nephrostom (Abb. 17).

Samentaschen 4 Paar im 6.- 9. Segment, kleine tropfenförmige Gebilde, die tief in der Muskelwand verborgen und im oberen Teil mit glänzenden Samenkammerchen gefüllt sind.

Die neue Art steht *M. (C.) magnus* am nächsten. Unterscheidet sich von dieser in der Form der Samentaschen, die tief in der Muskelwand verborgen sind und Samenkammerchen besitzen. Ferner erstreckt sich bei der neuen Art der Gürtel deutlich nur vom 15.-26. Segment, die männlichen Poren sind auf Intersegmentalfurche 20/21 erkannt worden.

***Martiodrilus (Cordilleroscolex) iserni* (Rosa, 1895)***Anteus iserni* Rosa, 1895:152*Thammodrilus buchwaldi*, Michaelsen, 1902: 30*Rhinodrilus (Thammodrilus) iserni*, Cognetti, 1906: 186*Thammodrilus (Thammodrilus) iserni*, Michaelsen, 1918: 86*Martiodrilus iserni*, Zicsi, 1990: 371*Martiodrilus iserni*, Righi, 1995: 515*Martiodrilus (Cordilleroscolex) iserni*, Zicsi & Csuzdi 1997: 84

Material: Ekuador. AF/3997 1 Ex., Prov. Pichincha, oberhalb Quito in Richtung Lloa 3200 m, 29. 4. 1989 leg. Zicsi, Loksa & de Vries. AF/4160 4 Ex., AF/4163 2 Ex., Pichincha Gebirge 3800 m, 27. 4. 1990 leg. Zicsi & Csuzdi.

***Martiodrilus (Cordilleroscolex) iserniformis* Zicsi & Csuzdi, 1997***Martiodrilus (Cordilleroscolex) iserniformis* Zicsi & Csuzdi, 1997:88

Material: Ekuador. AF/4373 1 Ex., Prov. Pichincha 2,5 km vor Lloa aus Richtung Rio Blanco Wiese, Schwarzerde, 29.4 1989 leg. Zicsi, Loksa & de Vries.- AF/1715 1 Ex., Cayambe Vulkan, oberhalb Ayora 3000 m. 23. 4. 1989 leg. Zicsi & Loksa.

Das Exemplar vom Fundort AF/4373 unterscheidet sich von der typischen Form durch die tropfenförmigen Samentaschenpaare im 10. Segment. Eine Verkürzung der 1. und 4. fadenförmigen Samentasche wird auch in der Originalbeschreibung erwähnt.

**BESTIMMUNGSSCHLÜSSEL DER ARTEN DER UNTERGATTUNG *MARTIODRILUS*  
(*CORDILLEROSCOLEX*) ZICSI & CSUZDI, 1997**

- |    |   |   |
|----|---|---|
| 1  | Samentaschen lang, fadenförmig . . . . .                    | 2   |
| -  | Samentaschen kurz, tropfenförmig . . . . .                  | 6   |
| -  | Samentaschen in der Muskelwand verborgen . . . . .          | 12  |
| 2  | Drei Paar Samentaschen vorhanden . . . . .                  | 3   |
| -  | Vier Paar Samentaschen vorhanden . . . . .                  | 5   |
| 3  | Oesophageale Testikelblasen vorhanden . . . . .             | 4   |
| -  | Perioesophageale Testikelblasen vorhanden . . . . .         | <i>hamifer</i> (Michaelsen, 1900)           |
| 4  | Pubertätsstreifen vom 20.-25. Segment . . . . .             | <i>iserni</i> (Rosa, 1895)                  |
| -  | Pubertätsstreifen vom 20.-1/2 28. Segment<br>. . . . .      | <i>gontzamanensis</i> Zicsi et Csuzdi, 1997 |
| 5  | Oesophageale Testikelblasen vorhanden . . . . .             | <i>iserniformis</i> Zicsi et Csuzdi, 1997   |
| -  | Perioesophageale Testikelblasen vorhanden . . . . .         | <i>riveti</i> (Michaelsen, 1900)            |
| 6  | Oesophageale Testikelblasen vorhanden . . . . .             | 7   |
| -  | Perioesophageale Testikelblasen vorhanden . . . . .         | 9   |
| 7  | Gürtel vom 15. -27. Segment . . . . .                       | <i>validus</i> (Cognetti, 1904)             |
| -  | Gürtel 14.-28. Segment . . . . .                            | 8   |
| 8  | Pubertätsstreifen vom 20.-1/2 26. Segment . . . . .         | <i>preciadoi</i> sp. n.                     |
| -  | Pubertätsstreifen vom 20.-1/2 27. Segment . . . . .         | <i>bolivarensis</i> Zicsi & Csuzdi, 1999    |
| 9  | Drei Paar Samentaschen vorhanden . . . . .                  | 10  |
| -  | Vier Paar Samentaschen vorhanden . . . . .                  | 11  |
| 10 | Pubertätsstreifen vom 20.-27. Segment . . . . .             | <i>darienianus</i> (Cognetti, 1905)         |
| -  | Pubertätsstreifen vom 20.-1/2 26.. 26. Segment<br>. . . . . | <i>columbianus</i> (Michaelsen, 1900)       |

- Pubertätsstreifen vom 18.-1/2 24. Segment . . . . . *panamaensis* James, 1990
- 11 Gürtel vom 1/2 14.-26. Segment . . . . . *pebasiensis* (Cognetti, 1914)
- Gürtel vom 1/2 14.-27. Segment . . . . . *magnus* (Cognetti, 1904)
- 12 Oesophageale Testikelblasen vorhanden . . . . . 13
- Perioesophageale Testikelblasen vorhanden . . . . . 14
- 13 Gürtel vom 15.-26. Segment . . . . . *crassus* (Rosa, 1895)
- Gürtel vom 1/2 24.-1/2 29. Segment . . . . . *ischuros* Zicsi, 1990
- 14 Pubertätsstreifen vom 17.-25. Segment . . . . . *olivaceus* James, 1990
- Pubertätsstreifen enden hinter dem 25. Segment . . . . . 15
- 15 Pubertätsstreifen bis zum 26. Segment reichend . . . . . 16
- Pubertätsstreifen bis zum 28. Segment reichend . . . . . 17
- 16 Pubertätsstreifen vom 20.-1/2 26. Segment . . . . . *alarconi* sp. n.
- Pubertätsstreifen vom 20.-26. Segment . . . . . *cognettii* (Beddard, 1921)
- 17 Pubertätsstreifen vom 20.-28. Segment . . . . . *beddardi* (Cognetti, 1904)
- Pubertätsstreifen vom 21.-28. Segment . . . . . *tigrinus* Zicsi & Csuzdi, 1997

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## On the identity of *Alucita endophaea* Meyrick, 1930 (Lepidoptera, Pterophoridae)

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**On the identity of *Alucita endophaea* Meyrick, 1930 (Lepidoptera, Pterophoridae).** - The type specimen of *Alucita endophaea* Meyrick, 1930 was examined. The name is a junior synonym of *Pterophorus albidus* (Zeller, 1852).

**Key-words:** Lepidoptera - Pterophoridae - African fauna - new synonym.

In 1991 I published a review on the African species of the genus *Pterophorus* Schäffer, 1766. In this publication I mentioned the problem to recover all type specimens of the species involved. One of the species that could not be examined was *Alucita endophaea* Meyrick, 1930, a species described from Lourenço Marquès (now in Mozambique) and for which the holotype was deposited in the Muséum d'histoire naturelle, Geneva (MHNG). Recently the Lepidoptera curator at MHNG, Dr B. Landry, was able to locate the specimen. Through his kindness I have been able to examine it and establish its identity.

**MATERIAL.** – Holotype female (MHNG), “Lourenço Marquès, v.(19)07 (N), gent CG 4671” [examined].

The species' name turned out to be a junior synonym of *Pterophorus albidus* (Zeller, 1852). the species is widely distributed in Africa, South and Southeast Asia, and extends into the Indo-Australian region. The synonymy of the species is as follows:

*Pterophorus albida* (Zeller, 1852). LT: Southern Africa.

*Alucita endogramma* Meyrick, 1922. LT: Fiji.

*Alucita endophaea* Meyrick, 1930. LT: Mozambique. **New synonym.**

*Acipitilia suffiata* Yano, 1963. LT: Japan, Okinawa.

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***Trioza flixiana* sp. n. (Hemiptera, Psylloidea),  
a new jumping plant-louse species from Central Europe**

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***Trioza flixiana* sp. n. (Hemiptera, Psylloidea), a new jumping plant-louse species from Central Europe.** - *Trioza flixiana* sp. n. is described from several localities in Switzerland. The species is closely related to *T. cirsii* from which it differs in details of the male paramere, the aedeagal apex, the female proctiger, the antennal colour and the longer terminal setae on antennal segment 10. Larvae are so far unknown.

**Key-words:** Psylloidea - *Trioza* - taxonomy - new taxon - Central Europe - *Cirsium* - Asteraceae.

## INTRODUCTION

On 3 June 2000 some 70 biologists met on Alp Flix, Sur (Switzerland, Graubünden) for collecting and naming as many species of organisms as possible. During a 24 h effort 2092 species could be recorded (Hänggi & Müller, 2001). Three species new for science were among the slightly over 2000 species, in addition to several new records for Switzerland (Hänggi & Müller, 2001; Haenni, 2001). Two of the three new species are insects which is hardly surprising given the size of the group in terms of species numbers and the relatively poor knowledge of the group in Switzerland (Burckhardt, 2000). Recently Haenni (2001) described the new scatopsid fly. Here the new psyllid species is described which belongs to the large artificial genus *Trioza* (Trioziidae).

The new trioziid is morphologically similar and probably closely related to the European *Trioza cirsii* Löw, *T. viridula* (Zetterstedt) and *T. agrophila* Löw which are all associated with *Cirsium* spp. (Asteraceae).

## MATERIAL AND METHODS

The material comes from the collections of the Moravské Muzeum, Brno (MMBC), Muséum d'histoire naturelle, Geneva (MHNG) and Naturhistorisches Museum, Basel (NHMB). Specimens are dry or slide mounted.

The morphological terminology follows mostly Ossiannilsson (1992). For preparing the drawings and taking the measurements specimens were permanently mounted in Canada balsam or euparal.

## TAXONOMIC TREATMENT

### *Trioza flixiana* sp. n.

Figs 1, 3, 5, 7

Holotype ♂, **Switzerland**: Graubünden, Sur, Stavel, 1800 m, 21.vi.2002, swept from *Cirsium spinosissimum* (D. Burckhardt & P. Lauterer), dry mounted (NHMB).

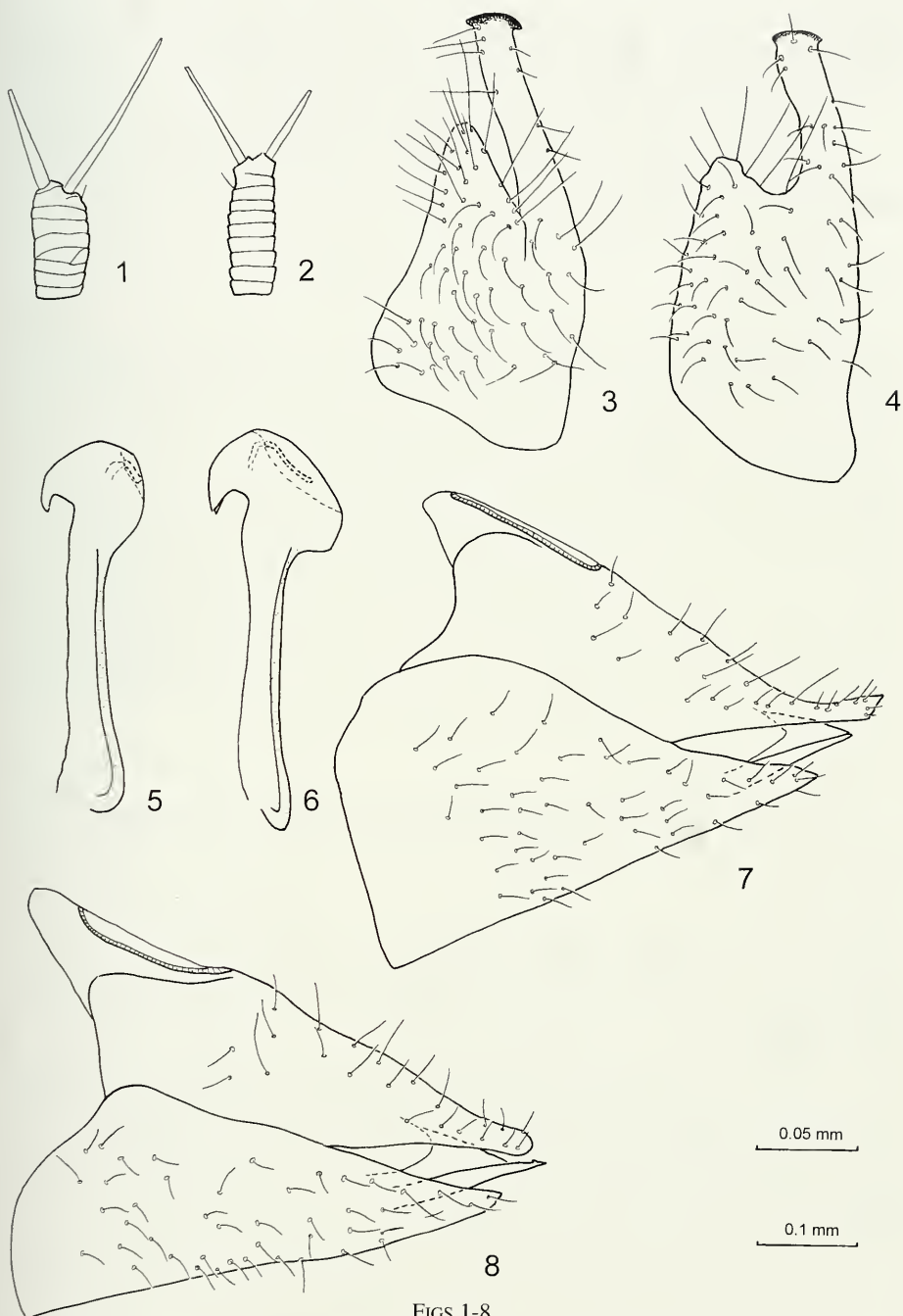
Paratypes. **Austria**: 1 ♂, 1 ♀, Kärnten, Glockner, Guttal, area of the Glockner-Hochalpen road, 1700 m, 29.vi.-11.viii.1978 (K. Thaler), dry mounted (MHNG). **Switzerland**: Basel-Land, 1 ♂, Reigoldswil, Bürten, 14.ix.1945, *Picea abies* (H. Schaefer), dry mounted (NHMB); 1 ♂, same data but Reigoldswil, Vogelberghöhe, 13.x.1945. - Bern, 1 ♂, Orvin, Jorat, 750 m, 24.iv.1980, *Picea abies* (D. Burckhardt), slide mounted (MHNG); 1 ♂, 1 ♀, same data but Prés d'Orvin, 15.v.1980. - Graubünden: 2 ♂, 4 ♀, same data as holotype (MMBC, NHMB); 1 ♂, Sur, Alp Flix, Gioppas, 1900-2000 m, 3.vi.2000 (D. Mifsud), dry mounted (NHMB); 1 ♂, 2 ♀, Engadin, above Ramosch, 1600-1700 m, 25.v.1980, *Picea abies* and *Pinus silvestris* (D. Burckhardt), dry and slide mounted (MHNG); 1 ♂, same but Resgia, 1080 m, 26.v.1980, *Picea abies*, dry mounted; 2 ♂, Misox, Val d'Albinasco, 1800 m, 4.ix.1979, *Picea abies* (D. Burckhardt), slide mounted (MHNG). - Neuchâtel, 1 ♀, La Chaux d'Amin, 1340-1360 m, 9.iv.1979, *Picea abies* (D. Burckhardt), dry mounted (MHNG). - Obwalden, 1 ♀, Pilatus, Matt, 1640 m, 6.ix.1986, conifers (D. Burckhardt), dry mounted (MHNG); 1 ♂, same data but 9.x.1988; 1 ♂, 1 ♀, same data but Pilatus, Aemsigen, 1600 m, 15.x.1999 (NHMB). - Schwyz, 1 ♂, Rigi, Staffel, 7.ix.1979, *Picea abies* (D. Burckhardt), dry mounted (MHNG); 1 ♂, 1 ♀, same data but Rigi, Staffel to Kulm, 1600-1800 m, 13.v.2000 (NHMB); 2 ♂, same data but 9.vi.2000, *Cirsium* sp.; 1 ♂, same data but Kulm, 1700 m, 16.x.1999, *Picea abies*; 1 ♀, same data but 12.vi.1981 (L. Rezbanyai-Reser), slide mounted (MHNG). - Solothurn, 1 ♂, Chluser Roggen, 740 m, 19.v.1980, *Picea abies* (D. Burckhardt), slide mounted (MHNG). - Valais, 1 ♀, Laggin Valley, 1240 m, 12.ix.1979, herbaceous vegetation (D. Burckhardt), dry mounted (MHNG). - Vaud, 1 ♀, Pays d'Enhaut, Gérine Valley, 1320 m, herbaceous vegetation (D. Burckhardt), slide mounted (MHNG).

Material not included in type series. **Czech Republic**: 1 ♀, Moravia borealis, Valšovský Žleb towards Rešov, 30.iv.1961 (P. Lauterer) (MMBC). **Slovakia**: 2 ♂, Belanské Tatry Mts., Bujačí Vrch Mt., Velký Ovčí Komín slope, 1300-1600 m, 20.vii.1962, (P. Lauterer) (MMBC); 1 ♂, same data but part Čiervená Hlína, 1400-1500 m, 21.vii.1962; 1 ♂, same data but Kobylí vrch Mt., 1100 m, 7.ix.1967; 3 ♀ same data but Velký Ovčí Komín slope, 1550-1650 m, 9.ix.1967; 2 ♀, Roháče (= Liptovské Hole) Mts., Roháčské Lake surroundings, 1700 m, 24.vi.1971 (P. Lauterer) (MMBC).

Description. Adult. Coloration. General coloration green or yellow; antenna yellowish, ochreous with segments 9 and 10 black. Anterior part of mesopraescutum, two or four longitudinal stripes on mesoscutum, mesothoracic venter, and sometimes abdominal ventrites brown to dark brown. Forewing with yellow veins and colourless to whitish, transparent membrane. Legs entirely light ochreous or with dark brown patches on the femora, light brown tibiae and yellowish tarsi. Apex of paramere black. Young specimens with less dark colour.

Morphology. Head narrower than mesoscutum, inclined in a 45° angle from the longitudinal body axis. Genal processes about two thirds length of vertex along midline, pointed apically. Antenna with conspicuously long terminal setae on segment 10 (fig. 1). Forewing long narrow, widest in apical two thirds to three quarters; apex bluntly angular. Surface spinules covering all cells, leaving narrow spinule-free stripes along the veins; regularly, sparsely spaced. Metatibia with 1+3 apical sclerotised spurs.





FIGS 1-8

*Trioza* spp. 1, 2: Antennal segment 10 with terminal setae; 3, 4: inner face of paramere; 5, 6: distal segment of aedeagus; 7, 8: female terminalia. 1, 3, 5, 7: *T. flixiana* sp. n.; 2, 4, 6, 8: *T. cirsi* Löw. Scale lines: figs 1-6 = 0.05 mm; figs 7, 8 = 0.1 mm.

Terminalia as in figs 3, 5, 7. Paramere with very large anterior lobe. Apex of distal portion of aedeagus almost globular; sclerotised end tube of ductus ejaculatorius short. Female proctiger long, with concave dorsal margin, apex truncate.

Larva unknown.

Host plant unknown. Some adults have been collected on *Cirsium spinosissimum* (Asteraceae) which is a likely host. Most specimens have been collected from conifers suggesting that the species overwinters as adult on conifers.

## CONCLUSIONS

*Trioza flixiana* sp. n. is morphologically similar to *Trioza cirsii* Löw, *T. viridula* (Zetterstedt) and *T. agrophila* (Löw). *T. flixiana* differs from the other three species in the very large anterior lobe of the parameres (fig. 3) which is small or absent in *T. cirsii* (fig. 4) and *T. viridula*, and absent in *T. agrophila*, and the very long terminal setae on antennal segment 10 (fig. 1) which are much shorter in the other three species (fig. 2). From *T. cirsii* with which it was often collected together, it differs also in the ochreous to light brown antennal segments 6-8 which are dark brown to black in *T. cirsii*, in the smaller apical dilatation of the distal aedeagal segment (fig. 5) which is large in *T. cirsii* (fig. 6), in the short sclerotised end tube of the ductus ejaculatorius (fig. 5) which is large in *T. cirsii* (fig. 6), and in the larger female proctiger with concave dorsal margin and truncate apex (fig. 7) which is shorter and with undulating dorsal margin and rounded apex in *T. cirsii* (fig. 8). The female terminalia of *T. flixiana* and *T. agrophila* are similar but the procter and subgenital plate of the former are slightly shorter and the subgenital plate less pointed apically.

## ACKNOWLEDGEMENTS

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## *Osmia (Melanosmia) steinmanni* sp. n., a new bee species from the Swiss Alps (Hymenoptera, Apoidea, Megachilidae)

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***Osmia (Melanosmia) steinmanni* sp. n., a new bee species from the Swiss Alps (Hymenoptera, Apoidea, Megachilidae).** - *Osmia (Melanosmia) steinmanni* sp. n. is described, illustrated and compared to other European species of the subgenus *Melanosmia*. It is morphologically most closely related to *O. svenssoni* Tkalců, 1983 hitherto recorded only from northern Sweden. *O. steinmanni* is known from two localities in eastern Switzerland situated in the subalpine and alpine zone of the Alps. It was found on stony slopes exposed to the south-east. Known pollen sources are *Hippocrepis comosa* and *Lotus corniculatus* (both Fabaceae).

**Key-words:** Megachilidae - *Osmia* - *Melanosmia* - taxonomy - new species - Switzerland.

### INTRODUCTION

Within the scope of the preparatory work for the fourth volume of the Swiss bee fauna (Amiet *et al.*, in preparation) seven ♀♀ of an unknown *Osmia* species (Hymenoptera, Apoidea, Megachilidae) were found in the entomological collections of the ETH Zürich and of the University of Zürich. All specimens had been collected at the Ebenalp (1500 m above sea level) situated in the Alpstein massif in eastern Switzerland on 10th June 1907. An excursion to the Ebenalp nearly one century later, on 1st June 2002, resulted in the discovery of several ♀♀ and of one ♂ of this enigmatic *Osmia*. The inspection of all museum and private bee collections in Switzerland revealed one further ♂ which had also been collected in the Swiss Alps near Juf (Avers, Graubünden, 2300 m above sea level) on 19th June 1994.

On closer morphological inspection these specimens turned out to belong to a hitherto unknown bee species. *Osmia steinmanni* sp. n. is a typical representative of the Holarctic subgenus *Melanosmia* Schmiedeknecht, 1885. In the Nearctic region *Melanosmia* is the major subgenus of *Osmia* with 91 described species (Hurd, 1979; Michener, 2000). Seventeen species are known in the Palaearctic (Zanden, 1988), ten species occur in Europe (Tkalců, 1983).

## SYSTEMATIC PART

*Osmia (Melanosmia) steinmanni* sp. n.

Figs 1-7

## MATERIAL

*Holotype*: ♀, Switzerland, Appenzell Innerrhoden, Wasserauen, Ebenalp, 749/238, 1500 m, 1.6.2002, leg. Felix Amiet, coll. ETH Zürich.

*Paratypes*: 5 ♀♀, 1 ♂, same locality and date as holotype, leg. Felix Amiet, Mike Herrmann and Andreas Müller, coll. ETH Zürich (1 ♀, 1 ♂), coll. Muséum d'histoire naturelle Genève (1 ♀), coll. Felix Amiet (1 ♀), coll. Mike Herrmann (1 ♀) and coll. Andreas Müller (1 ♀); 7 ♀♀, same locality as holotype, 10.6.1907, coll. ETH Zürich; 1 ♂, Switzerland, Graubünden, Juf-Stallerberg, 2300 m, 19.6.1994, leg. Bernhard Merz, coll. Felix Amiet.

## ETYMOLOGY

The new species is dedicated to the excellent bee specialist Dr Erwin Steinmann (Chur) who is as fond of the mountains as "his" bee seems to be.

## DIAGNOSIS

*O. steinmanni* sp. n. belongs to the subgenus *Melanosmia* Schmiedeknecht, 1885 described in detail by Tkalčú (1983). In both sexes it is morphologically most similar to *O. svenssoni* Tkalčú, 1983 hitherto known only from northern Sweden (Tkalčú, 1983), the ♀ can easily be confounded with *O. inermis* (Zetterstedt, 1838) as well (see below).

The diagnosis is given in the form of keys and tables. The keys including all European *Melanosmia* species except *O. bulgarica* Friese, 1922 (see discussion) lead to *O. steinmanni* and its morphologically most similar relatives which are then compared in tabular form. The morphological terminology follows Michener *et al.* (1994).

The opinion that *O. svenssoni* and *O. uncinata* Gerstäcker, 1869 are synonymous (Schwarz *et al.*, 1996) is not followed here. The examination of the type specimens of *O. svenssoni* corroborates the view of Tkalčú (1983) that *O. svenssoni* and *O. uncinata* are valid species morphologically clearly separated from each other.

## Female

- 1 Propodeum shiny, propodeal triangle nearly completely polished or at least along sides with shiny area. Body length at least 11 mm.  
*Osmia alticola* Benoist, 1922; *Osmia maritima* Friese, 1885; *Osmia xanthomelana* (Kirby, 1802). See Tkalčú (1983) and Haeseler (1999) for distinctive characters.
- 1\* Propodeum and propodeal triangle completely shagreened and dull. Body length at most 10 mm . . . . . 2
- 2 Declining basal portion of first tergite shiny, at most superficially shagreened here and there. *Osmia hyperborea* Tkalčú, 1983; *Osmia parietina* Curtis, 1828; *Osmia pilicornis* Smith, 1846; *Osmia uncinata* Gerstäcker, 1869. See Tkalčú (1983) and Haeseler (1999) for distinctive characters.
- 2\* Declining basal portion of first tergite densely shagreened, only with silky lustre. *Osmia inermis* (Zetterstedt, 1838); *Osmia svenssoni* Tkalčú, 1983; *Osmia steinmanni* sp. n.. See Tab. 1 for distinctive characters.



TABLE 1: Distinctive characters of ♀ of *Osmia steinmanni* sp. n., *Osmia svenssoni* Tkalčú, 1983 and *Osmia inermis* (Zetterstedt, 1838).

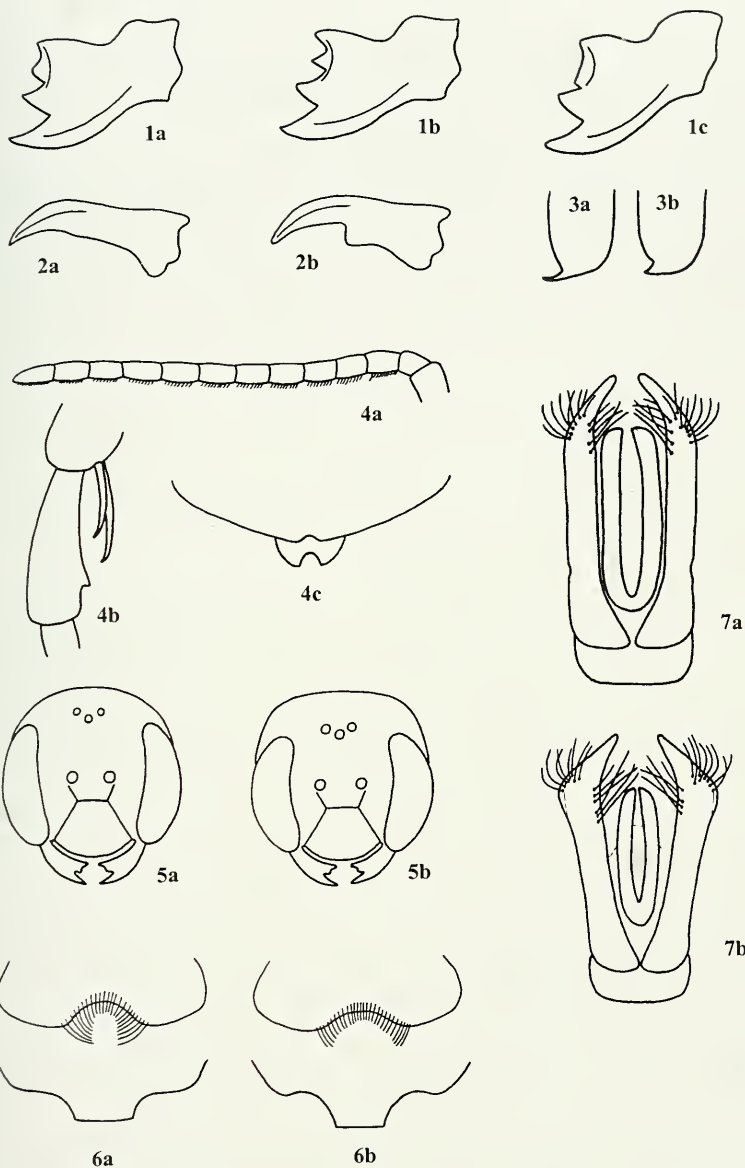
<i>Osmia steinmanni</i> sp. n. (n = 13)	<i>Osmia svenssoni</i> Tkalčú, 1983 (n = 1, paratype)	<i>Osmia inermis</i> (Zetterstedt, 1838) (n = 10)
Swiss Alps (Ebenalp, Juf)	Northern Sweden (Abisko) (Tkalčú, 1983).	Northern and central Europe, North America (Tkalčú, 1983; Warneke, 1988).
Second mandibular tooth asymmetrically triangular, separated from third tooth by acute-angled and broad indentation, from first tooth by shallow and rounded indentation (Fig. 1a).	Second mandibular tooth symmetrically triangular, broadly separated from both first and third tooth by acute-angled and broad indentation (Fig. 1b).	Second mandibular tooth broad and long, little prominent, not clearly separated from first tooth; indentation between second and third tooth very narrow, acute-angled (Fig. 1c).
Mandible at its inferior outer margin nearly straight, without tooth (Fig. 2a).	As in <i>Osmia steinmanni</i> .	Mandible at its inferior outer margin with prominent, asymmetrically triangular tooth (clearly visible only when mandible is opened) (Fig. 2b).
Ocelli less distantly separated from each other, distance between middle and lateral ocellus about two third of diameter of middle ocellus.	As in <i>Osmia steinmanni</i> .	Ocelli more distantly separated from each other, distance between middle and lateral ocellus about equal to diameter of middle ocellus.
Nervulus (cu-v) of fore wing postfurcal, i.e. running into cubital vein distally from orifice of basal vein.	As in <i>Osmia steinmanni</i> .	Nervulus (cu-v) of fore wing interstitial, i.e. running exactly into orifice of basal vein.
Tibial spine of middle leg longer, narrower and weakly bent (Fig. 3a).	As in <i>Osmia steinmanni</i> .	Tibial spine of middle leg shorter, broader and more triangular (Fig. 3b).
Pilosity of vertex, scutum, propodeum and first tergite whitish to yellowish-white.	Pilosity of vertex, scutum, propodeum and first tergite brightly yellowish-brown.	As in <i>Osmia svenssoni</i> .
Pilosity of scutum in its anterior four fifth whitish to yellowish-white with single intermixed blackish hairs, that of backmost part of scutum and of scutellum brightly yellowish-brown.	Pilosity of scutum and scutellum uniformly brightly-yellowish brown without blackish hairs.	As in <i>Osmia svenssoni</i> .
Pilosity of mesepisternum uniformly white to yellowish-white, in some specimens with single intermixed blackish hairs.	Pilosity of mesepisternum predominantly blackish, only on its most anterior and uppermost part on narrow zone brightly yellowish-brown.	Pilosity of mesepisternum in its upper part brightly yellowish-brown, in its lower part whitish.
Marginal zone of second and third tergite impressed on its whole width, clearly separated from disc.	Marginal zone of second and third tergite not impressed and not separated from disc.	Marginal zone of second and third tergite only slightly impressed, weakly separated from disc.
Punctuation of tergite 2 medio-basally coarser, interspaces as large as the size of one to maximally two punctures.	Punctuation of tergite 2 medio-basally finer, interspaces up to the size of three punctures.	As in <i>Osmia steinmanni</i> .
Punctuation of central area of scutum just behind longitudinal suture more dispersed, interspaces up to the size of two to three punctures.	Punctuation of central area of scutum just behind longitudinal suture denser, interspaces maximally as large as the size of one puncture.	As in <i>Osmia steinmanni</i> .
Longest hairs on outer margin of tibia of hind leg longer than maximal width of tibia.	Longest hairs on outer margin of tibia of hind leg as long as maximal width of tibia.	As in <i>Osmia svenssoni</i> .

Male

- 1 Outer margin of gonoforceps preapically with semicircular widening, gonoforceps here nearly twice as broad as at its narrowest width. Body length at least 11 mm.  
*Osmia alticola* Benoist, 1922; *Osmia maritima* Friese, 1885; *Osmia xanthomelana* (Kirby, 1802). See Tkalčú (1983) and Haeseler (1999) for distinctive characters.
- 1\* Outer margin of gonoforceps preapically without widening or only weakly widened, gonoforceps here at most little broader than at its narrowest width. Body length at most 10 mm . . . . . 2
- 2 Fourth sternite with normal hairs, without hooked bristles.  
*Osmia inermis* (Zetterstedt, 1838); *Osmia hyperborea* Tkalčú, 1983. See Tkalčú (1983) and Haeseler (1999) for distinctive characters.
- 2\* Fourth sternite with hooked bristles both along apical margin and on pre-marginal area; along apical margin the bristles are oriented horizontally whereas on the premarginal area they are directed increasingly vertically . . . 3
- 3 Underside of antennal segments only microscopically haired.  
*Osmia parietina* Curtis, 1828; *Osmia uncinata* Gerstäcker, 1869. See Tkalčú (1983) and Haeseler (1999) for distinctive characters.
- 3\* Underside of antennal segments with conspicuous bristles which are one fourth as long as diameter of antenna to as long as diameter of antenna . . . 4
- 4 Bristles on underside of antennal segments as long as diameter of antenna. Projecting middle part of sixth sternite narrow, densely covered with conspicuously knobbed hairs.  
*Osmia pilicornis* Smith, 1846.
- 4\* Bristles on underside of antennal segments about one fourth as long as diameter of antenna. Projecting part of sixth sternite broad, without knobbed hairs.  
*Osmia svenssoni* Tkalčú, 1983; *Osmia steinmanni* sp. n.. See Tab. 2 for distinctive characters.

TABLE 2: Distinctive characters of ♂ of *Osmia steinmanni* sp. n. and *Osmia svenssoni* Tkalčú, 1983.

<i>Osmia steinmanni</i> sp. n. (n = 2)	<i>Osmia svenssoni</i> Tkalčú, 1983 (n = 1, holotype)
Vertex (seen from the front) weakly ascending, outline of head roundish (Fig. 5a).	Vertex (seen from the front) more strongly ascending, outline of head more quadrangular (Fig. 5b).
Third sternite more deeply recessed, emargination about one third as deep as broad (Fig. 6a).	Third sternite less deeply recessed, emargination about one fifth as deep as broad (Fig. 6b).
Projecting middle part of sixth sternite shorter, less than half as long as broad (Fig. 6a).	Projecting middle part of sixth sternite longer, more than half as long as broad (Fig. 6b).
Outer margin of gonoforceps preapically not widened, gonoforceps here as broad as more basally (Fig. 7a).	Outer margin of gonoforceps preapically distinctly widened, gonoforceps here broader than more basally (Fig. 7b).
Marginal zone of second, third and fourth tergite strongly impressed on its whole width, polished to only superficially shagreened.	Marginal zone of second, third and fourth tergite weakly impressed, densely shagreened at least on its basal half.
Pilosity of second to fourth tergite yellowish-white.	Pilosity of second to fourth tergite brightly yellowish-brown.



FIGS 1-7

1: Right mandible of the ♀: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalčú, 1983, c *Osmia inermis* (Zetterstedt, 1838). - 2: Inferior outer margin of right mandible of the ♀: a *Osmia steinmanni* sp. n., b *Osmia inermis* (Zetterstedt, 1838). - 3: Tibial spine of right middle leg of the ♀: a *Osmia steinmanni* sp. n., b *Osmia inermis* (Zetterstedt, 1838). - 4: ♂ of *Osmia steinmanni* sp. n.: a Right antenna from the front, b Right basitarsus of hind leg, c Apical margin of sixth and seventh tergite. - 5: Head of the ♂ seen from the front: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalčú, 1983. - 6: Apical margin of third and sixth sternite of the ♂: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalčú, 1983. - 7: ♂ genitalia in dorsal view: a *Osmia steinmanni* sp. n., b *Osmia svenssoni* Tkalčú, 1983.

## DESCRIPTION

**Female**

Body length 8-10 mm, fore wing length 7.0 - 7.7 mm ( $\bar{\phi}$  = 7.3 mm, n = 12). Body colour dark brown to black without metallic sheen.

*Head*: Head seen from the front about as long as broad. Distance between lateral ocellus and margin of vertex about three times as long as ocellar diameter. Mandible four-toothed: second tooth asymmetrically triangular, separated from third tooth by an acute-angled and broad indentation, from first tooth by a shallow and rounded indentation (similar to *O. uncinata*, see Tkalců, 1983) (Fig. 1a). Inferior outer margin of mandible nearly straight, without tooth (Fig. 2a). Punctuation of vertex, genal area, supraantennal area, supraclypeal area and clypeus (apart from the polished marginal area) very dense, interspaces much smaller than the size of one puncture. Paraocular area less densely punctate, interspaces up to the size of one puncture. Pilosity of clypeus predominantly blackish with single intermixed white hairs, pilosity of the remaining head whitish to yellowish-white with many intermixed blackish hairs. Hairs on apical half of clypeus dense obstructing the view onto the polished marginal area of the clypeus (as in *O. inermis* and *O. svenssoni*).

*Thorax*: Punctuation of scutum (except in centre), scutellum and mesepisternum very dense, interspaces much smaller than the size of one puncture. Central area of scutum just behind longitudinal suture more dispersely punctate, interspaces up to the size of two to three punctures. Metanotum, propodeal triangle and propodeum densely shagreened, dull. Pilosity of backmost part of scutum and of scutellum brightly yellowish-brown clearly contrasting with the remaining pilosity of the thorax which is whitish to yellowish-white. Scutum and in some specimens also mesepisternum with single intermixed blackish hairs. Veins and stigma of wings dark brown to black. Nervulus (cu-v) of fore wing running into cubital vein distally from orifice of basal vein ("post-furcal"). Tibial spine of fore and middle leg long, narrow and weakly bent (Fig. 3a). Tibial spurs of hind leg black. Erect pilosity of femur of all legs predominantly whitish with intermixed blackish hairs, that of tibia and tarsus predominantly blackish with intermixed white hairs. Longest hairs on outer margin of tibia and basitarsus of hind leg longer than maximal width of tibia and basitarsus respectively.

*Abdomen*: Declining basal portion of first tergite densely shagreened, only with silky lustre (as in *O. inermis* and *O. svenssoni*, see Tkalců, 1983). Punctuation of disc of second to fourth tergite basally dense (interspaces mostly of about the size of one puncture), distally more dispersed (interspaces up to the size of three punctures). Interspaces on second tergite nearly polished, on third tergite superficially shagreened and on fourth tergite distinctly shagreened. Marginal zone of second and third tergite impressed on its whole width, clearly separated from disc, shagreened and dispersely punctate. Pilosity on first tergite whitish to yellowish-white, on second and third tergite yellowish-brown with many intermixed blackish hairs, on fourth and fifth tergite predominantly blackish with whitish hairs along the marginal zone. Sixth tergite covered with appressed white hairs. Longest hairs on second to fourth tergite about as long as the last three segments of the antenna, on first tergite slightly longer. Abdominal scopa black.



## Male

Body length 9 mm, fore wing length 6.7 - 7.0 mm ( $\bar{\text{O}} = 6.85$  mm,  $n = 2$ ). Body colour dark brown to black; head, thorax and abdomen with faint blue green metallic sheen.

*Head:* Head seen from the front about as long as broad (Fig. 5a). Distance between lateral ocellus and margin of vertex about two and a half to three times as long as ocellar diameter. Underside of antennal segments each with 10-20 white bristles about one fourth as long as antennal diameter (as in *O. svenssoni*, see Tkalců, 1983) (Fig. 4a). Punctuation of vertex, genal area and face (apart from the polished marginal area of clypeus) very dense, interspaces much smaller than the size of one puncture. Pilosity of head long and whitish, on clypeus, paraocular area and supraclypeal area very dense.

*Thorax:* Punctuation of scutum, scutellum and mesepisternum very dense, interspaces much smaller than the size of one puncture. Metanotum, propodeal triangle and propodeum densely shagreened, dull. Pilosity of thorax whitish, on scutellum more yellowish but not as brightly yellowish-brown as in the ♀. Veins and stigma of wings dark brown to black. Nervulus (cu-v) of fore wing running into cubital vein distally from orifice of basal vein ("postfurcal"). Tibial spurs of hind leg black. Erect pilosity of all legs whitish. Basitarsus of hind leg toothed, with slightly diverging sides in its basal two third (parallel in *O. parietina*, see Tkalců, 1983) (Fig. 4b).

*Abdomen:* Declining basal portion of first tergite densely shagreened, only with silky lustre (as in *O. inermis* and *O. svenssoni*). Punctuation of disc of second to fourth tergite very dense, interspaces up to the size of one puncture but mostly smaller. Marginal zone of second to fourth tergite strongly impressed on its whole width, polished to only superficially shagreened, nearly impunctate. Pilosity on first, fifth and sixth tergite whitish, on second to fourth tergite yellowish-white. Longest hairs on second to fourth tergite little shorter than the last two segments of the antenna, on first tergite distinctly longer. Apical margin of sixth tergite slightly notched in the middle, seventh tergite bilobed (Fig. 4c). Apical margin of second sternite more or less rounded (slightly emarginate in *O. uncinata*, see Tkalců, 1983). Third sternite deeply recessed, the emargination about one third as deep as broad and densely beset with long yellowish hairs (Fig. 6a). Fourth sternite as in *O. svenssoni* (see Tkalců, 1983): apical margin straight to very shallowly emarginate, premarginal area black, strongly shagreened and completely dull with hardly visible punctures (in contrast to *O. parietina* and *O. uncinata* where the premarginal area is dark brown, less strongly shagreened and more shiny with more distinct punctures); apical margin and premarginal zone beset with long and hooked, conspicuously yellowish-red coloured bristles (lighter in *O. parietina* and *O. uncinata*); along apical margin the bristles are oriented horizontally whereas on the premarginal area they are directed increasingly vertically. Fifth sternite broadly but weakly emarginate. Projecting part of sixth sternite rectangular (more roundish in *O. parietina* and *O. uncinata*, see Tkalců, 1983), less than half as long as broad (Fig. 6a). Gonoforceps inflected in its apical part, preapically with a tuft of stiff and yellowish-red bristles both on the outer and the inner side (Fig. 7a); its outer margin preapically not widened (weakly widened in *O. parietina*, see Tkalců, 1983), gonoforceps

here as broad as more basally; proximal to the inflexion and seen from above sides of gonoforceps nearly parallel for some distance (diverging towards base in *O. uncinata*).

#### DISTRIBUTION, HABITAT AND FLOWER PREFERENCES

*O. steinmanni* is known only from two localities in eastern Switzerland: Ebenalp (Wasserauen, Appenzell Innerrhoden) and Stallerberg (Juf, Graubünden). With 1500 m and 2300 m above sea level these two localities are at the lower subalpine and the lower alpine zone respectively.

At the Ebenalp *O. steinmanni* was found on stony slopes exposed to the south-east. The vegetation cover varied between densely vegetated meadow-like areas to barely vegetated screes intermixed with groups of spruces. The most prominent plant in flower was *Hippocrepis comosa* (Fabaceae). Bee species accompanying *O. steinmanni* were *Andrena intermedia* Thomson, 1870, *Andrena semilaevis* Pérez, 1903, *Lasioglossum cupromicans* (Pérez, 1903), *Osmia inermis* (Zetterstedt, 1838), *Osmia xanthomelana* (Kirby, 1802), *Hoplitis tuberculata* (Nylander, 1848) and *Bombus monticola* Smith, 1849, all typical inhabitants of upper montane and subalpine regions.

The ♀♀ of *O. steinmanni* were observed at flowers of *H. comosa*. The microscopic analysis of the pollen loads of four ♀♀ collected in 2002 revealed that this plant species is an important pollen source. All loads contained pollen of *H. comosa*. In addition, *Lotus corniculatus* (Fabaceae) was recorded in all samples as well.

#### DISCUSSION

Owing to the detailed study of Tkalců (1983) and the supplemental work of Haeseler (1999) the subgenus *Melanosmia* is well known in Europe. The discovery of a new *Melanosmia* species in the well investigated central European bee fauna is a surprise. The only unclear *Melanosmia* species in Europe is *O. bulgarica* described by Friese (1922) based on a single ♀ from Macedonia. Warncke (1988) treats *O. bulgarica* as a subspecies of *O. inermis* and mentions its occurrence in Macedonia, Greece and Italy. The type specimen obviously got lost (Tkalců, 1983), but according to the original description *O. bulgarica* differs from all other European *Melanosmia* species, including *O. steinmanni*, by its lack of black hairs on head, thorax and abdomen. Tkalců (1983) mentions a *Melanosmia* ♀ from Gran Sasso (Abruzzo, Italy) which might be either conspecific with *O. bulgarica* or represent a new species. Its declining basal portion of the first tergite being polished and its mandible bearing a tooth on the inferior outer margin exclude the possibility that this Italian specimen and *O. steinmanni* belong to the same species.

Although all museum and private bee collections available in Switzerland were examined only three contained specimens of *O. steinmanni* indicating that this species is extremely rare. However, its early flight period falling in late May, June and probably early July in combination with its occurrence in subalpine and alpine areas might explain why this species was so rarely collected. Bee researchers collect bees at higher elevations preferably later in the season when the weather conditions are more favourable. Therefore, *O. steinmanni* is expected to occur not only at additional localities in eastern Switzerland but also at other places in the Swiss and probably Austrian alps.

*Melanosmia* is especially well represented in montaineous regions (Michener, 2000). Two central European species, *O. alticola* and *O. inermis*, are known to occur beyond the timber line, the latter mounting up to 2800 m (Haeseler, 1999; Schedl, 1982). *O. steinmanni* is a further *Melanosmia* species reaching the alpine zone.

Based on morphological characters of the ♀ (but not of the ♂), *O. inermis* and *O. steinmanni* seem to be closely related. Most noteworthy is that both species were recorded together in the same habitat on the same day at the Ebenalp. Similarly, *O. svenssoni*, the closest known relative of *O. steinmanni*, coexists with *O. inermis* in northern Sweden (Tkalců, 1983). Given this syntopic occurrence the question arises how *O. inermis* and *O. steinmanni* are ecologically separated in the Swiss Alps. The few data indicate that the flight period of *O. steinmanni* starts earlier than that of *O. inermis*. At the Ebenalp, two freshly emerged ♂♂ but no ♀♀ of *O. inermis* were found on 1st June 2002 whereas the only ♂ of *O. steinmanni* collected that same day was heavily worn. However, most ♀♀ of *O. steinmanni* recorded on this day were rather fresh indicating that there is an overlap rather than a clear separation in the flight periods of these two species. *O. inermis* is known to prefer flowers of *Hippocrepis*, *Lotus* and *Onobrychis* (all Fabaceae) for pollen collection (Westrich, 1990). The few pollen loads of *O. steinmanni* were found to consist of pollen from partly the same Fabaceae. Therefore, an ecological separation with respect to the preferred pollen sources seems rather improbable. The possibility exists that the two species differ in their nesting sites or nest architecture. *O. inermis* is known to build its brood cells with masticated leaves under stones (Priesner, 1981; Schedl, 1982; Else & Edwards, 1996; own observation). Unfortunately, nests of *O. steinmanni* have not yet been recorded leaving the possibility of differing nesting biologies an open question.

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## ***Galagete*, a new genus of Autostichidae representing the first case of an extensive radiation of endemic Lepidoptera in the Galápagos Islands**

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***Galagete*, a new genus of Autostichidae representing the first case of an extensive radiation of endemic Lepidoptera in the Galápagos Islands.** - *Galagete*, gen. n. (type species: *Gelechia protozona* Meyrick) is described to include 11 species of Autostichidae apparently endemic to the Galápagos Islands. This group represents the first recognised case of an extensive radiation of endemic Lepidoptera in the archipelago. The following species are described as new: *Galagete cinerea*, *G. consimilis*, *G. cristobalensis*, *G. darwini*, *G. espanolaensis*, *G. levequei*, *G. pecki*, *G. seymourensis*, and *G. turritella*. *Gelechia gnathodoxa* Meyrick and *Gelechia protozona* Meyrick, both described from the Galápagos Islands, are transferred to *Galagete* and redescribed. *Galagete* is closely related to *Taygete* Chambers, a taxon previously placed in the Gelechiidae. Specimens of *Galagete* were reared from twigs and dead leaves of *Scalesia* species (Asteraceae) and from Galápagos tortoise (*Geochelone elephantopus*) scats.

**Key-words:** Moths - Autostichidae - Symmocinae - *Taygete* - Gelechiidae - Galápagos Islands - taxonomy - adaptive radiation - *Scalesia*.

### INTRODUCTION

Of the 294 described and undescribed species of Lepidoptera known from the Galápagos archipelago, some 42% are considered endemic. Since we now estimate that close to 50 of these species were introduced by human colonists (Peck *et al.*, 1998), the number of native species is probably around 250, and so the rate of original endemicity is closer to 50 percent. Of the 202 or so genera, only five have three or more endemic species. *Cosmopterix* Hübner (Cosmopterigidae, Landry, 2001), *Stenoptilodes* Zimmerman, and *Oidaematophorus* Wallengren (Pterophoridae, Landry, 1993; Landry & Gielis, 1992) each have three species presumed to be endemic, but the morphological evidence suggests that each species represents a different lineage within the respective genera. Only two genera: *Eupithecia* Curtis (Geometridae, Rindge, 1973; Landry & Rindge, 1995) and *Utetheisa* Hübner (Arctiidae, Hayes, 1975) have three endemic species that may be more closely related to each other than to species distributed outside the archipelago. With a total of 13 species (two of which are not described

here for lack of material), *Galagete* thus represents the first documented case of a radiation of Galápagos lepidopteran endemics comparable in size to the radiations of the Darwin's finches, the Asteraceae genus *Scalesia* Arnott, or the Tenebrionidae genus *Stomion* Waterhouse (Finston & Peck, 1997).

## MATERIAL AND METHODS

This study is based primarily on 187 specimens that I collected in 1989 and 1992 on the Galápagos Islands (see Landry & Gielis, 1992 and Landry, 1993 for more details). I have also studied the type specimens of *Gelechia gnathodoxa* Meyrick and *G. protozona* Meyrick deposited at The Natural History Museum (BMNH), London, England. In April and May 2002 I made a third trip to the Galápagos at the invitation of Mr Lazaro Roque, entomologist at the Charles Darwin Research Station (CDRS), Santa Cruz Island, Galápagos. We collected together 37 *Galagete* specimens on Isabela (Alcedo) and Pinzón. Also, I was able to borrow 58 additional specimens from the CDRS collection. Most of these had been collected by L. Roque, some times with Dr Charlotte Causton. The data from these specimens were incorporated into this manuscript where possible.

The new species described below were determined to be new with the help of Dr Klaus Sattler at the BMNH. The descriptions of the fore- and midleg color patterns refer to the sides of the legs that are exposed laterally for the fore- and midlegs, dorsally for the hindleg. The fore- and midlegs medially and the hindlegs ventrally are the same colour as the abdomen ventrally, usually pale beige. The following abbreviations are used in citations of label data: "BL" for Bernard Landry, "msnm" for meters above sea level (in Spanish), and "MVL" for Mercury Vapour Lamp.

Genital preparations were stained with orange G and chlorazol black. The male tegumen was detached from the rest of the genitalia on the left side and spread down side up. The cover slip was propped up by 0.25 mm to avoid breakage of the transtilla. Wing preparations were stained with orange G, but this gave sub-optimal results lacking in contrast. All preparations were mounted in Euparal.

The colour photos of the imagos were taken with a camera mounted on a stereoscope and figures 17 and 18 with the same camera mounted on a compound microscope. The final pictures were generated with AutoMontage®. The genital drawings were made with a camera lucida mounted on a Wild compound microscope. The setae and scales were drawn on one side of the parts only. The male genitalia are shown with the aedeagus as well as the tegumen+uncus+gnathos separated from the rest and unflattened except for the male of *G. seymourensis* for which the only available male was dissected and mounted before I realised the damage caused to the transtilla when the genitalia were flattened. The male genitalia of three species are shown sideways also. The female genitalia are shown in ventral view and in some cases the bursa was also drawn fully expanded before slide mounting. Mr Gilles Roth of the MHNG inked the drawings.

A cladistic analysis was performed with PAUP\* (Swofford, 2001). I used the 15 characters listed on Table 1. *Taygete sphecophila* (Meyrick) was used as the outgroup because it was found to be the most closely related taxon to *Galagete* on the basis of the presence of the same type of coremata organ (figs 17, 18) and the fusion of R<sub>4</sub>, R<sub>5</sub>,

TABLE 1. Characters used in cladistic analysis with scores attributed to character-states.

1. Female sternum VIII simple (0); bilobed (1) (figs 31-36).
2. Apical margin of female tergum VIII simple (0) (figs 32 A, 33-37); bilobed (1) (figs 31, 32 C).
3. Corpus bursa with signum (0) (figs 32 A, 33-37); without signum (1) (figs 31, 32 C).
4. Dorsal base of papillae anales separated in the middle (0) (figs 31-33); joined by sclerotized band (1) (figs 34, 35 D, 36 A).
5. Transtilla absent (0); well developed and tripartite (1) (figs 21-30, 37).
6. Uncus with pair of setose arms medially situated, barely separated, and pointing posteriorly (0); setose arms laterally situated, pointing anteriorly and downward (1) (figs 21-30, 37).
7. Apical half of uncus not projected mediodorsally (0) (figs 21-23, 26-30, 37); projected mediodorsally (1) (figs 24, 25).
8. Sacculus with a simple small projection (0) (figs 21-30, 37); large and with two projections (1).
9. Vesica with small cornuti only (0) (figs 21-23, 26-30, 37); with large cornuti (1) (figs 24, 25).
10. Aedeagus with at most a small crest medioventrally on coecum penis (0) (figs 24-30, 37); with a large crest medioventrally on coecum penis (1) (figs 21-23); with a pair of small crests laterally on coecum penis (2). This character is unordered.
11. Median process of transtilla narrowly terminated (0) (figs 24-26, 29, 30); enlarged apically (1) (figs 21, 22, 27, 28, 37).
12. Lateral projections of transtilla short and rounded (0) (figs 21-23, 28, 30); rather short and narrow (1) (figs 24, 25, 29); long and narrow (2) (figs 26, 27, 37). This character is ordered.
13. Juxta a symmetric plate with a rounded, median concavity at apical margin (0) (figs 21-23, 26-30, 37); asymmetrical and forming sclerotized ring around aedeagus (1) (figs 24, 25).
14. Valva simple on costal margin (0) (figs 22-26, 28, 29); costal margin with process(es) (1) (figs 21, 27, 30, 37).
15. Colour of forewing of various shades of brown with darker markings (0) (figs 3-9, 13-15); dark brown with white markings (1) (figs 1, 2); whitish to cream coloured with dark-brown markings (2) (figs 10-12).

TABLE 2. Matrix of character states and *Galagete* taxa used in the cladistic analysis (see Table 1 character definitions). A question mark is used when the state of the character is unknown in the species (as for the first three characters in the unknown female of *G. espanolaensis*).

Taxa	Character numbers														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>T. sphecochila</i>	0	1	0	0	0	0	0	1	0	2	?	?	0	0	0
<i>G. seymourensis</i>	1	1	1	0	1	1	0	0	0	1	?	0	0	0	0
<i>G. protozona</i>	1	1	1	0	1	1	0	0	0	1	1	0	0	1	1
<i>G. gnathodoxa</i>	1	1	1	0	1	1	0	0	0	1	1	0	0	0	1
<i>G. turritella</i>	1	0	0	0	1	1	1	0	1	0	0	1	1	0	0
<i>G. espanolaensis</i>	1	?	?	?	1	1	1	0	1	0	0	1	1	0	0
<i>G. consimilis</i>	1	0	0	1	1	1	0	0	0	0	1	2	0	1	0
<i>G. darwini</i>	1	0	0	1	1	1	0	0	0	0	0	2	0	0	0
<i>G. levequei</i>	1	0	0	1	1	1	0	0	0	0	1	0	0	0	2
<i>G. cristobalensis</i>	1	0	0	0	1	1	0	0	0	0	0	1	0	0	2
<i>G. pecki</i>	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0
<i>G. cinerea</i>	1	0	0	1	1	1	0	0	0	0	1	2	0	1	0

and  $M_1$  in the forewing (figs 19, 20). The matrix is shown on Table 2. The characters were given equal weight. There were two multistate characters: character 12 was treated as ordered and character 10 as unordered. The results of an exhaustive search with the maximum parsimony algorithm are given below. Decay indices were generated with AutoDecay (Eriksson, 1998) and viewed with TreeView (Page, 1996).

## RESULTS OF THE CLADISTIC ANALYSIS

The cladistic analysis produced 7 trees of 25 steps (consistency indices: 0.720; retention indices: 0.767; rescaled consistency indices: 0.552). The consensus tree reveals seven clades: (((protozona + gnathodoxa) + seymourensis) + ((darwini + (consimilis + cinerea)) + (turritella + espanolaensis) + levequei + cristobalensis + pecki)). Three character states support the monophyly of *Galagete* (1-1, 5-1, 6-1), two character states (3-1, 10-1) are exclusive to the protozona + gnathodoxa + seymourensis clade, three others (7-1, 9-1, 13-1) to the turritella + espanolaensis species pair, one (12-2) for the darwini + consimilis + cinerea clade, and one (15-1) for the protozona + gnathodoxa pair. These are discussed in more details under the Remarks section for each taxon.

A better resolved tree including the two recognised but undescribed species, along with better knowledge of the distribution of the species would be necessary to make valuable biogeographical analyses and for comparisons with other groups of Galápagos endemic species.

## SYSTEMATIC TREATMENT

*Galagete* gen. n.

Type species: *Gelechia protozona* Meyrick, 1926.

*Diagnosis.* *Galagete* can be separated from other genera (notably *Taygete*) by the presence in the males of a tripartite "transtilla" made of two setose or scaled lateral lobes (or arms) and a simple, thin, central arm (figs 21-30). *Taygete* does not have a transtilla, but it has a strongly developed sacculus with two projections while that of *Galagete* is made of one rather small projection. The uncus in *Galagete* has a lateral pair of setose arms pointing anteriorly and downward while in *Taygete sphecochila* the setose arms are barely separated, medially located, and projecting posteriorly. The bilobed apical margin of the female's sternum VIII (figs 31-36) is believed to represent an autapomorphy for *Galagete*. In *Taygete*, sternum VIII is a broad, simple plate with the ostium bursae in the middle. Also, the larger species of *Galagete* (*protozona*, *gnathodoxa*, *seymourensis*, and *turritella*) have a band of modified, pointed, and stiff yellow scales on terga II-VII in the males and II-VI (or II-VII) in the females (fig. 16). *Galagete levequei* also has pointed scales on some terga but they are not pigmented differently than the surrounding scales.

*Description.* MALE (figs 17-19, 21-30). Head with rather long and narrow occipital scales arising from each side and projecting upward and medially and/or anteriorly; rest of scaling appressed. Frons evenly convex. Ocellus and chaetosema absent. Haustellum well developed. Labial palpus upturned, reaching above head, segments II and III equal in length and each slightly longer than diameter of eye, third segment acute. Maxillary palpus 4-segmented. Antenna reaching almost wing apex; antennal flagellomeres simple, rather short and thick, slightly ovate in cross section, with two sets of short brown scales surrounding flagellomeres completely and with several sensillae about as long as the scales and set around the whole surface of the



flagellomeres; scape without pecten. Male retinaculum consisting of a subcostal membranous hook (fig. 19), subcostal scales covering the hook, and a few small scales directed anteriorly at base of radial stem. Forewing base in anal sector with band of microspines along inner margin. Base of hindwing anal vein dorsally with patch of long and erect setalike scales. Forewing venation (based on BL 1310, 1311, 1312, the latter two are females) (figs 19, 20): Sc to middle of costa or before;  $R_1$  from about middle of cell or slightly before;  $R_2$  and  $R_3$  separate, both from before upper angle of cell;  $R_4$ ,  $R_5$ , and  $M_1$  from upper angle of cell, connected,  $R_4$  and  $R_5$  ending on costa before apex,  $M_1$  reaching outer margin below apex;  $M_2$  and  $M_3$  separate,  $M_2$  from above lower angle of cell,  $M_3$  from lower angle of cell or above; CuA1 from lower angle of cell or before; CuA2 from before lower angle of cell; CuP absent; cell a little more than half wing length; A1 and A2 joined at  $1/3$  their lengths. Hindwing venation (based on BL 1310, 1311, 1312, the latter two are females) (figs 19, 20): Sc closely following costa, reaching it at more than  $2/3$  wing length, sometimes curving away from costa before reaching it; Rs connected with  $M_1$  after upper angle of cell, Rs reaching costa slightly before apex,  $M_1$  reaching outer margin at apex or slightly below;  $M_2$  from slightly above lower angle of cell, reaching outer margin near middle,  $M_3$  and CuA1 from lower angle of cell or shortly connected,  $M_3$  to tornus, CuA1 to inner margin before tornus; CuA2 from about  $2/3$  cell to inner margin at  $2/3$ ; CuP and anal veins indistinct; apex of wing not markedly produced; outer margin not distinctly concave and sometimes slightly projecting outward at junction with  $M_2$ . Tibial spurs 0, 2, 4; hind tibia with long and slender scales on dorsal edge. Hind coxa and sides of metascutum with whitish, long setalike scales. Abdominal base with strong venulae, apodemes, and a coremata organ in the form of a long evaginable membranous structure set with long and narrow scales originating between sterna II and III (figs 17, 18). Terga II-VII in the larger species of *Galagete* (*protozona*, *gnathodoxa*, *seymourensis*, and *turritella*) with a band of modified, pointed, and stiff yellow scales (fig. 16). *Galagete levequei* also has pointed scales on some terga, but they are not pigmented differently than the surrounding scales. Male genitalia (figs 21-30, 37). Uncus basically separated in two sections sometimes at right angle, with a pair of longitudinal crests dorsolaterally on basal section, with more or less triangular and setose lateral arms pointing ventrally on second section, and apically often with a pair of short posteriorly directed projections or projecting dorsally at right angle. Gnathos flaplike at base of two arms fused medially to form a strong hook usually folded on itself as an elongate "U" in lateral view, but sometimes less completely folded on itself. Dorsal connection of tegumen varying in width; pedunculi usually short and broad. Transtilla with a pair of lateral arms varying in length, dorsoventrally compressed, usually covered dorsally with scales (sometimes set perpendicular and imbricated to form an anteroposterior barrier), or setae, and a median arm usually narrow and longer than lateral arms. Valva usually short and broad, sometimes more elongate, with strong, short pedunculi at base of costa, sometimes with short sclerotized crest at apex of costa, with a well-sclerotized sacculus. Juxta strongly melanized, usually symmetric and sheathlike with a deep medioapical notch where aedeagus is connected, but sometimes asymmetric, and sometimes oriented longitudinally against ventral wall of aedeagus and fused to ring of sclerotization around aedeagus. Vinculum only slightly extended

anteromedially and bulbous, with rounded anterior margin. Aedeagus usually elongate, symmetric, with larger basal half, and open ventrally at apex, but sometimes short and thick, asymmetric, especially at apex, and with apical opening ventrally and laterally; vesica usually with numerous spicules, but sometimes with cornuti.

**FEMALE** (figs 20, 31-36). Eye slightly smaller than male's. Antennal flagellomeres slightly narrower than males'. Frenulum with 2 acanthae. Retinaculum consisting of anteriorly directed scales at base of cubital stem and posteriorly directed scales at base of Sc (fig. 20). Abdomen without corematal organ but with band of modified and stiff yellow scales on terga II-VI in same species as for males (fig. 16). Female genitalia (figs 31-36). Papillae anales slightly variable in length, moderately setose, apically rounded in lateral view; dorsobasal margin with or without emargination. Posterior apophyses usually straight, variable in length. Anterior apophyses with a dorsal branch connected to lateral margins of tergum VIII and a ventral branch connected laterally to basal margin of sternum VIII, the two branches connected usually at level of ostium bursae to form single "free" branch. Both pairs of apophyses often sinuous toward apex. Apical margin of sternum VIII with pair of rounded and flat lobes separated by median emargination; lobes with moderately long, sparse setae. Apical margin of tergum VIII with or without lateral lobes, with sparse setae along margin if lobes absent or on lobes. Ostium bursae located medially in intersegmental membrane between margins of sterna VII and VIII, in a somewhat rounded depression ornate with a sclerotized ring. Ductus bursae often constricted at base, subsequently variable in shape and length. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae usually elongate, more or less spiculate, with or without signum; signum, when present, a plate usually with lateral spines.

*Etymology.* The generic name is a combination of letters suggesting its Galápagos origin in the first two syllables and its close evolutionary affinity to *Taygete* in its last two syllables. The name is considered feminine in gender.

*Biology.* Little is known of the immature stages or of the adult behaviour except for phenology, habitat, and light attraction. Several specimens of *Galagete darwini* and *G. levequei* in the CDRS were reared from dead leaves and branches of *Scalesia* (Asteraceae) species, but the behaviour of the larvae and exactly what they consume is unknown. One specimen of *G. gnathodoxa* collected on Pinzón was reared from tortoise scats (CDRS). This is consistent with the feeding habits of other Autostichidae (Gozmány, 1975; Hodges, 1999).

*Systematic position.* *Galagete* is clearly related closely to *Taygete* Chambers, 1873. Both groups share several characters (presence of corematal organ<sup>1</sup>, the fusion of R<sub>4</sub>, R<sub>5</sub>, and M<sub>1</sub> in the forewing, and similar male and female genitalia). The new genus is separated from *Taygete* by features of the genitalia, notably, in the males by the more strongly developed sacculus and uncus in *Taygete*, and by the presence of an elaborate transtilla in *Galagete*. In females the abdominal sternum VIII is bilobed in *Galagete* but simple in *Taygete*. The tripartite male transtilla, the position of the setose

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<sup>1</sup>This structure (fig. 17) apparently was first recorded and illustrated by Dr László Gozmány (1975).

lobes of the uncus, and the bilobed female abdominal sternum VIII possibly represent autapomorphies for *Galagete*.

The familial assignment of *Taygete* within the Gelechioidea has been problematic. In recent checklists (Becker, 1984; Hodges, 1983) *Taygete* was placed in Gelechiidae, Gelechiinae. Then, Hodges (1986: 6) mentioned that *Taygete attributella* (Walker) is related instead to the Oecophoridae because it has a cubital pecten on the female forewing. However, this was an error of the author who meant to write “retinaculum” instead of “pecten” (Hodges, pers. comm.). The females of *Galagete* and *Taygete* indeed have a cubital retinaculum in addition to posteriorly directed scales on Sc (see fig. 20). According to Hodges (1999) this feature is present in Elachistinae, Epimarpinae, Momphinae, and Stathmopodinae, now placed in four different gelechioid families. It should be noted that *Taygete* was not included in Hodges’ (1999) analysis. Hodges (1986) mentioned that female Gelechiidae can be recognised by the presence of a radial retinaculum and Minet (1986) considered this character to represent an autapomorphy for the family. Hodges (1999) does not use this character as an autapomorphy for the Gelechiidae, presumably because the Physoptilinae (Gelechiidae) have a different type of female retinaculum with anteriorly directed scales starting in cell and extending to the area between Sc and R. This latter character is shared by the Autostichinae (Hodges, 1999).

The gnathos formed by a pair of lateral, articulated, symmetric sclerites with an articulated mesial hook currently seems to be the only known synapomorphy for adult Gelechiidae (Hodges, 1999). The mesial hook is present in *Galagete*, but there is no additional pair of sclerites. The articulation of the gnathos seems to be between the flaplike bases of its arms and the bases of the uncus. Although there is a constriction between the bases of the hook and the flaplike bases of the gnathos arms, and movement can be induced between the two parts, they appear fused to each other at the constriction rather than articulated as two separate parts.

Hodges (1999) defined the Autostichidae on the basis of two parallelisms within the Gelechioidea: 1- the gnathos is an articulated band with an unarticulated mesial hook; and 2- there are spiniform setae in band across abdominal terga. These characters are both present in *Galagete* and *Taygete sphecophila*. As defined by Hodges (1999), the Autostichidae include the Autostichinae, Holcopogoninae, and Symmocinae. The presence of the abdominal cremal organ in *Taygete*, *Galagete*, as well as *Oecia* Walsingham, 1897 (Holcopogoninae) and *Oegoconia* Stainton, 1854 (Symmocinae) (Gozmány, 1975, 2000) also suggests an affinity of *Taygete* and *Galagete* with the Autostichidae. Therefore, the morphological evidence suggests that *Taygete* and *Galagete* should be placed in the Autostichidae. Based on the absence of CuP in the forewing the two genera are tentatively assigned to the Symmocinae. The fusion of R<sub>4</sub>, R<sub>5</sub>, and M<sub>1</sub> in the forewing seems to be unique to *Taygete* and *Galagete* as I have not been able to see it in other Symmocinae and Holcopogoninae (Gozmány, 1963, 1964, 1967, 2000).

*Remarks.* In addition to the 11 species described or redescribed here, I know of two other species of *Galagete* in the Galápagos. One is represented by a single male specimen (fig. 15) collected at the site of the Charles Darwin Research Station, Santa Cruz Island, in 1989 (CNC). Its genitalia were unfortunately damaged during prep-



aration and cannot be described accurately. It is a very small specimen (wingspan: 6.7 mm) with grey forewings apparently marked only by a slightly darker grey patch at base of costa. The other species is represented by a series of six females collected on 15 January 2002 on the island of Fernandina by L. Roque-Albelo and C. Causton. I prefer to wait for the availability of males to describe this species as the differences in female genitalia and habitus between this species and *G. turritella* are not very strong. Of the 11 species treated below, all are known from both sexes except *G. espanolaensis* known from males only.

***Galagete protozona* (Meyrick) comb. n.**

Figs 1, 16, 20, 21, 28, 31

*Gelechia protozona* Meyrick, 1926: 277; Gaede, 1937: 205; Clarke, 1969: 120, pl. 60, fig. 2; Becker, 1984: 46.

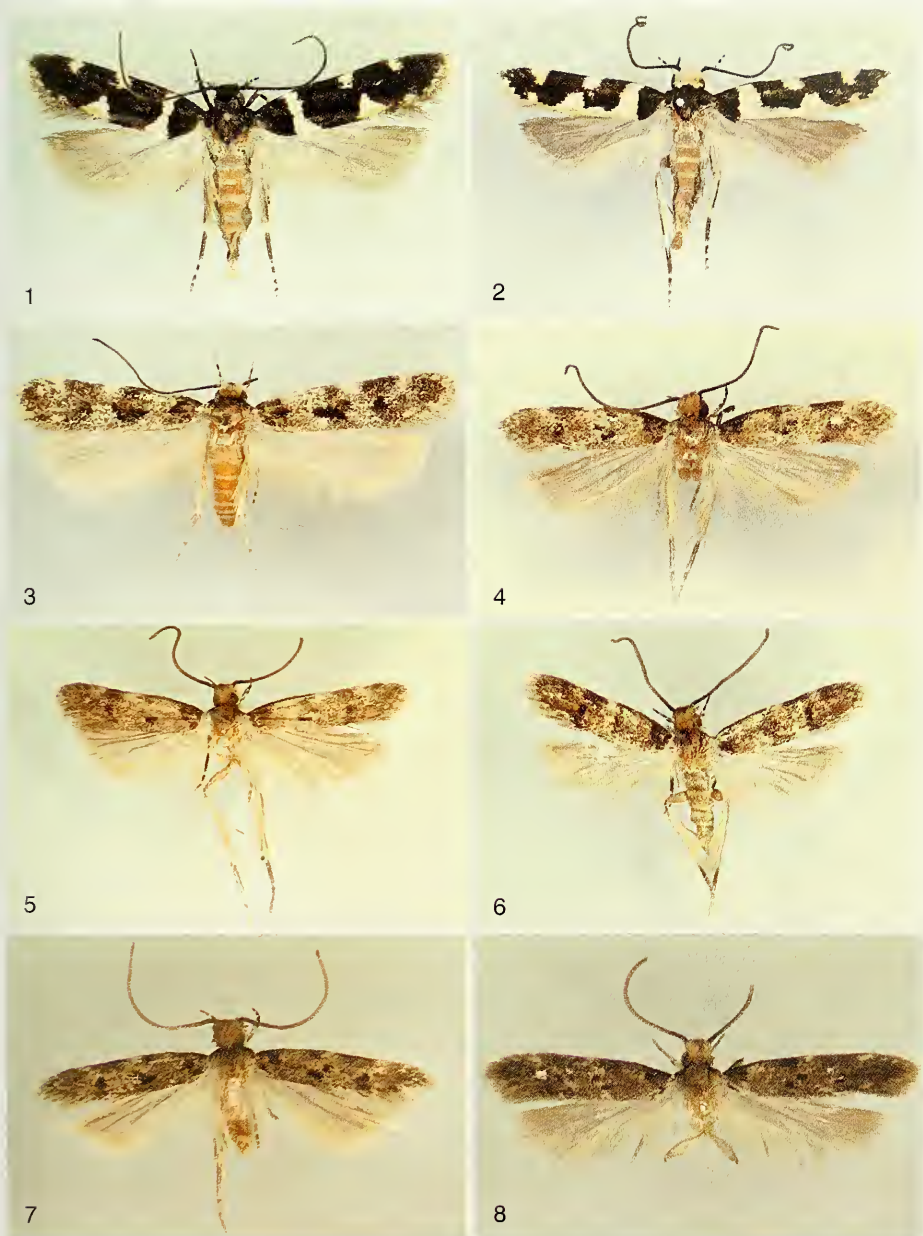
Lectotype ♀ (by present designation), Ecuador: "Albermarle [Isabela] Island, Galápagos, at light, 50 f[ee]t, 3.8.[19]24, St. George Exped[itio]n, C.L. Collenette." (BMNH). The species was described from three specimens of both sexes. Meyrick (1926) did not select a type among the three syntypes, but Clarke (1969) reports a female type specimen with a "Type ♂" label and without abdomen. I believe that Clarke should have selected this specimen as lectotype and it is here considered as such to clearly fix the application of the name to the taxon.

Paralectotypes. Two specimens without abdomen collected on Isabela in August by C.L. Collenette (BMNH). One was collected on August 3 and the other probably on August 1, but a pinhole makes this datum uncertain (K. Tuck, pers. comm.).

*Diagnosis.* *Galagete protozona* is similar to *G. gnathodoxa* in having a wing pattern that is unique among Galápagos moths (see figs 1 and 2). *Galagete protozona* can be separated from *G. gnathodoxa* by the absence of white scaling on the inner margin of the forewing between the postbasal transverse band and the postmedian white spot.

*Redescription.* Head pale yellowish beige with dark-brown periorbital scales to mostly dark brown with white to creamy-white scales around eye and on frontoclypeus. Maxillary palpus greyish brown at base, beige apically. Haustellum greyish brown on basal third, subsequently whitish beige. Labial palpus greyish brown on first segment; second segment greyish brown at base and as a short ring subapically, otherwise whitish beige; third segment greyish brown with more or less extensive whitish-beige dorsal spots or complete rings at 1/3, 2/3, and apically. Antennal scape dark brown with small whitish beige spot apicoventrally; flagellum greyish brown, slightly darker on basal segments. Thorax dorsally dark brown except for pale greyish-brown metascutellum. Foreleg coxa greyish brown, sometimes paler (beige) at base; femur dark brown, sometimes with whitish-beige scales apically; tibia dark brown with small white to beige spots at base and middle, and with a larger spot apically; tarsomeres mostly dark brown, tarsomere I with a few white or beige scales at base and apex, tarsomere V beige on apical half. Midleg femur greyish brown to dark brown; tibia dark brown with white spots at base (very small), middle, and apex; tibial spines mostly beige with greyish brown laterally; tarsomeres dark brown with beige scales at apices but tarsomere V mostly beige. Hindleg femur greyish brown with beige scaling at apex; tibia pale greyish brown (sometimes darker brown at base) with beige scaling at base of spines and apex, also with dorsal crest of long and narrow beige scales; tibial spines beige; tarsomeres I-IV mostly greyish brown except for beige apices; last





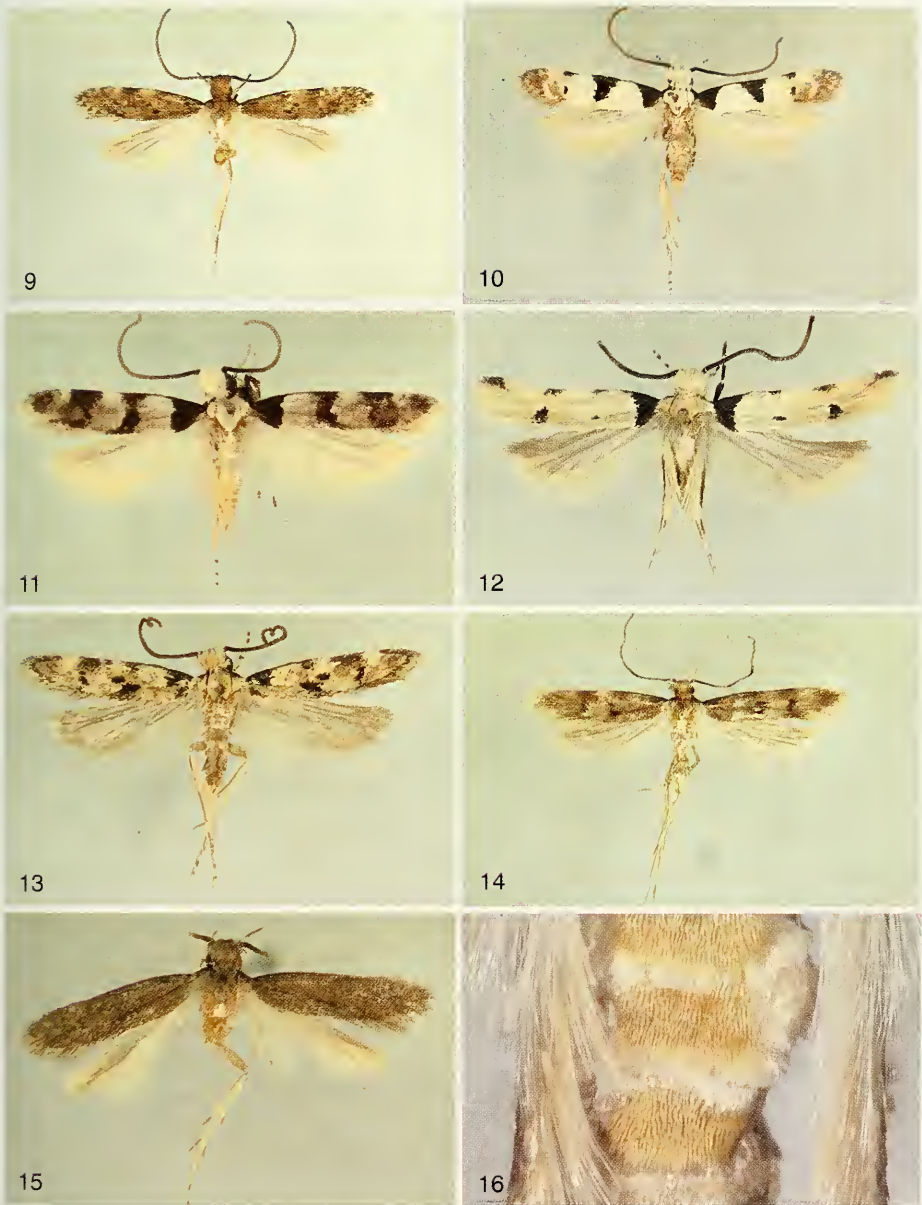
FIGS 1-8

Adults of *Galagete* species. 1. *G. protozona*, male from Santa Fé; 2. *G. gnathodoxa*, female from Floreana; 3. *G. seymourensis*, paratype female from Seymour Norte; 4. *G. turritella*, holotype (from Santiago); 5. *G. turritella*, paratype male from Isabela; 6. *G. espanolaensis*, holotype; 7. *G. darwini*, paratype male from San Cristóbal; 8. *G. darwini*, paratype male from Seymour Norte.

tarsomere beige. Male wingspan (n=2): 12.5-13.0 mm; female's (n=7): 10.5-16.0 mm. Forewing (fig. 1) mostly dark brown with white, cream-coloured, or pale greyish-brown markings as a subbasal transverse band of variable width but wider on inner margin, two small spots of variable shape on costa at 1/2 and 5/7, a larger generally triangular spot on inner margin at about 2/3, and, sometimes, with another smaller spot on inner margin below subapical costal spot, 2-3 tinier white spots toward apex along inner margin, and some basally brown and apically beige scales along inner margin from triangular spot to apex; fringe mostly greyish brown, sometimes with some white scales at apex. Hindwing uniformly grey; fringe concolorous except for slight beige tinge at base of scales. Abdomen tergum I white to greyish white; terga II-VII (fig. 16) covered with small, narrow, and pointed spinelike straw-yellow scales except for narrow posterior band of larger white scales; rest of abdomen laterally with a band of greyish-brown scales, ventrally whitish beige, and beige around genitalia.

Male genitalia (n=2) (figs 21, 28). Basal half of uncus at right angle from second half; second half not produced dorsally, apex distinctly produced into pair of short lateral points; arms not laterally compressed, sub-triangular, rather broad and of medium length, apically blunt; crests somewhat narrowly rounded, strongly demarcated. Median hook of gnathos of medium girth, apically narrower, dorsoventrally compressed, pointed, and distinctly upturned. Dorsal connection of tegumen wide; pedunculi short and wide. Lateral arms of transtilla of medium length, somewhat triangular with rounded margins, with median margin more strongly melanized, dorsally covered with non-imbricating short and narrow scales; median arm rather wide, dorsoventrally compressed, about 1/3 X longer than lateral arms, apically enlarged and blunt (or slightly convex). Valva of medium width, rather short, dorsal margin ventrally trending very gently before apex, ventral margin without subbasal notch and dorsally trending from 1/3, apex almost blunt; costa strongly melanized with crested extensions directed medially at base and apically, the apical extensions longer and triangular in shape; sacculus of medium length, of narrow (almost spinelike) to medium width, without additional ridge. Juxta symmetrical, heart shaped, slightly elongate, with deep rounded notch. Vinculum of medium size, bulbous, rounded apically, without dorsal projection medially. Aedeagus long and mostly narrow, larger on basal 1/2 with medium-sized and narrow coecum penis adorned with short crest medioventrally, dorsal margin angled at about half right angle from slightly before middle, ventral margin angled from middle; apical 3/10 angled upward at about half right angle and open ventrally, dorsal wall laterally enlarged to the right subapically, apically narrower and rounded; vesica abundantly spiculate apically, without cornuti.

Female abdomen sometimes mostly grey on tergum VII and sometimes with a few yellow pointed scales on tergum VII as well as on terga II-VI. Female genitalia (n=2) (fig. 31). Papillae anales rather long and narrow (about 2 X longer than greatest, basal width in ventral view), in situ and in dorsal view with parallel sides at base and subsequently tapering gently, laterally compressed at apex, in lateral view projecting straight behind posteriorly (although tip of abdomen usually bent downward), parallel margined from base, and rounded at apex; dorsobasal margin thinly melanized in middle. Posterior apophyses straight, only slightly enlarged apically, 1.4 X length of papillae anales, reaching basal margin of sclerotized ring of ostium. Free branch of anterior



FIGS 9-16

Adults of *Galagete* species. 9. *G. consimilis*, paratype male from Isabela; 10. *G. levequei*, holotype (from Santa Cruz); 11. *G. levequei*, paratype male from Isabela; 12. *G. cristobalensis*, holotype (from San Cristóbal); 13. *G. pecki*, holotype (from Isabela); 14. *G. cinerea*, paratype female from Isabela; 15. Undescribed *Galagete* species (unique damaged specimen from Santa Cruz; see Remarks of generic treatment above); 16. *G. protozona*, modified scales on terga II-V.



apophyses with slight outward curve from base but apically parallel sided; dorsal and free branches together slightly shorter than posterior apophyses; ventral branches forming slightly convex, heavily melanized, short, narrow and distinct band along basal margin of sternum. Apical margin of sternum VIII with lobes short and conical; emargination reaching margin and slightly broader and rounder than lobes. Apical margin of tergum VIII with slightly shorter and narrower lobes and with a broader emargination than on sternum VIII. Ostium bursae in circular depression with about 2 X wider than long sclerotized ring. Ductus bursae without apparent basal constriction, of medium girth and slightly enlarging gradually toward corpus bursae. Inception of ductus seminalis at about 1/3 length of ductus bursae. Corpus bursae simply rounded, slightly elongate, slightly shorter than ductus bursae, without signum or distinct spicules or scobination.

*Biology.* Moths were attracted to light from sea level to an elevation of 1300 meters, in January, March, April, May, August, October, and November.

*Distribution.* Presumably endemic to the Galápagos, this species was found on Fernandina, Floreana, Isabela, Santa Fé, and Seymour Norte.

*Remarks.* *Galagete protozona* and the following species are believed to be most closely related to each other than to other *Galagete* species on the basis of the unique wing pattern and colours (character state 15-1 of Table 1). This relationship in the cladistic analysis shows a decay index of 1. *Galagete protozona* and *G. gnathodoxa* are together most closely related to *G. seymourensis* (decay index of 1) on the basis of two character states (3-1, 10-1 of Table 1), i.e. the absence of a signum on the corpus bursae and the presence of a large crest on the coecum penis of the aedeagus. According to the cladistic analysis, the above-mentioned clade of three species is the sister group to another clade formed by the rest of the *Galagete* species, a branch with a decay index of 2.

*Galagete gnathodoxa* (Meyrick) comb. n.

Figs 2, 22, 31

*Gelechia gnathodoxa* Meyrick, 1926: 277; Gaede, 1937: 176; Clarke, 1969: 123, pl. 56, fig. 5; Becker, 1984: 46.

Holotype ♀, Ecuador: "James [Santiago] Island, Galápagos, at light, sea level, 26.7.[19]24, St. George Exped[ition], C.L. Collenette." (BMNH). The species was described from a single female specimen which was dissected (BMNH Slide No. 9074) but because the abdomen had been badly eaten by museum pests, there are few parts of the genitalia left.

*Diagnosis.* *Galagete gnathodoxa* and *G. protozona* are similar in wing pattern (figs. 2 and 1), but their wing pattern is unique in Galápagos moths. The forewings are black with white or sometimes white and pale-brown markings. The two species can be separated readily by the presence in *G. gnathodoxa* of a band of white scaling on the forewing inner margin between the white postbasal transverse band and the postmedian white spot.

*Redescription.* Head white to creamy white with dark-brown periorbital scales posteriorly, posterodorsally, and anteriorly below antenna, sometimes also with yellowish-orange periorbital scales dorsally. Maxillary palpus mostly dark brown, tipped white. Haustellum longitudinally striped with white, in the middle, and brown or greyish brown laterally. First segment of labial palpus dark brown or greyish brown;





17



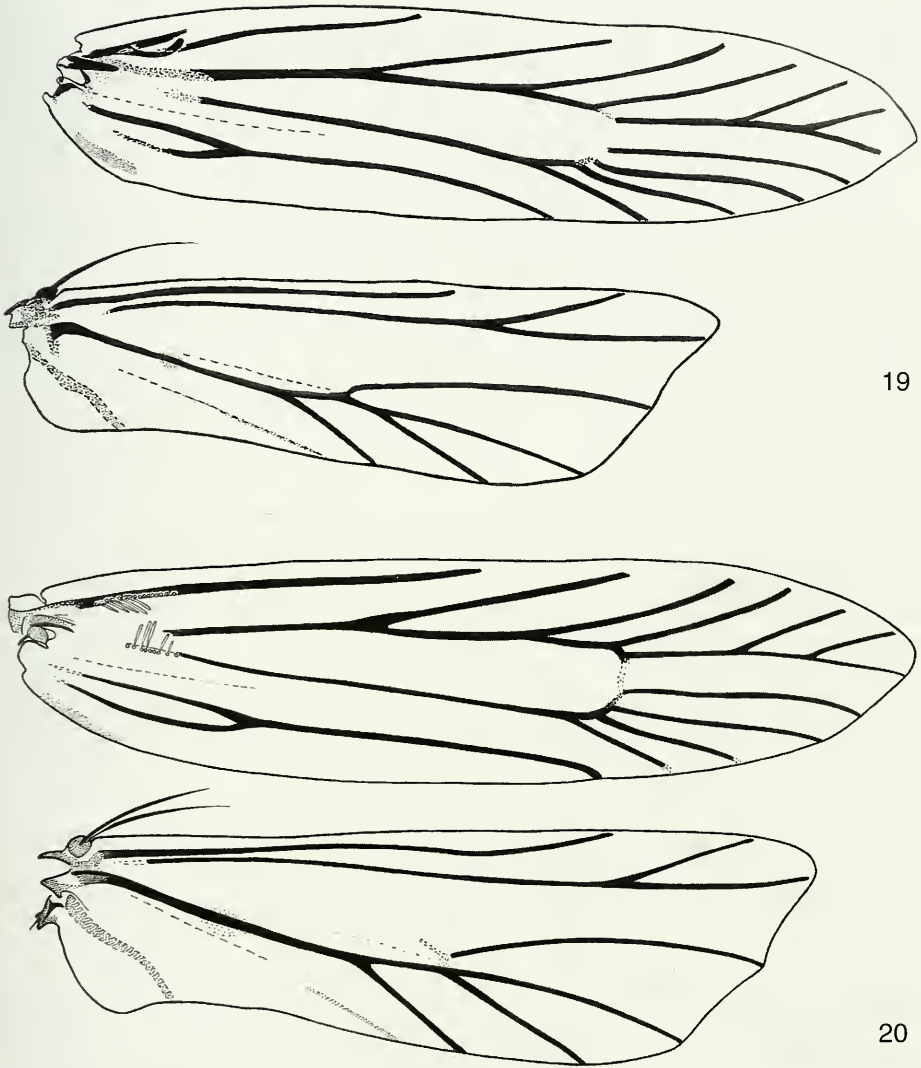
18

FIGS 17-18

Abdominal coremata organ of *G. turritella* in side view, slide BL 1132. 17. Base of male abdomen and coremata organ partially evaginated; 18. Apex of modified scales of abdominal coremata organ.

second segment mostly white, with dark brown on basal half except usually for a thin line dorsally, and sometimes also before apex dorsally and laterally, sometimes with yellowish brown ventrally, laterally near middle, and/or subapically; third segment with rings of dark-brown scales postmedially and subapically, also with yellowish-brown or dark-brown scaling subbasally. Antennal scape mostly dark brown with more or less white to creamy-white scaling ventrally, at apex laterally, and sometimes at apex dorsally; flagellum basally dark brown, changing to pale brown near middle, sometimes with white on first flagellomere. Thorax dorsally dark brown except for pale greyish-brown metascutellum. Foreleg coxa dark brown with beige basally; femur dark brown with a few beige scales at base and a few white scales at apex; tibia dark brown with very few white scales at base, middle, and apex; tarsomeres I-III mostly dark brown with beige at apex, tarsomere I also with white at base, tarsomere IV half brown and half beige, tarsomere V mostly beige with few brown scales at base. Midleg coxa and femur as in proleg; tibia as in proleg but usually with more white scaling in middle, spines beige; tarsomeres as in proleg. Hindleg coxa as in proleg; femur dark brown with few beige scales at base and apex; tibia laterally brown except for white apex, with a dorsal crest of thin and elongate beige scales, spines beige; tarsomere I dark brown with white base and apex; tarsomeres II-IV brown on basal half and beige; tarsomere V all beige or beige with a few brown scales at base. Male wingspan (n=2): 9.5-12.0 mm; female's (n=7): 10.0-11.5 mm. Forewing (fig. 2) dark brown with white markings as a subbasal transverse band of variable width, connected with band along inner margin to a triangular spot slightly beyond middle, and to another smaller triangular spot subapically, also with two small white spots on costa at 1/2 and 5/7, and sometimes with tinier white spots along basal half of terminal margin; with creamy-white, yellowish-orange, or pale brown scales generally within the white areas along margins (especially along inner margin) and sometimes as a small spot at the base medially; fringe pale greyish brown, white or pale creamy white except for darker greyish-brown scales at apex. Hindwing pale greyish brown with concolorous fringe except for slight yellowish tinge in anal sector and along margin. Male abdominal tergum I mostly with greyish-white scales of reduced size, with anterior and posterior rows of larger greyish-white scales; terga II-VII mostly covered with small spinelike, pointed straw-yellow scales except for posterior row of larger greyish-white scales; rest of abdomen mostly brown or greyish brown laterally and ventrally except for yellowish-white scaling around genitalia and along mid-line ventrally. Female abdominal terga similarly adorned.

Male genitalia (n=2) (fig. 22). Basal half of uncus almost at right angle from second half; second half not projecting dorsally, apex with pair of small rounded bumps; arms not laterally compressed, sub-triangular, broad and short, apically rounded; crests rather narrowly rounded, well demarcated. Median hook of gnathos somewhat short, of medium girth, apically rounded and slightly upturned. Dorsal connection of tegumen very wide; pedunculi wide and short. Lateral arms of transtilla short, oval shaped, with median margin more strongly melanized, dorsally covered with rather short and narrow scales slightly curved at apex and not imbricating; median arm narrow about 1/3 longer than lateral arms, dorsoventrally compressed, apically enlarged and blunt. Valva short and broad, dorsal margin angled ventrally from about



FIGS 19-20

Wing venation features of *Galagete*. 19. Male wing venation of *G. consimilis*; 20. Female wing venation of *G. protozona*.

2/3, ventral margin without notch, broadly convex, angled dorsally from before middle, apex rather narrowly rounded; costa more strongly melanized from base to middle; sacculus a small shark-toothlike projection with a low supporting ridge perpendicular to it from base dorsally. Juxta symmetrical, more or less lozenge shaped, with deep rounded notch. Vinculum short and broadly rounded, without projection dorsomedially. Aedeagus long and mostly narrow, larger on basal 1/2 with rather long and narrow coecum penis adorned with short crest apically, dorsal margin angled

ventrally at about half right angle before 1/2, ventral margin at about 1/2; apical 2/5 slightly angled upward and open ventrally, dorsal wall laterally enlarged to the right subapically, apex narrower and rounded; vesica with large number of very short spicules, without cornuti.

Female genitalia (n=2) (fig. 31). Papillae anales rather elongate and narrow (2 X longer than broad on slide), in situ appearing narrow for whole length, narrowly rounded at apex in side view, and angled downward at half right angle from base; dorsobasal margin indistinct medially because of less melanized and wide longitudinal depression. Posterior apophyses straight, very slightly enlarged at apex, about 2 X length of papillae, reaching slightly beyond ostium. Free branch of anterior apophyses slightly curved upward and outward; dorsal and free branches together as long as posterior apophyses; ventral branches forming distinct, narrow, narrowly rounded, melanized band along basal margin of sternum. Apical margin of sternum VIII with lobes rather narrow; emargination similar to lobes in size and shape, reaching slightly beyond middle of length between apex of lobes and basal margin of sternum. Apical margin of tergum VIII laterally with pair of lobes slightly shorter and wider than ventral lobes. Ostium bursae in rounded and partly sclerotized depression, sclerotized area sometimes forming a ring across middle. Ductus bursae constricted at base, subsequently rather wide. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae only slightly larger than ductus bursae, short and circular, without signum or distinct spicules or scobination.

*Biology.* Moths were collected at light between sea level and 1300 m in January, March, April, May, June, July, and October. One specimen in the CDRS has a label mentioning "Pinzón, from tortoise scats, 10 .v.[19]81, G. Walker." The tortoise in question can only be *Geochelone nigra* (Quoy and Gaimard) (= *G. elephantopus* (Harlan)) (Testudinidae).

*Distribution.* This species is believed to be endemic to the Galápagos where it was collected on Fernandina, Floreana, Isabela, Pinzón, and Santiago.

*Remarks.* The phylogenetic relationships of *G. gnathodoxa* and its two most closely related species are explained above under the Remarks for *G. protozona*.

### *Galagete seymourensis* sp. n.

Figs 3, 23, 32

Holotype ♂, Ecuador: Galápagos, Seymour Norte, 29.iii.1992, M[ercury] V[apour] L[amp] (B. Landry) (genitalia dissected, BL 1133) (MHNG).

Paratypes, Ecuador: 3 ♀ (two dissected, BL 1169, 1344) from the Galápagos Island of Seymour Norte, collected on 23.i.1989 at MVL by B. Landry. (CDRS, CNC, MHNG).

*Diagnosis.* Among the species of *Galagete*, *G. seymourensis* can be distinguished by its large size (wingspan between 13.0 and 14.0 mm) and by its forewing maculation appearing grey with paler (almost white) and darker (almost black) spots. Particularly distinctive are the two darker spots along the forewing's midline sub- and postmedially. *Galagete turritella* (figs 4, 5) may have similar markings, but it is smaller, averaging 10.0 to 11.0 mm in wingspan (maximum 12.0 mm), and its forewing appears more chestnut brown than grey. *Galagete cinerea* (fig. 14) is also a grey species, but it is smaller (wingspan: 12.8 mm), the forewings are narrower, and the forewing markings are poorly contrasted and reduced.



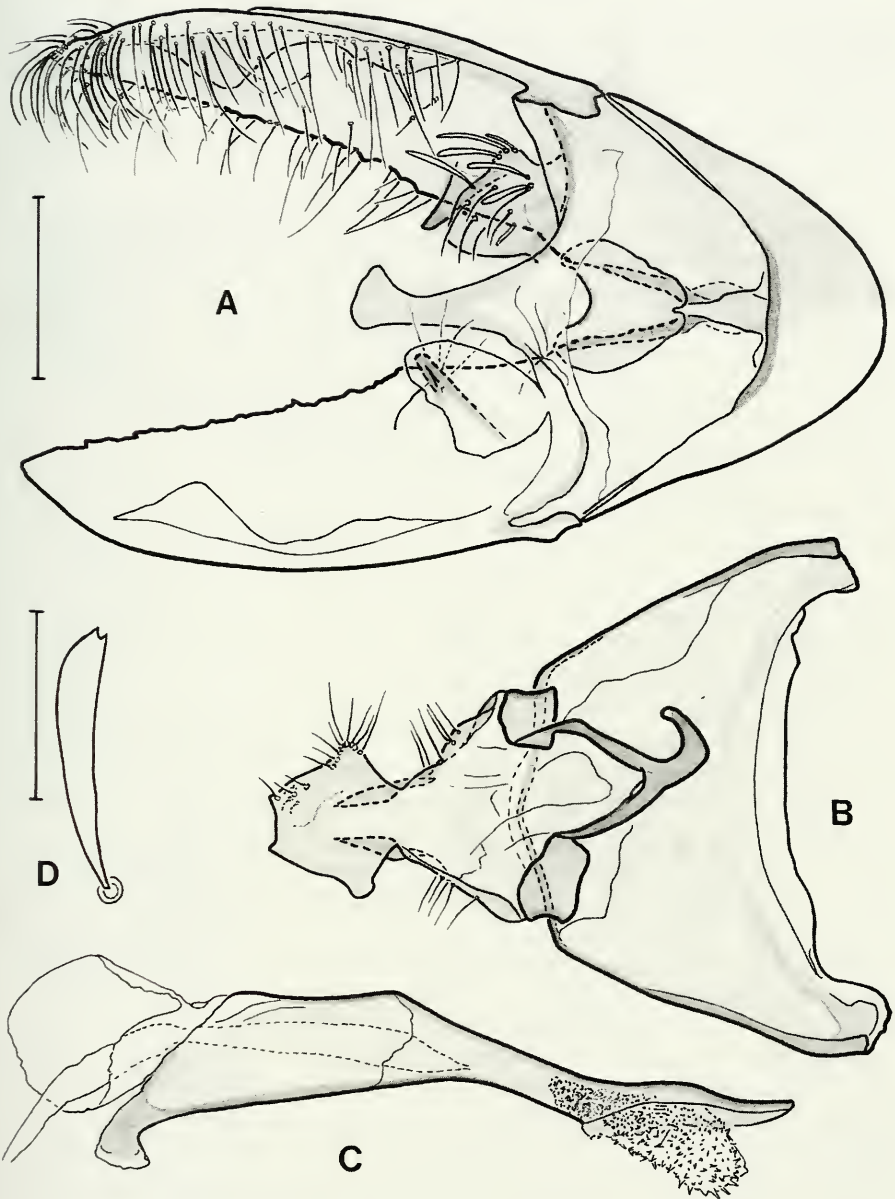


FIG. 21

Male genitalia of *Galagete protozona*. A. Ventral parts (scale = 0.2 mm); B. Dorsal parts; C. Aedeagus; D. Scale of lateral lobe of transtilla (scale = 0.05 mm).

*Description.* Head's appressed scales of frontoclypeus and vertex mostly beige, with greyish brown in middle of vertex; longer erect scales laterally on occiput beige and pale brown; with few dark-brown periorbital scales posteriorly. Haustellum and maxillary palpus whitish beige. Labial palpus dark brown on segment I; segment II mostly whitish beige with dark brown on basal half laterally and ventrally, and as an incomplete ring subapically; segment III whitish beige ringed with brown at base and subapically, and with dark brown postmedially. Antennal scape apparently with bands of whitish beige and dark brown (rubbed on available specimens), whitish beige apically and ventrally; first flagellomere with whitish-beige and dark-brown scales; rest of flagellum dark brown changing to paler brown from about 1/3. Thorax mostly brown to dark brown with pale beige at apex of tegula and mesoscutum; metascutellum pale greyish beige. Foreleg coxa dark brown at apex, whitish beige basally; femur dark brown with whitish beige along ventral margin; tibia dark brown with whitish beige basally, at base of epiphysis, and apically; tarsomeres mostly dark brown with whitish beige at base and apex of tarsomere I and apex of tarsomeres II to V. Midleg coxa and femur whitish beige with dark brown on dorsal edge of femur, especially at apex; tibia dark brown to paler brown toward apex, with white to whitish beige at base, middle, apex, and on spurs. Tarsomeres mostly whitish beige with dark brown on tarsomere I dorsally except at base and apex, and on tarsomeres II-IV on basal half. Hindleg mostly whitish beige with pale greyish brown laterally on tibia and dorsally on tarsomere I and darker greyish brown on base of tarsomeres II and III. Male wingspan (n=1): 13.0 mm; female's (n=3): 13.3-14.0 mm. Forewing (fig. 3) greyish brown; most scales white or beige at base and brown to dark brown apically; darker brown areas as a spot between costa and midline subbasally, a small longitudinal bar below midline intersecting a poorly defined band submedially, a smaller spot at about 2/3 along midline, and paler spots along costa intersected with white spots at 1/4, 1/2, and 3/4; also with more dispersed white scales in sectors below costal white spots and as a small spot near anal angle; shorter scales of fringe beige tipped with brown, longer scales mostly white at apex and pale brown at anal angle. Hindwing pale greyish brown; fringe whitish beige tinged with yellowish beige at base of scales. Male and female abdominal terga II-VII mostly covered with short and thick yellowish-beige pointed scales, with row of normally shaped scales apically on terga I-VI; scales of tergum I pale greyish beige, short, and apically V-shaped; sterna whitish beige.

Male genitalia (n=1, mounted on slide before description) (fig. 23). Second half of uncus not produced dorsally, apicomediaally with a shallow rounded concavity; arms not apparently compressed laterally, short and broad; crests apparently well demarcated and rounded. Median hook of gnathos medium sized, apparently pointed apically and slightly upturned, but not dorsoventrally compressed. Dorsal connection of tegumen very wide; pedunculi short and broad. Lateral arms of transtilla short, rounded, with median margin more strongly melanized, dorsally with narrow scales of medium length, apparently not imbricating; median arm longer than lateral arms, rather wide, apparently compressed dorsoventrally and apically rounded. Valva short and broad, dorsal margin gently angled ventrally from base, ventral margin with postbasal concavity and subsequent convexity, gently angled dorsally from about middle, apex broadly rounded; costa apparently without crest, more strongly melanized from base to

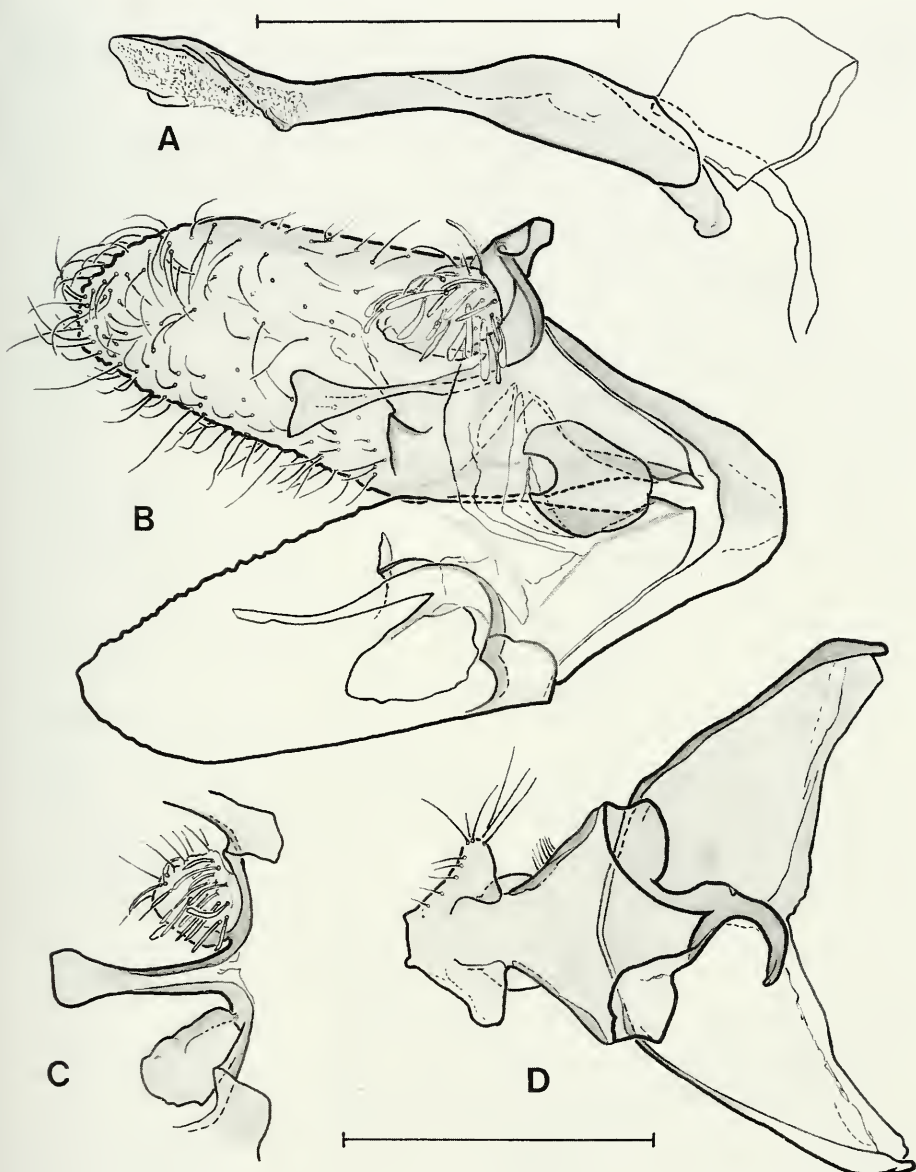


FIG. 22

Male genitalia of *Galagete gnathodoxa* (scales = 0.3 mm). A. Aedeagus; B. Ventral parts (transtilla broken); C. Complete transtilla of other specimen; D. Dorsal parts.

before apex; sacculus a rather large bell-shaped crest with short additional ridge near middle dorsally, apparently larger on right valva. Juxta somewhat lozenge shaped, symmetrical, with deep rounded notch. Vinculum medium sized, evenly rounded apically, without dorsomedian projection. Aedeagus sinuate, with base about 3 X larger than postmedian constricted section, with medium-sized and narrow coecum penis

adorned with short crest mediodorsally, also with short and narrow peduncle on dorsal margin at about 1/3; apical 1/3 slightly angled upward and open ventrally, dorsal wall slightly enlarged subapically on right side, narrower and rounded apically; vesica apically with numerous spicules, without cornuti.

Female genitalia (n=2) (fig. 32). Papillae anales rather short (as long as basal width in ventral view), conical, not clearly visible in situ on single undissected specimen; dorsobasal margin not melanized medially at longitudinal depression. Posterior apophyses mostly straight, slightly curved and enlarged apically, almost 2 X length of papillae, reaching beyond ostium bursae and into segment VII slightly. Free branch of anterior apophyses slightly curved in one direction or other; free and dorsal branches together slightly longer than posterior apophyses; ventral branches forming distinct and strongly melanized narrow band with a short and blunt projection medially. Apical margin of sternum VIII with lobes rather large and broadly rounded; emargination about as deep as lobes, almost reaching margin, narrow, rounded at base. Apical margin of tergum VIII with lateral lobes short and broadly rounded, separated by shallow and broadly rounded emargination. Ostium bursae in somewhat cup-shaped depression with sclerotized ring almost as long as wide. Ductus bursae not constricted at base, of medium girth, gradually enlarging into corpus bursae. Inception of ductus seminalis at about 1/3 length of ductus bursae. Corpus bursae simple, rounded but slightly elongate, without signum but with tiny spicules on entire internal surface.

*Etymology.* *Galagete seymourensis* is named for the type locality. The island's name refers to Lord Hugh Seymour, admiral (1759-1801).

*Biology.* The moths were attracted to light on the low island of Seymour in January and March.

*Distribution.* Presently known from the Island of Seymour Norte only, the species is presumed to be endemic to the Galápagos.

*Remarks.* The association of the sexes is possibly wrong because the only male was not collected at the same time as the three females. However, wing maculation is identical in all four specimens as far as could be discerned given that the male and the dissected females are somewhat descaled. The species is closely related to *G. protozona* and *G. gnathodoxa* as explained above in the Remarks for *G. protozona*.

### *Galagete turritella* sp. n.

Figs 4, 5, 17, 18, 24, 33

Holotype ♂ (dissected, BL 1315), Ecuador: Galápagos, Santiago, Bahía Espumilla, 4.iv.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 11 ♂, 7 ♀ from the Galápagos Islands, collected at MVL by B. Landry, unless specified otherwise. *Floreana*: 1 ♂ (dissected, BL 1132), Las Cuevas, 23.iv.1992; 1 ♀ (dissected, BL 1344), Punta Cormoran, 21.iv.1992. *Isabela*: 1 ♂ (dissected, BL 1314), 8.5 km N Puerto Villamil, 11.iii.1989; 2 ♂ (dissected, BL 1405, BL 1407), 1 ♀ (dissected, BL 1410), Alcedo, lado N[orte] E[ste], camp arida alta, 200 m, 14.iv.2002, u[ltra] v[iolet] l[ight] (B. Landry, L. Roque); 1 ♀ (dissected, BL 1383), Alcedo, lado N[orte] E[ste], low arid zone, bosq[ue] palo santo, 18.iv.2002, u[ltra] v[iolet] l[ight] (B. Landry, L. Roque); 2 ♀, Tagus Cove, 13.v.1992. *Santa Cruz*: 1 ♀, Tortuga Bay, 29.i.1989; 1 ♂, Charles Darwin Research Station, 3.ii.1989; 1 ♂ (dissected, BL 1399), Barranco, 10.xii.2001, u[ltra] v[iolet] l[ight] (L. Roque); 2 ♂ (one dissected, BL 1388), Charles Darwin Research Station, xii.1968, Lepidoptera # 84 (R. Perry, T.J. DeVries). *Santiago*: 1 ♂, 1 ♀ (dissected, BL 1342) with same data as holotype. *Seymour Norte*: 1 ♂ (dissected, BL 1283), 23.i.1989; 1 ♂, 29.iii.1992. (BMNH, CDRS, CNC, MHNG).



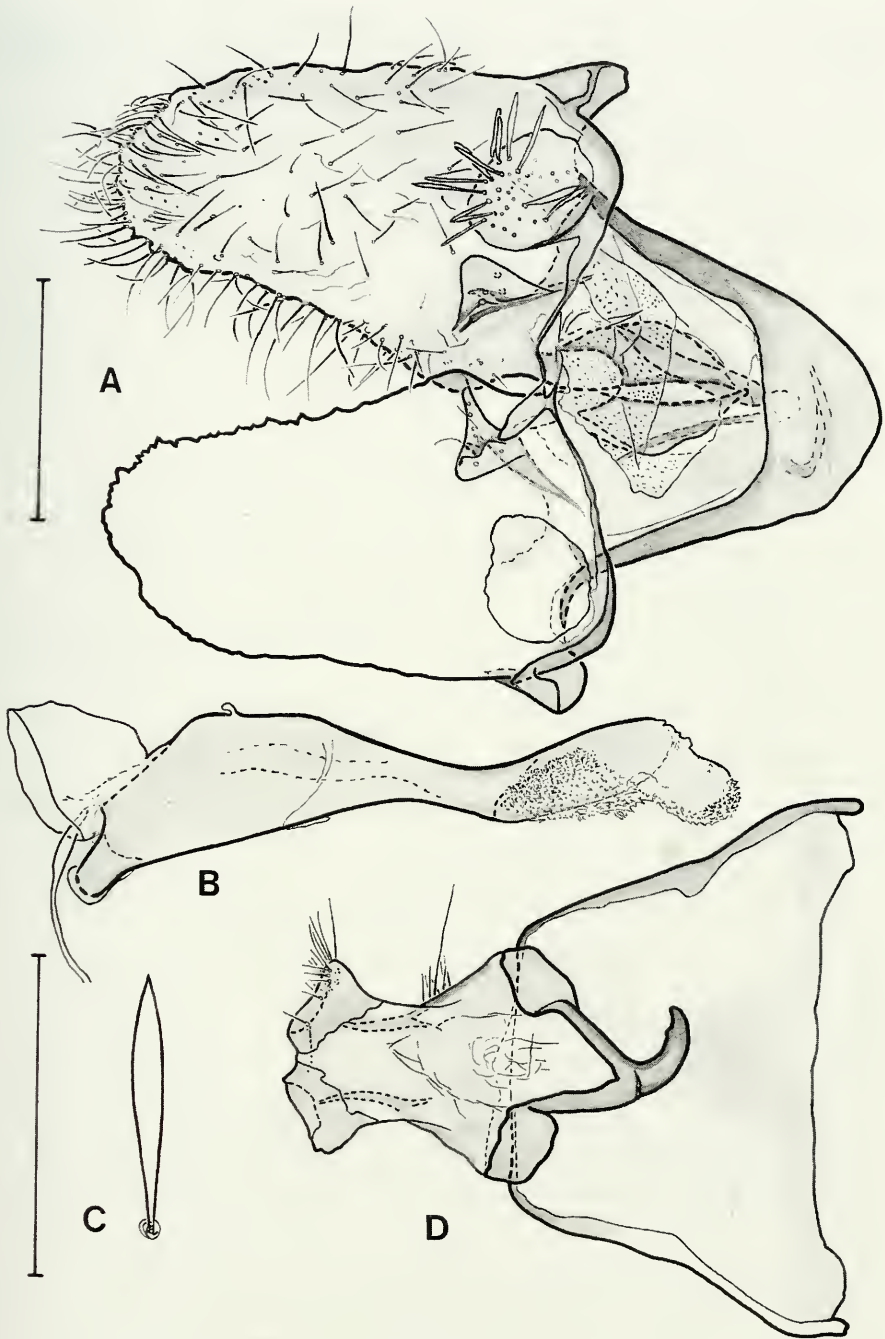


FIG. 23

Male genitalia of *Galagete seymourensis*. A. ventral parts (scale = 0.3 mm); B. Aedeagus; C. Scale of lateral lobe of transtilla (scale = 0.1 mm); D. Dorsal parts.

*Diagnosis.* The chestnut-brown forewing colour and pattern of dark-brown markings are unique in *Galagete* and Galápagos moths in general. The closest looking species are probably *G. pecki* (fig. 13) and *G. seymourensis* (fig. 3), but *G. turritella* (wingspan: 9.7-11.2 mm) is larger than *G. pecki*, for which I have not seen specimens larger than 8.7 mm, and the forewing ground colour of *G. pecki* is beige, rather than the chestnut brown in *G. turritella*. On the other hand, *G. seymourensis* is larger (wingspan between 13.0 and 14.0 mm) than *G. turritella*, and its forewing ground colour appears grey.

*Description.* Head longer occipital and vertexal scales chestnut brown (sometimes vertexal scales dark brown), shorter appressed scales underneath and on frontoclypeus greyish brown, paler on frontoclypeus, also sometimes with whitish-beige or pale chestnut-brown scales along sides of frontoclypeus, and dark-brown periorbital scales posteriorly, posterodorsally, and anteriorly (or anteroventrally). Maxillary palpus whitish beige. Haustellum whitish beige, sometimes with greyish brown at base. First segment of labial palpus laterally brown, medially whitish beige; second segment laterally brown on basal 1/3, beige in middle and apically, and greyish brown subapically, medially mostly beige with greyish brown subapically and sometimes with brown along ventral edge; third segment mostly dark brown with beige patch at 1/3, sometimes also at 2/3 and apex, or more extensive beige scaling along dorsal edge. Antennal scape dark brown with white or beige scales at apex ventrally and dorsolaterally and sometimes also as a streak at base or all along lateral edge; flagellum dark brown on first few segments, paler greyish brown subsequently. Thorax dorsally chestnut brown with dark brown along collar, basal 2/3 of tegulae, and tip of mesoscutellum, greyish beige on metascutellum, sometimes more extensively and uniformly dark brown. Foreleg coxa dark brown with paler whitish beige scales basally; femur dark brown with a few white scales apicoventrally; tibia dark brown with a few white or beige scales postmedially (usually) and apically; tarsus dark brown with beige at apex of last and sometimes first tarsomeres. Midleg coxa whitish beige to pale greyish brown; femur whitish beige to greyish brown at base, darkening toward dark-brown apex; tibia greyish brown with beige postmedially (sometimes) and apically; tarsomeres dark brown with beige apices. Hindleg beige with a tinge of pale greyish brown and with darker brown (or greyish-brown) scales at apex of femur, base of tibia, and most of tarsomeres I and II except apices, and basal halves of tarsomeres III and IV. Male wingspan (n=11): 9.7-11.2 mm; female's (n=7): 9.2-11.7 mm. Forewing (figs 4, 5) chestnut brown with suffusion of brown-tipped scales; with dark-brown markings as a large triangle from costa to inner margin, linked by strong costal line to small submedian costal spot, with medium-sized submedian spot in cubital fold, with small spot along midline slightly beyond submedian spot of costal fold (the latter two sometimes joined), with large costal triangle at 2/3, with medium-sized spot along midline at 2/3, and sometimes with inner margin spot at 2/3 and series of small spots along margin in wing's distal 1/5; markings sometimes less contrasting due to more extensive greyish-brown scaling or more contrasted and forming 4 transverse bands at base, 1/3, 2/3, and apex; fringe greyish brown. Hindwing pale greyish brown; fringe pale greyish beige with base of scales purely beige. Male abdomen dorsally shining pale greyish white to darker greyish white on all of tergum I, basal 1/2-2/3 of tergum II, base of tergum III,

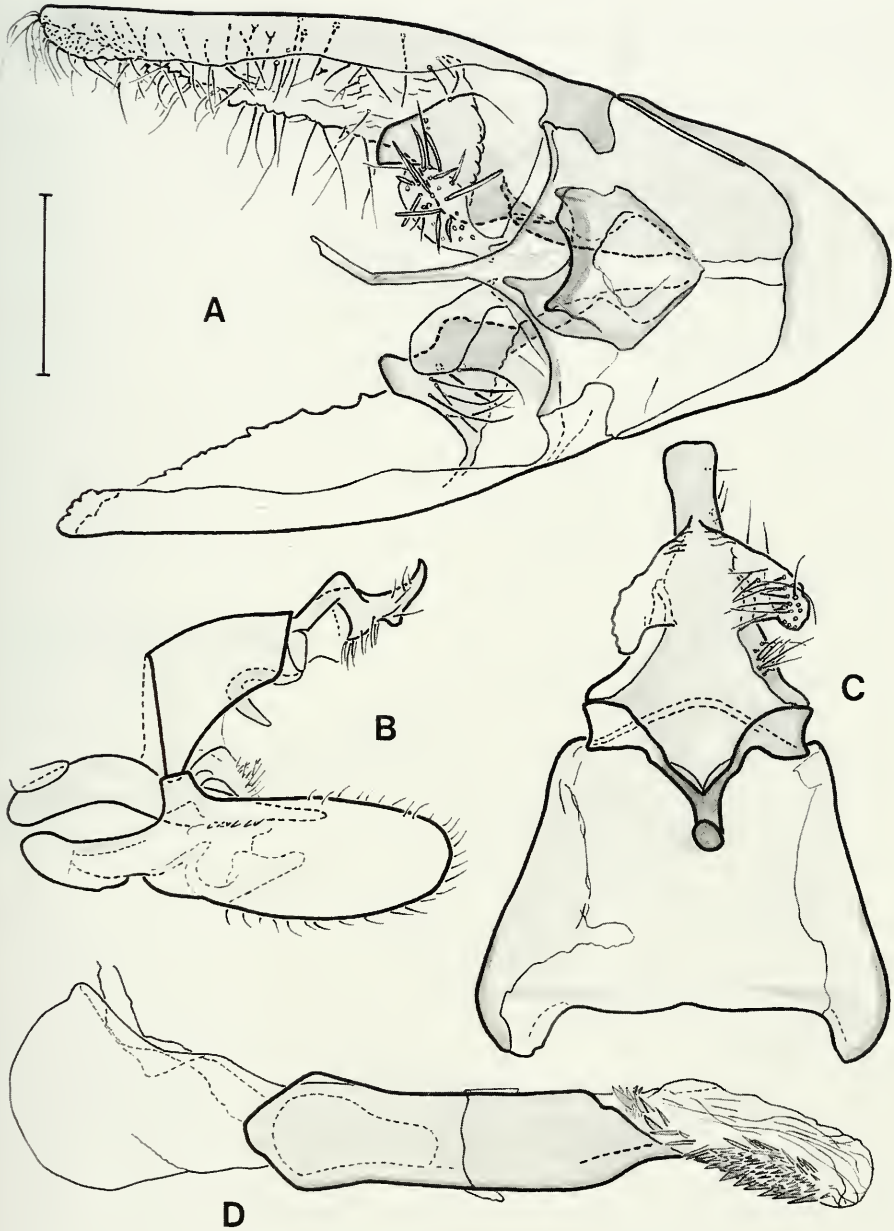


FIG. 24

Male genitalia of *Galagete turritella*. A. Ventral parts (scale = 0.2 mm); B. Whole genitalia in side view, not to scale with A, C, and D. C. Dorsal parts; D. Aedeagus in ventral view.

and as a single row at apex of terga II-VII; with thick modified (pointed) yellow scales as a band distally on tergum II, medially on tergum III, and on basal visible surface of terga IV-VII; female terga as for male except for absence of modified yellow scales on sternum VII; sterna uniformly beige in both sexes.

Male genitalia (n=7) (fig. 24). Basal half of uncus at right angle with second half; second half strongly projecting dorsally, projection variable in width, generally as long as lateral arms, with posterior margin straight, apex anteroposteriorly compressed with rounded, straight, or slightly concave apical margin; arms not laterally compressed, sub-triangular, rather long, apically narrower and rounded; crests narrowly rounded, well demarcated. Median hook of gnathos of medium girth, apically rounded and only slightly upturned. Lateral arms of transtilla short, longer than wide, evenly sclerotized, dorsally with numerous setae and only a few narrow scales near base, apically rounded; median arm narrow, slightly longer than lateral arms, gently pointed and slightly upturned apically. Valva rather elongate, dorsal margin gently angled ventrally from about 3/4, ventral margin with subbasal notch, subsequently broadly convex, broadly rounded apically; costa well melanized from base to about 2/3; sacculus medium sized, flattened, directed apicodorsally, with the apicodorsal margin projecting, narrow, and rounded, and the apicoventral margin projected slightly or not at all, supported by low basal ridge along ventral margin of valva. Juxta asymmetrical, with a small spinelike projection apically on right side, connected with narrow dorsal sclerotized ring around aedeagus. Vinculum medium sized, somewhat narrowly rounded apically, without dorsal projection medially. Aedeagus rather short and thick, slightly angled from before middle, with short lateral bumps at base and with short coecum penis unadorned with a crest; second half asymmetrical, bent slightly to the right, open ventrally and on the left side, dorsal wall depressed on left side from about 2/3, apically rounded; vesica with elongate patch of short to medium-sized cornuti on right side toward apex and ventrally, preceded by narrow line of cornuti ventrally and toward the left side, without spicules.

Female genitalia (n=4) (fig. 33). Papillae anales elongate (almost 2 X longer than largest (median) width in ventral view), in situ appearing completely compressed laterally and in lateral view appearing of medium width and gently tapering to narrowly rounded apex; dorsobasal margin less melanized medially and with longitudinal depression. Posterior apophyses straight, with slightly enlarged apices, 1.4 X length of papillae, reaching ostium. Free branches of anterior apophyses slightly divergent and sometimes curving inward toward apex; free and dorsal branches together 1.4 X length of posterior apophyses; ventral branches along basal margin of sternum forming heavily melanized band usually diffusing and emarginated medially. Apical margin of sternum VIII with lobes of medium length and broadly rounded to blunt; emargination very narrow and of medium depth, reaching about 2/5 distance between apices of lobes and margin of sternum. Apical margin of tergum VIII simple, slightly concave or convex. Ostium bursae in wide bowl-shaped depression adorned with narrow sclerotized ring at bottom of depression. Basal 1/3 of ductus bursae sclerotized, spiculate, and of moderate girth, subsequently reduced in girth but enlarging gently toward corpus. Inception of ductus seminalis at very base of ductus. Corpus bursae elongate, not well demarcated from ductus bursae, shortly protruding at



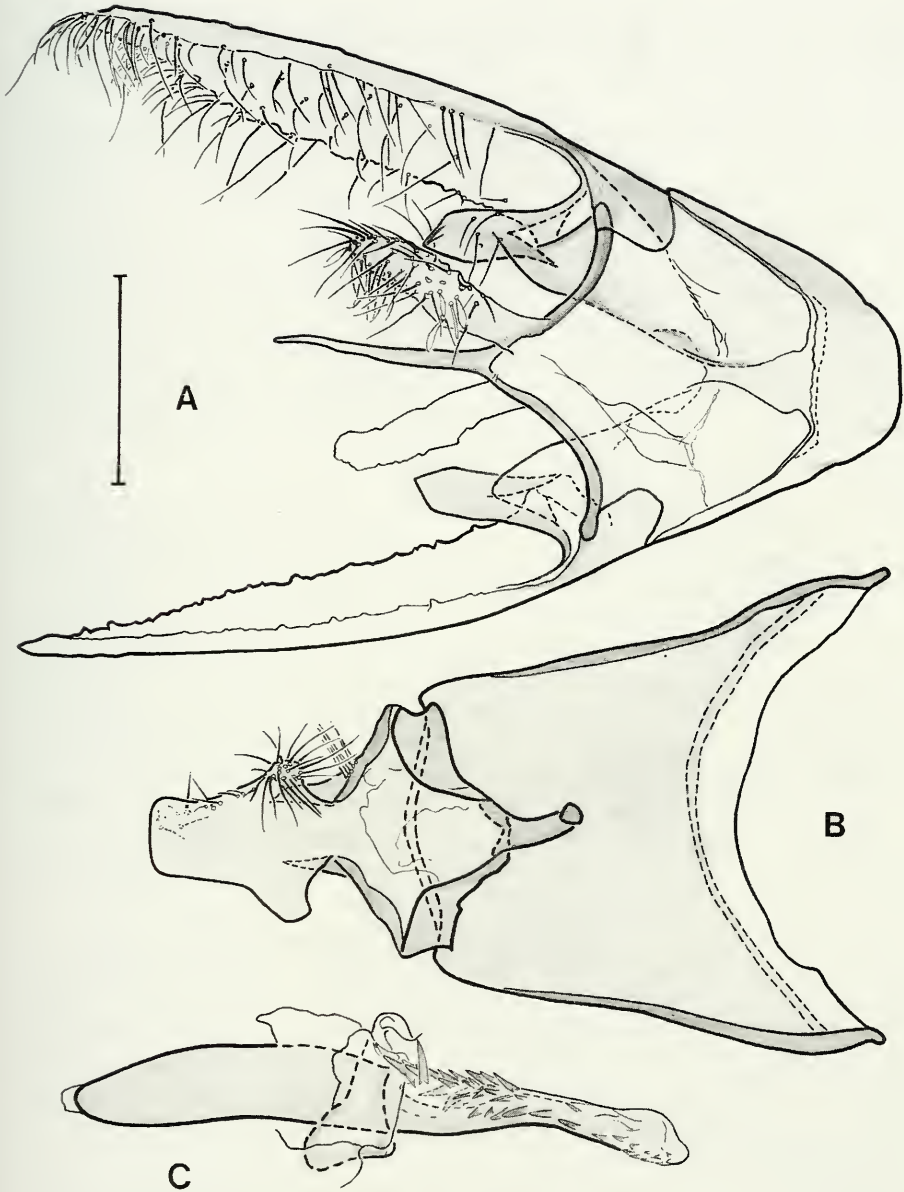


FIG. 25

Male genitalia of *Galagete espanolaensis*. A. Ventral parts (scale = 0.2 mm); B. Dorsal parts; C. Aedeagus and juxta (broken specimen missing ductus ejaculatorius complex).

signum, slightly bent to the right at apex; signum an elongate lozenge-shaped or cross-shaped plate with pair of short lateral spine-shaped ridges, situated above middle.

*Etymology.* From the Latin *turris*, tower, and *ella*, a diminutive. Refers to the shape of the uncus.

*Biology.* The moths were found at light during the first five months of the year and in December at sea level and up to 200 meters in elevation.

*Distribution.* This species was found on the islands of Floreana, Isabela, Santa Cruz, Santiago, and Seymour Norte.

*Remarks.* The male genitalia are somewhat variable in the width of the dorsal projection of the uncus. The cladistic analysis shows that *Galagete turritella* is most closely related to *G. espanolaensis* (decay index of 3). This is explained by three synapomorphies, viz. the dorsally projected uncus, the apically asymmetric aedeagus with the large spines on the vesica, and the asymmetric and modified juxta (7-1, 9-1, 13-1 on Table 1). The relationships of this pair of taxa with other *Galagete* species are unresolved.

### *Galagete espanolaensis* sp. n.

Figs 6, 25

Holotype ♂, Ecuador: Galápagos, Española, Bahía Manzanillo, 25.iv.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratype, Ecuador: 1 ♂ (dissected, BL 1284) with same data as holotype (BMNH).

*Diagnosis.* *Galagete espanolaensis* is a small dark species with a wingspan of 9.0 mm. It is quite similar in wing pattern to *G. darwini* (figs 7, 8), *G. consimilis* (fig. 9), and *G. turritella* (figs 4, 5). Compared to *G. turritella* it is generally smaller (specimens of *G. turritella* being usually 10.0 mm or greater in wingspan) and the forewing markings, especially the dark spots sub- and postmedially, are less distinct. The male genitalia offer the best diagnostic characters between *G. espanolaensis* and the other two species: in *G. espanolaensis* the uncus is produced upward distally (fig. 25), as in *turritella* (fig. 24), the aedeagus is adorned with spines, and the juxta is reduced in size and fused to a sclerotized ring around the aedeagus.

*Description.* Head's appressed scales of frontoclypeus and vertex mostly greyish brown, shining, with beige scales on lower part on frontoclypeus, and dark greyish-brown periorbital scales anteriorly; longer erect scales laterally on occiput beige with some dark brown at margin of eye posteriorly. Haustellum whitish beige. Maxillary palpus basally dark greyish brown, apically whitish beige. Segment I of labial palpus dark greyish brown and whitish beige; segment II mostly whitish beige medially, with dark greyish brown subapically, laterally mostly dark greyish brown with whitish beige at 2/3 and apically; segment III mostly dark greyish brown with beige apically and as incomplete rings at 1/2 and 3/4. Antennal scape dark brown dorsally with beige scales at apex, white along anterior margin, ventrally with a mixture of white and greyish brown; flagellum shining, mostly greyish brown with darker brown on basal flagellomeres. Thorax mostly a mixture of various brown shades, the scales darker tipped; darker brown at base of tegula; metascutellum shining pale greyish brown with white along margins. Foreleg coxa dark brown on most of apical half, whitish beige on basal half; femur dark brown with a few whitish beige scales apically; tibia dark brown with whitish beige apically and at base of epiphysis, longer

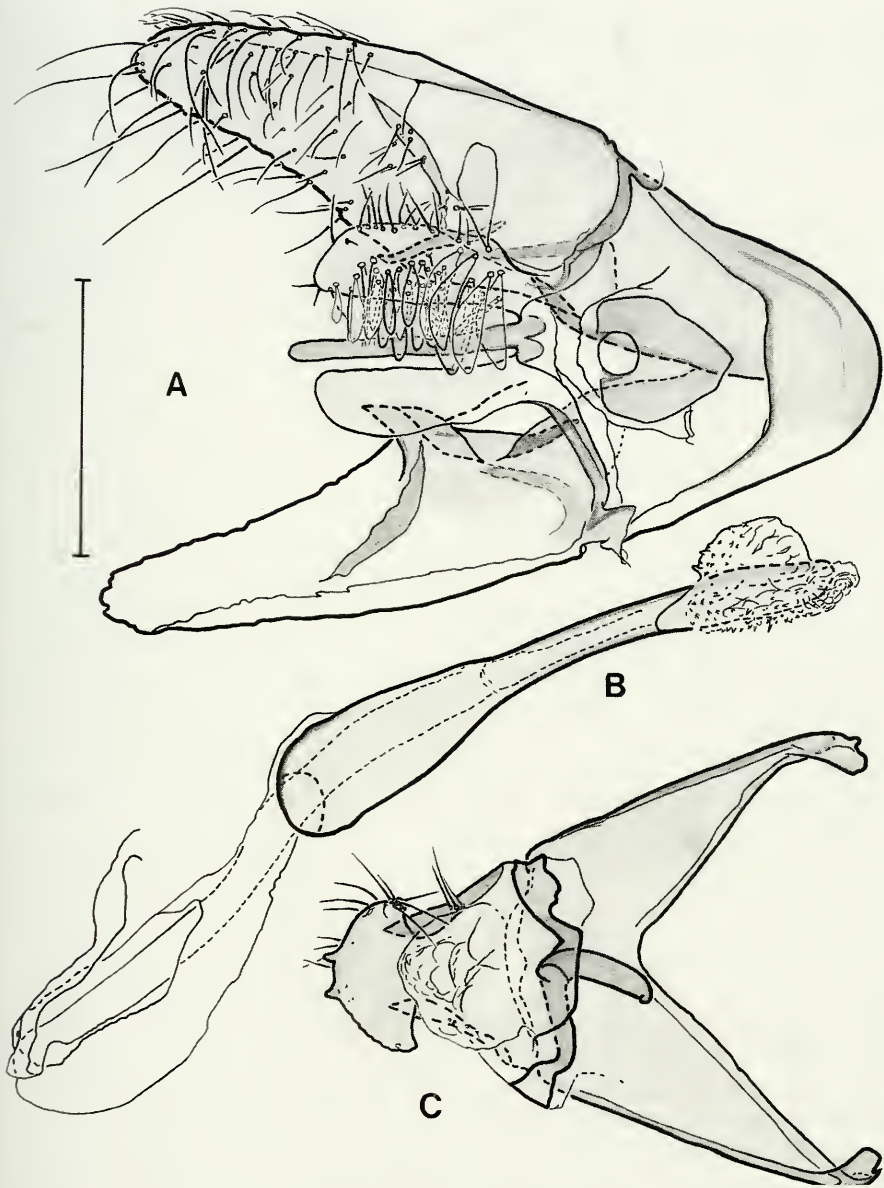


FIG. 26

Male genitalia of *Galagete darwini*. A. Ventral parts (scale = 0.2 mm); B. Aedeagus; C. Dorsal parts.

slender scales hiding epiphysis dark greyish brown and beige; tarsomeres dark brown with beige at apex of I, sometimes II, and V. Midleg coxa whitish beige; femur greyish brown with whitish beige medially and apically; tibia dark brown with large beige

spots at middle and apex, and with a few beige scales at base, tibial spines greyish brown and beige; tarsomeres mostly dark brown except for beige apices. Hindleg coxa whitish beige; femur pale greyish white, shining; tibia mostly (including fringe and spurs) whitish beige with greyish brown most apparent at base; tarsomeres dark brown on most of I, base of II and sometimes III, whitish beige elsewhere. Male wingspan (n=2): 9.0 mm. Forewing (fig. 6) a mixture of darker tipped dark-brown and chestnut-brown scales; darker brown markings as a rather large band basally, a narrow line along costa interrupted before middle, a medium-sized triangle on costa postmedially, a sub-apical costal spot followed by medium-sized line all around apex and connected to postmedian band slightly above inner margin (postmedian band not reaching postmedian costal spot), and a diffuse although rather large band across wing submedially; fringe greyish brown with paler yellowish brown at base of scales near anal angle. Hindwing pale greyish brown, slightly darker on distal half; fringe pale greyish brown with a yellowish tinge at base of scales, especially on longer scales of inner margin. Abdomen dorsally pale greyish brown with row of greyish-white scales at apex of each tergum, terga II-VII with band of short and thick, pointed, yellowish-beige scales apically; ventrally whitish beige; beige around genitalia.

Male genitalia (n=1) (fig. 25). Basal half of uncus at right angle with second half; latter half projecting dorsally at right angle, slightly longer than lateral arms, trough shaped, with apex rounded; arms not laterally compressed, medium sized, sub-triangular; crests broadly rounded, well demarcated. Median hook of gnathos of medium size, apically not compressed, very shortly pointed and upturned. Dorsal connection of tegumen very wide; pedunculi short and broad. Lateral arms of transtilla long and rather narrow, evenly sclerotized, median margin almost straight, lateral margin angled medially toward apex, dorsally without scales but abundantly setose apex rounded; median arm very narrow, about 1/4 longer than lateral arms, gently upturned, apically narrowly rounded. Valva rather long and narrow, dorsal margin trending ventrally at half right angle shortly before apex, ventral margin with only very slight concavity postbasally and trending dorsally from about 2/3, apex narrowly rounded; costa slightly more strongly melanized from base to about middle; sacculus rather narrow, medium sized, apically spoon shaped but pointed, pointing upward, with basal corners extended as crests for support, especially ventrally along ventral margin of valva to its base. Juxta small, hazelnut shaped, dorsoventrally compressed, fused to narrow ring surrounding aedeagus. Vinculum rather narrow, broadly rounded and slightly upturned apicomediaally. Aedeagus of medium length and girth, angled slightly from about 1/3, only slightly enlarged laterally subbasally, with medium-sized coecum penis adorned with short crest apically; last 2/3 asymmetrical, open dorsally and on left side from about half total length of aedeagus; exposed vesica adorned with some 40-50 strong spines of varying sizes mostly on first half of opening dorsally and along margin on left side ventrally, without spicules.

Female. Unknown.

*Etymology.* *Galagete espanolaensis* is named for the island where I collected it.

*Biology.* The moths came to light near the shore of Española, at the end of April.

*Distribution.* Currently known only from the Galápagos island of Española; presumed to be endemic to the archipelago and possibly to Española.



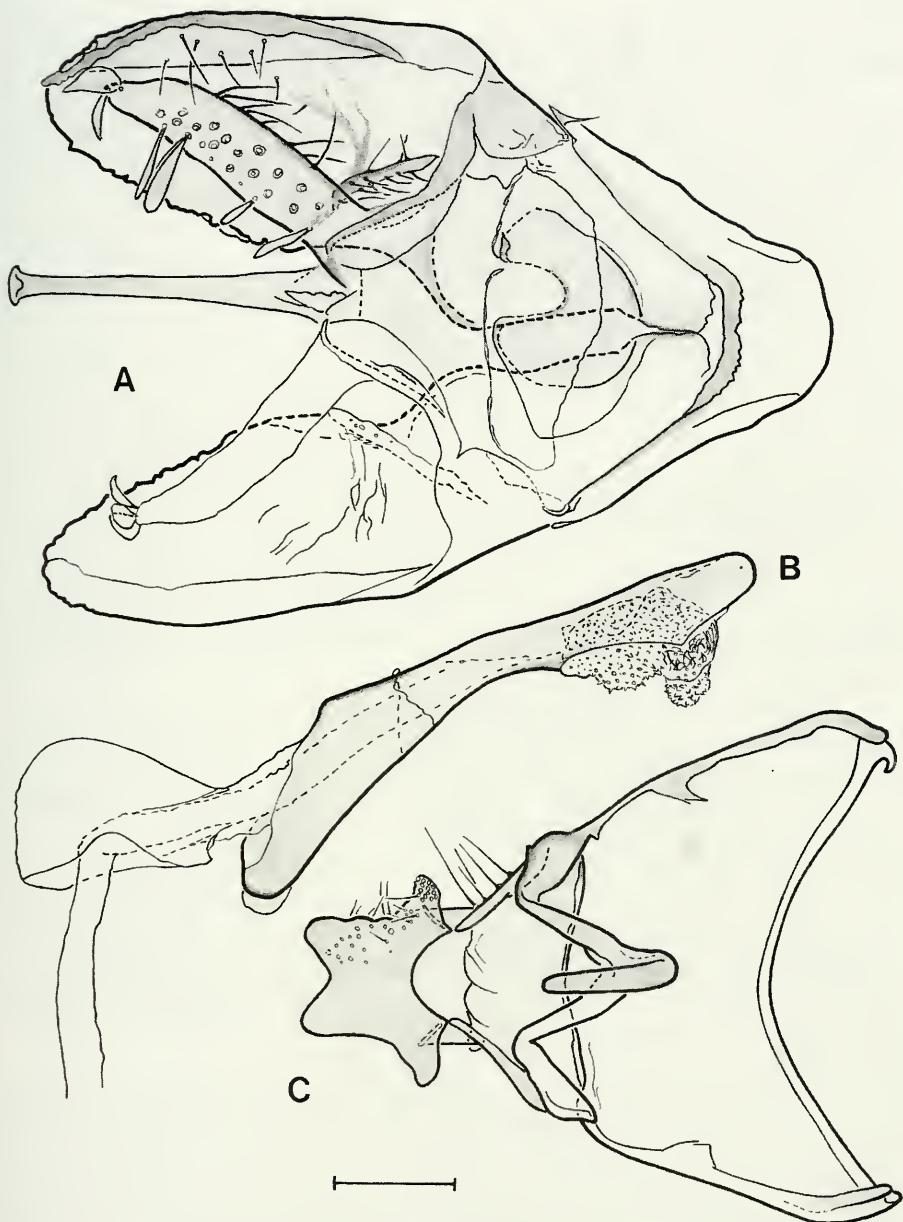


FIG. 27

Male genitalia of *Galagete consimilis*. A. Ventral parts; B. Aedeagus; C. Dorsal parts (scale = 0.1 mm).

*Remarks.* *Galagete espanolaensis* is most closely related to *G. turritella* as mentioned above in details under the Remarks for that species.

*Galagete darwini* sp. n.

Figs 7, 8, 26, 34

Holotype ♂ (genitalia dissected, BL 1338), Ecuador: Galápagos, S[an]ta Cruz, Tortuga Reserve, W S[an]ta Rosa, 6.ii.1989, M[ercury] V[apour] L[amp] (B. Landry) (CNC).

Paratypes, Ecuador: 48 ♂, from the Galápagos Islands, collected at MVL by B. Landry, except as indicated. *Española*: 1 ♂, Bahía Manzanillo, 29.iv.1992; 1 ♂ (dissected, BL 1289), Las Tunas Trail, 100 m elev., 30.iv.1992. *Floreana*: 1 ♂, Punta Cormoran, 21.iv.1992; 1 ♂ (dissected, BL 1287), Las Cuevas, 23.iv.1992. *Isabela*: 1 ♂, 2 km W Puerto Villamil, 5.iii.1989; 2 ♂, 8.5 km N P[uer]to Villamil, 11.iii.1989; 1 ♂ (dissected, BL 1332), Alcedo, lado Este, 700 m elev., 6.iv.1999 (L. Roque); 1 ♂, Alcedo, lado N[orte] E[ste], playa, night on bushes, 13.iv.2002 (B. Landry); 5 ♂, Alcedo, lado N[orte] E[ste], 700 m, camp guayabillos, 16.iv.2002, u[ltra] v[iolet] [light] (B. Landry, L. Roque); 1 ♂ (dissected, BL 1290), Volcan Darwin, 300 m elev., 15.v.1992; 1 ♂, Alcedo, Zona arida alta, Malaise trap, 13.x.1999 (L. Roque); 1 ♂, Alcedo, Los Guayabillos, sweep net, 15.x.1999 (L. Roque). *Pinzón*. 2 ♂ (one dissected, BL 1382), playa Escondida, 20.iv.2002, u[ltra] v[iolet] [light] (B. Landry, L. Roque). *Rabida*: 2 ♂ (one dissected, BL 1335), tourist trail, 3.iv.1992. *San Cristóbal*: 2 ♂ (one dissected, BL 1324), 2 km SW P[uer]to Baquerizo, 11.ii.1989; 1 ♂, 4 km SE P[uer]to Baquerizo, 12.ii.1989. *Santa Cruz*: 1 ♂ (dissected, BL 1325), Los Gemelos, 31.i.1989; 2 ♂, CDRS, 3.ii.1989; 1 ♂ (dissected, BL 1285), 2 km W Bella Vista, 27.ii.1989; 1 ♂, ECCD, El Barranco, 13.iii.2000, MVL trap (L. Roque); 1 ♂, CDRS, Barranco, 14.iii.2002, u[ltra] v[iolet] [light] (L. Roque); 3 ♂, CDRS, Barranco, 20 m elev., 30.iv.2002, u[ltra] v[iolet] [light] (B. Landry); 1 ♂ (dissected, BL 1394), CDRS, Barranco, 13.ix.2001, Malaise [trap] (L. Roque); 2 ♂ (dissected, BL 1402, BL 1406), Barranco, 11.xii.2001, Malaise [trap] (L. Roque); 2 ♂ (one dissected, BL 1392), Los Gemelos, xii.2001, u[ltra] v[iolet] [light] (L. Roque). *Seymour Norte*: 1 ♂, 23.i.1989; 2 ♂ (dissected, BL 1288 & 1330), 29.iii.1992. *Wolf*. 5 ♂ (2 dissected, BL 1395, BL 1396), Barrenador [borer] of *Scalesia baurii*, 7.ii.2002 (L. Roque, C. Causton); 1 ♂, Minador [miner] *Scalesia baurii*, 7.ii.2002 (L. Roque, C. Causton); 1 ♂, N 01 23.380' W 091 49.201', 7.ii.2002 (L. Roque, C. Causton). (BMNH, CDRS, CNC, MHNG).

*Diagnosis*. Based on external characters I am not able to separate *Galagete darwini* and *G. consimilis* with certainty, although the latter may be a slightly larger species. However, the male genitalia provide good diagnostic characters. Among others, the uncus apically is deeply notched in *G. consimilis* (fig. 27), whereas it has only a pair of short pointed bumps in *G. darwini* (fig. 26), the costa of the valva is strongly sclerotized all the way to its apex in *G. consimilis*, whereas it is only sclerotized basally in *G. darwini*, the median projection of the transtilla is enlarged apically in *G. consimilis*, whereas it is not in *G. darwini*, the paired projections of the transtilla are rather wide, sharply constricted subapically, and bear a scale apically in *G. consimilis*, whereas they are narrow, not sharply constricted subapically, and with a seta apically in *G. darwini*. The putative females are diagnosed in the treatment of *G. consimilis*.

*Description*. Head pale beige to greyish beige on frontoclypeus and greyish beige to pale orange brown laterally on occiput, otherwise dark greyish brown, or mostly greyish beige to pale orange brown (rarely yellowish orange) with dark-brown periorbital scales. Haustellum white. Maxillary palpus white with a few dark-brown scales at base usually. First segment of labial palpus white (or yellowish white) medially, dark brown laterally; second segment beige (or yellowish orange) medially with or without dark-brown patches at middle and apex on ventral side, laterally mostly brown with beige postmedially and apically, or mostly beige (or yellowish orange) with brown at base and apex; third segment mostly brown with beige (or yellowish orange) patches on dorsal edge at 1/3 and 2/3, or with dorsal edge all beige. Scape dark brown, usually with a few paler, beige, scales at apical margin mostly on lateral edge

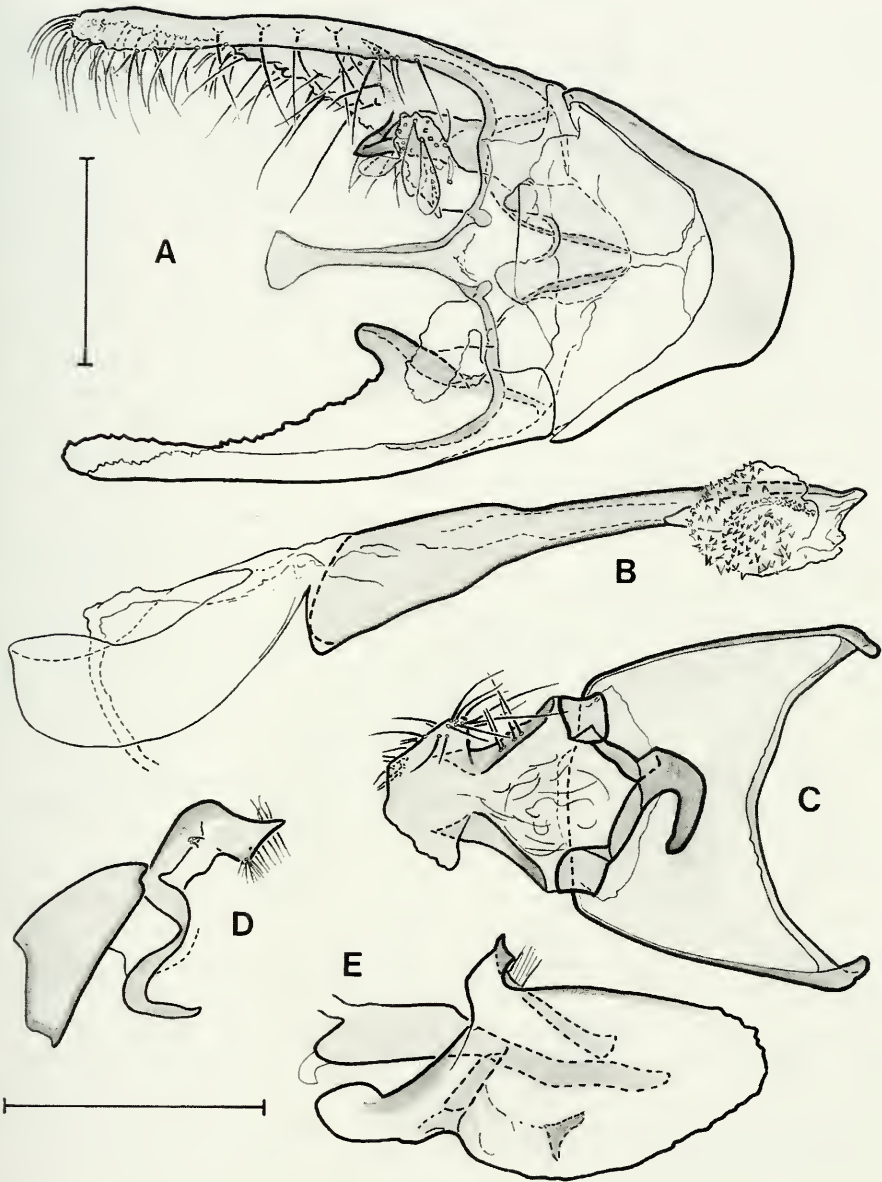


FIG. 28

Male genitalia of *Galagete levequei* (A-C) and *G. protozona* (D, E). A. Ventral parts (scale = 0.2 mm); B. Aedeagus; C. Dorsal parts; D-E. Lateral view of whole genitalia. (scale = 0.5 mm).

and ventrally; flagellomeres dark brown near base of flagellum, paler greyish brown beyond about 1/3. Thorax mostly dark brown to greyish brown with narrow line of beige (or yellowish orange) apically on tegula, or with more extensive beige or pale orange brown (or yellowish orange) in middle with dark brown on apex of meso-



scutellum; greyish white on metascutellum. Foreleg coxa whitish beige at base, greyish brown on second half; femur dark brown with a few white scales at apex; tibia dark brown with or without white to beige scaling postmedially and at apex; tarsomeres I-IV mostly dark brown except for beige apex of tarsomere I; last tarsomere beige. Midleg coxa beige; femur beige with greyish brown apex; tibia dark brown except for patches of white to beige medially and apically; tarsomeres I-IV dark brown except for beige apices; tarsomere V beige. Hindleg coxa beige; femur beige with greyish-brown apex; tibia pale greyish brown with beige dorsal crest; tarsomeres I-IV pale greyish brown with beige apices or mostly beige with pale greyish-brown base on tarsomeres II-IV; tarsomere V beige. Male wingspan (n=49): 7.0-8.5 mm; female's (n=16): 7.0-9.0 mm. Forewing (figs 7, 8) ground colour whitish beige to pale orange brown (rarely yellowish orange), with scattered darker brown scales; dark-brown to greyish-brown markings as a large basal triangle interrupted near middle by small paler spot, a medium-sized spot along costa at about 1/3 sometimes enclosing darker and smaller subcostal spot, a costal line between basal triangle and costal spot at 1/3, a small spot at 2/5 along midline, a dark medium-sized spot along cubital fold at about 1/3 sometimes connected to rather large but paler (usually greyish-brown) area along inner margin, a good-sized usually greyish-brown costal spot at 3/5 sometimes connected to small dark-brown spot below near middle, latter sometimes connected to inner margin by more brown scales, apical 1/5 mostly greyish brown, sometimes with scattered paler scales and sometimes with series of small spots terminally along apex and outer margin; fringe mostly greyish brown to greyish beige with the apex of some scales whitish. Hindwing pale greyish brown with pale greyish-beige fringe. Abdomen dorsally without modified scales, beige; ventrally whitish beige.

Male genitalia (n=18) (fig. 26). Basal half of uncus only slightly angled from second half; second half not produced dorsally, apex with a pair of short points more or less separated from each other; arms laterally compressed, sub-triangular, broad and short; dorsal crests broadly rounded, only slightly protruding. Median hook of gnathos of medium girth, only slightly upturned and pointed apically. Tegumen with dorsal connection of medium width; pedunculi rather narrow. Lateral arms of transtilla of medium width to narrow, evenly sclerotized, median margin straight, lateral margin broadly rounded, dorsal surface covered with short imbricating fan-shaped scales, apically rounded narrowly, neither upturned nor scaled; median arm very narrow for whole length, apically rounded narrowly, compressed dorsoventrally, and slightly upturned. Valva rather short and broad, dorsal margin angled ventrally at 2/3, ventral margin angled dorsally from 1/2 and with shallow postbasal concavity, rather narrowly rounded at apex; costa only slightly more strongly melanized from base to 1/2; sacculus a short, laterally compressed, truncated triangle projecting apicodorsally and toward middle, with an additional low ridge perpendicular to it from its middle posteriorly. Juxta, symmetrical, more or less heart shaped, with rounded notch of medium depth. Vinculum short and rounded, with a short bump dorsally on anteromedian margin. Aedeagus narrow, pistol shaped, slightly larger at base with very short coecum penis sometimes adorned with short crest medioventrally; apical 1/5 open ventrally, dorsal wall very slightly enlarged subapically, apically rounded and slightly bent to the right; vesica apically with many spicules, without cornuti.



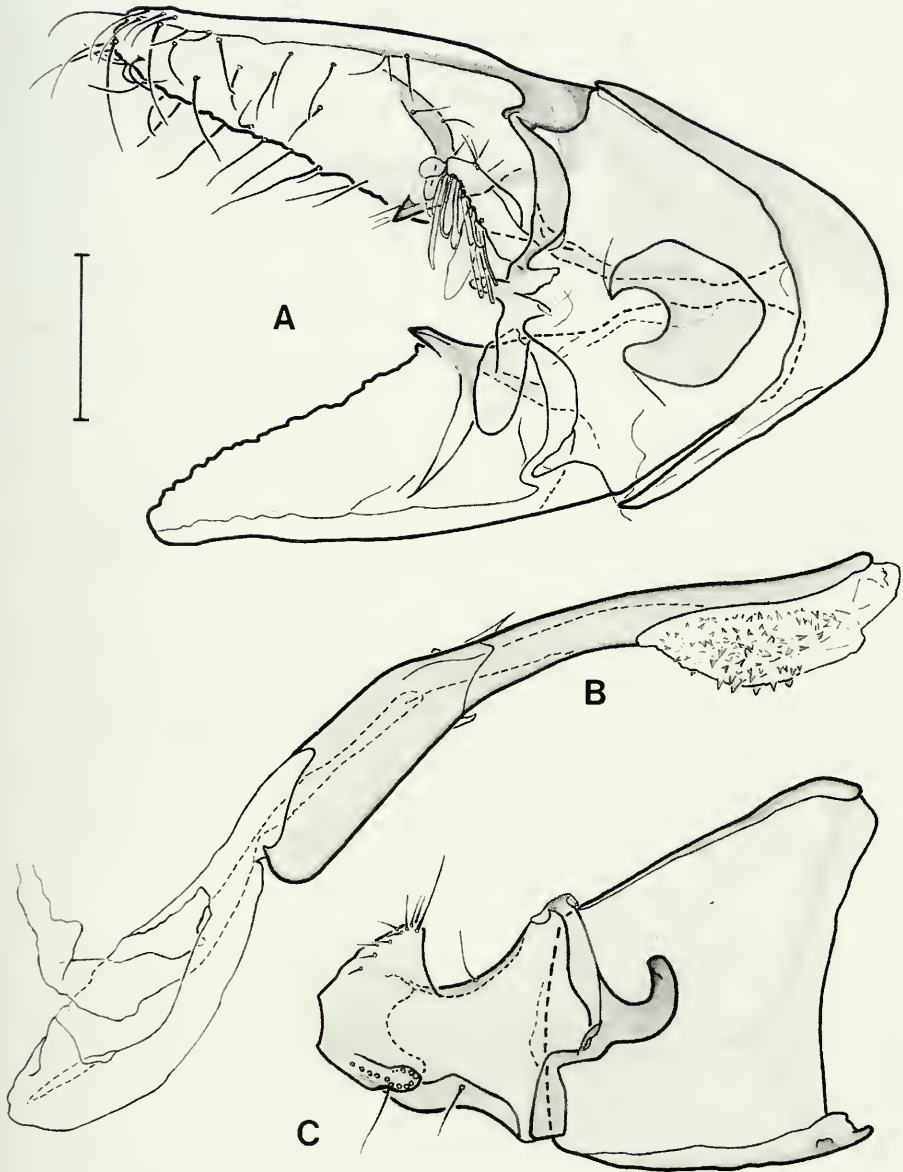


FIG. 29

Male genitalia of *Galagete cristobalensis*. A. Ventral parts (scale = 0.1 mm); B. Aedeagus; C. Dorsal parts (slightly slanted).

Female genitalia (n=16) (figs 34 A-C). Papillae anales rather elongate (about 2 X basal width in lateral view), in situ usually appearing sunken inward longitudinally along midline thus appearing larger at base and gently narrowing in lateral view, with apex narrowly rounded; dorsobasal margin with a distinctly melanized band forming a

distinct, narrowly rounded concavity in the middle. Posterior apophyses mostly straight, slightly enlarged and curved at apex, slightly longer than papillae, reaching ostium. Dorsal and free branches of anterior apophyses together slightly longer than posterior apophyses; free branches slightly angled outward and parallel sided from middle to apex; ventral branches forming narrow, heavily melanized, and broadly rounded distinct band at basal margin of sternum, but sometimes less distinct medially. Apical margin of tergum VIII simple, straight. Apical margin of sternum VIII with lobes broadly rounded; emargination rather shallow and more or less narrowly rounded, reaching about midway between apex of lobes and basal margin of sternum. Ostium bursae with rather narrow and short sclerotized ring. Ductus bursae about 1/2 width of sclerotized ring of ostium at base, subsequently enlarging gently toward corpus bursae. Inception of ductus seminalis dorsal, shortly after basal constriction of ductus bursae. Corpus bursae pear shaped, not very distinct from ductus bursae; surface covered with tiny slender spicules; signum an oval plate near anterior end of corpus bursae, with a pair of short spines at edge of narrower ends and sometimes with an additional pair of shorter spines between lateral spines and middle of plate.

*Etymology.* *Galagete darwini* is named in honour of the founders and staff of the Charles Darwin Foundation for the Galápagos Islands for their dedication and efforts toward conservation of the archipelagos' unique species and habitats.

*Biology.* *Galagete darwini* has been found from January to May and from September to December from sea level to 700 meters in elevation. On Wolf Island the larvae of this species are associated with the dead leaves and/or branches of *Scalesia baurii* Robins. & Greenm. They were eating at the surface of the branches among the dead leaves that are found below the green leaves on the same branches (L. Roque, pers. comm.). Hence, the larvae do not appear to be borers or miners, as mentioned on the labels. Exactly how to feed and what they eat remain to be found.

*Distribution.* *Galagete darwini* is found on Española, Floreana, Isabela, Pinzón, Rabida, San Cristóbal, Santa Cruz, Seymour Norte, and Wolf. If females are correctly associated the species is also found on Genovesa and Marchena.

*Remarks.* Because I am not able to separate *Galagete darwini* and *G. consimilis* with external characters, I was not able to associate their males and females with certainty. However, at the beginning of this study I believed that the three males and nine females collected on Genovesa were probably conspecific; the three males had the same genitalia and the two females I dissected were the same. Subsequently, I discovered that the series of specimens reared from Wolf Island and deposited at the CDRS were represented by a different pair of male and female genitalia type. Consequently, until a series of both sexes is reared from one single female or diagnostic characters common to both sexes are found, the association of the sexes in these two taxa is uncertain. For this reason I have excluded the females from their type series. However, for the purpose of describing them I associate the dissected females reared from Wolf Island (and the other specimens with the same genitalia) to *G. darwini* because there is only one form of genitalia for each sex in this series and the food of the larvae or the microhabitat may be specific. Also, because Wolf is small (1.344 km<sup>2</sup>) and isolated (43 minutes of latitude North of Pinta) from the larger islands of the archipelago, I believe that it is less likely to have both species than Genovesa, which

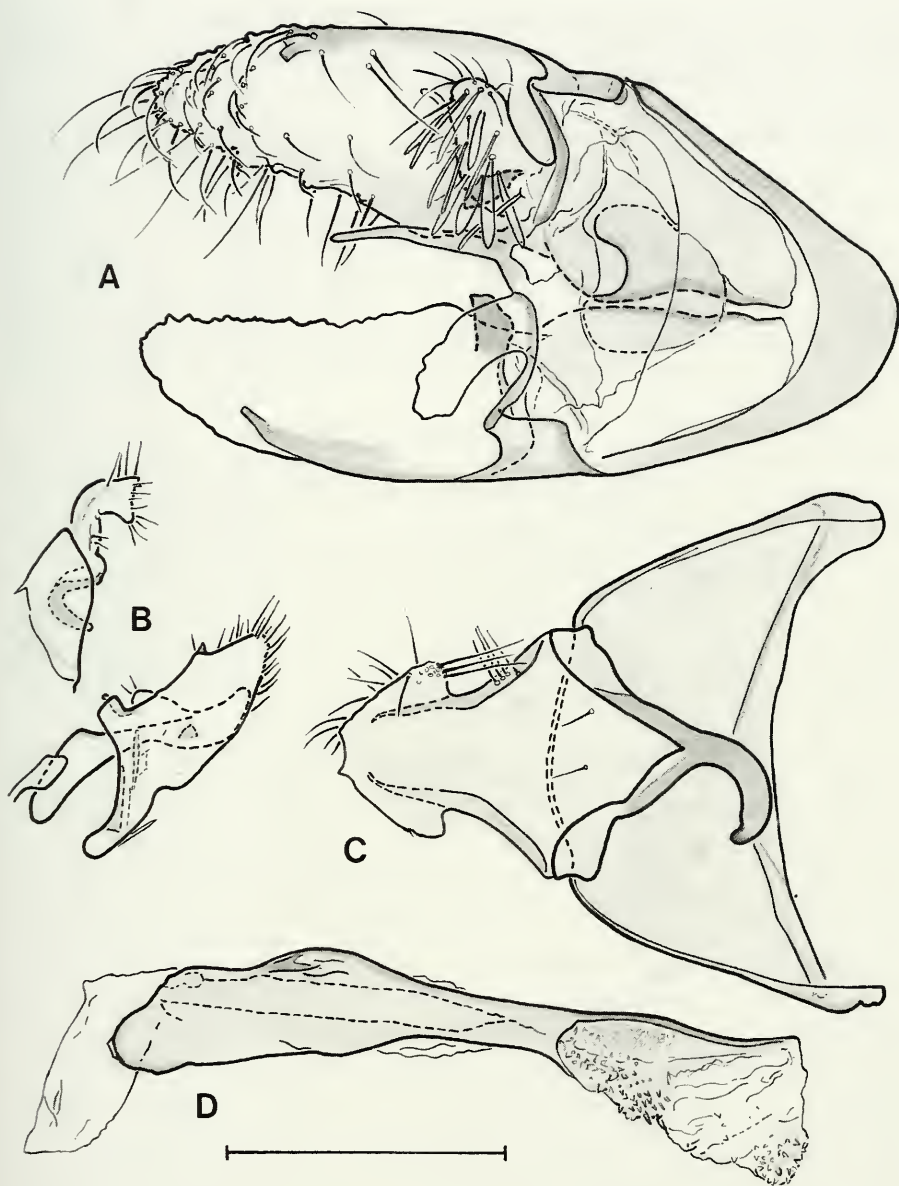


FIG. 30

Male genitalia of *Galagete pecki*. A. Ventral parts; B. Whole genitalia in side view; C. Dorsal parts; D. Aedeagus (scale = 0.2 mm).

is larger (14.10 km<sup>2</sup>) and closer to the centre of the archipelago. If females are correctly associated, the genital variation in *G. darwini* females is expressed in the shape of the lobes and emargination of sternum VIII, the shape of the apical margin of tergum VI-II, and the shape of the signum (more circular, cross shaped, or reduced to a small spot)

and the number of its spines, the submedian spines sometimes being paired (see fig. 34 A-C). The phylogenetic relationships of this species to the other *Galagete* species are mentioned in details below under the Remarks for *G. consimilis*.

*Galagete consimilis* sp. n.

Figs 9, 19, 27, 34, 35

Holotype ♂, Ecuador: Galápagos, Genovesa, Bahía Darwin, 26.iii.1992, M[ercury] V[apour] L[amp] (B. Landry) (genitalia dissected, BL 1164) (MHNG).

Paratypes, Ecuador: 8 ♂, from the Galápagos Islands, collected at MVL by B. Landry, except when specified otherwise. *Genovesa*. 2 ♂ (dissected, genitalia: BL 1164; wings: BL 1310), with same data as holotype. *Floreana*. 1 ♂ (dissected, BL 1400), arid zone, 130 msnm, S 01 17.053' W 090 28.295', 24.viii.1996, in black light trap (L. Roque). *Isabela*: 1 ♂ (dissected, BL 1291), Puerto Villamil, 2.iii.1989; 1 ♂, 2 km W Puerto Villamil, 5.iii.1989; 1 ♂, 11 km N Puerto Villamil, 13.iii.1989. *San Cristóbal*: 2 ♂ (dissected, BL 1286, 1327), pampa zone, 18.ii.1989. (BMNH, CDRS, CNC, MHNG).

*Diagnosis*. Based on external characters *Galagete consimilis* is impossible to distinguish from *G. darwini* with certainty. The male diagnostic characters are mentioned under the diagnosis for *G. consimilis*, and they can be seen usually by simply brushing off the scales surrounding the genitalia. If correctly associated the females of *G. consimilis* (figs 34, D-G, 35 A-C) differ from those of *G. darwini* (figs 34 A-C) by the signum being located closer to the middle of the bursa, by its larger lateral spines usually not accompanied by smaller spines or sometimes with only one smaller spine, by the somewhat wider sclerotized ring of the ostium bursae, and the papillae anales generally do not collapse apically when mounted on slide, which may mean that they are more heavily melanized than those of *G. darwini*.

*Description*. Head with a copper shine, mostly beige to pale greyish brown on vertex and frontoclypeus, darker brown on medial side of antenna and eye, with cluster of erect, fulvous-beige scales on each side of occiput, with dark-brown periorbital scales posteriorly. Haustellum varying from dark brown to pale beige, sometimes brown toward base and pale beige toward apex. Maxillary palpus beige basally, dark brown apically. Labial palpus usually cream coloured on dorsal edges of segments and brown to dark greyish brown elsewhere, sometimes with more extensive cream-coloured or beige scaling on median side of segment II. Antennal scape dark brown with a few cream-coloured or beige scales on ventroapical margin, sometimes with more extensive beige scaling ventrally and cream coloured apically on laterodorsal side; flagellum greyish brown with a copper tinge, paler toward apex. Thorax brown with dark brown at apex of mesoscutellum and at base, especially on tegula, sometimes more extensively dark brown, greyish white on metascutellum, sometimes with fulvous at apex of tegula. Foreleg coxa greyish brown with beige basally; femur dark brown with a few whitish-beige scales apically; tibia dark brown with small white to beige patch apically and usually also postmedially; tarsomere I dark brown with small white to beige spots at base and apex; tarsomeres II-IV dark brown; tarsomere V dark brown at base, beige apically. Midleg coxa beige; femur pale greyish brown or with beige scaling toward middle and greyish brown toward apex; tibia dark brown with more or less extensive beige patches at apex and postmedially; tarsomeres I-V dark brown with beige apically. Hindleg coxa and femur mostly beige, with greyish brown at apex of femur; tibia mostly greyish brown laterally with beige elsewhere; tarsomeres



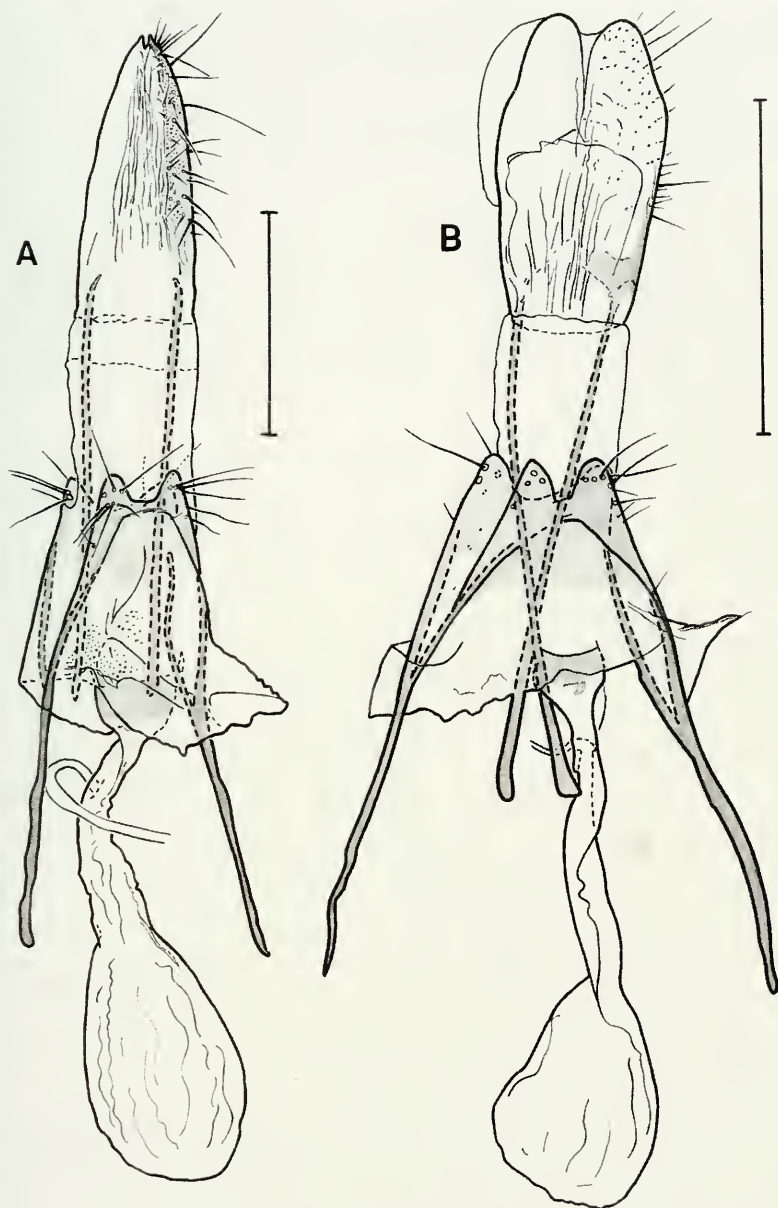


FIG. 31

Whole female genitalia. A. *Galagete protozona*; B. *Galagete gnathodoxa* (scales = 0.5 mm).

I-V greyish brown and beige, greyish brown on most of tarsomere I except apex, sometimes also on basal half of tarsomeres II and III, and very base of tarsomere IV. Male wingspan (n=8): 8.5-9.0 mm; female's (n=7): 8.5-10.0 mm. Forewing (fig. 9) dark brown to greyish brown with more or less distinct chestnut-coloured and darker brown

markings: darker brown as single spots variable in size subbasally below costa, submedially in middle of wing, below and before submedian spot, postmedially and below middle, sometimes above postmedian spot and along apex, and as a series of 3-4 small spots along outer margin; chestnut-coloured as a short streak subbasally along subcosta, as a longer streak interrupted by dark-brown spot along cubital fold, medially as irregular spots mostly on costa and inner margin, postmedially in an oblique and more or less interrupted line or series of small spots from about 4/5 costa to end of anal vein, as a series of small spots subapically along outer and apical margins, and apically as small spots between dark-brown spots; fringe greyish brown at apex and along most of outer margin, pale greyish white on inner margin and base of outer margin. Hindwing pale greyish white; fringe greyish white along costa, paler greyish white along outer margin, cream coloured in anal sector. Abdomen mostly greyish white, dorsally with paler fan-shaped scales at apex of segments and with beige pointed scales most easily distinguished on terga IV-VII.

Male genitalia (n=6) (fig. 27). Basal half of uncus only slightly angled from second; second half not produced dorsally, apex with a more or less deep, rounded notch, the two lateral extensions slightly upturned; arms tubular, narrow, and rather long; dorsal crests more or less broadly rounded, well demarcated. Median hook of gnathos of medium girth, only slightly upturned and pointed apically. Tegumen with dorsal connection of medium width; pedunculi broad. Lateral arms of transtilla elongate, of medium width, evenly sclerotized, median margin slightly concave, lateral margin slightly convex postmedially and curved inward at half right angle at about 4/5, dorsal surface covered with short imbricating fan-shaped scales, apically more or less pointed, shortly upturned, and typically with one scale at apex; median arm narrow, apically enlarged, rounded, dorsoventrally compressed, and slightly upturned. Valva rather short, rather broadly rounded at apex, dorsal margin gently trending ventrally at about 4/5, ventral margin with a postbasal rounded concavity, angled dorsally from about 1/2; costa strongly melanized from base to short, rounded, subapical projection; sacculus a rather large, truncated, laterally compressed triangle, projecting medially, without additional posterior ridge. Juxta symmetrical, almost circular, with deep circular notch. Vinculum short and rounded, without bump dorsomedially. Aedeagus narrow, slightly arched, slightly larger at base with short coecum penis adorned with short medioventral crest; apical 1/3 ventrally open, dorsal wall slightly enlarged subapically, apically rounded and slightly bent to the right; vesica apically with a large number of very short spicules, without cornuti.

Female genitalia (n=7) (figs 34 D-G, 35 A-C). Papillae anales elongate (3 X longer than basal width), not examined in situ; dorsobasal margin well melanized, sometimes forming a strongly melanized band and broadly rounded or only slightly emarginated near middle. Posterior apophyses straight or broadly curved, as long as papillae anales or slightly shorter, usually reaching just beyond sclerotized ring of ostium bursae. Free branch of anterior apophyses straight or somewhat curved; dorsal and free branches together about as long as papillae anales; ventral branches usually diffusing (enlarging and become less heavily melanized) toward middle of sternum, not forming melanized and narrow margin medially. Apical margin of sternum VIII with lobes somewhat asymmetrical, with lateral margins more broadly rounded than

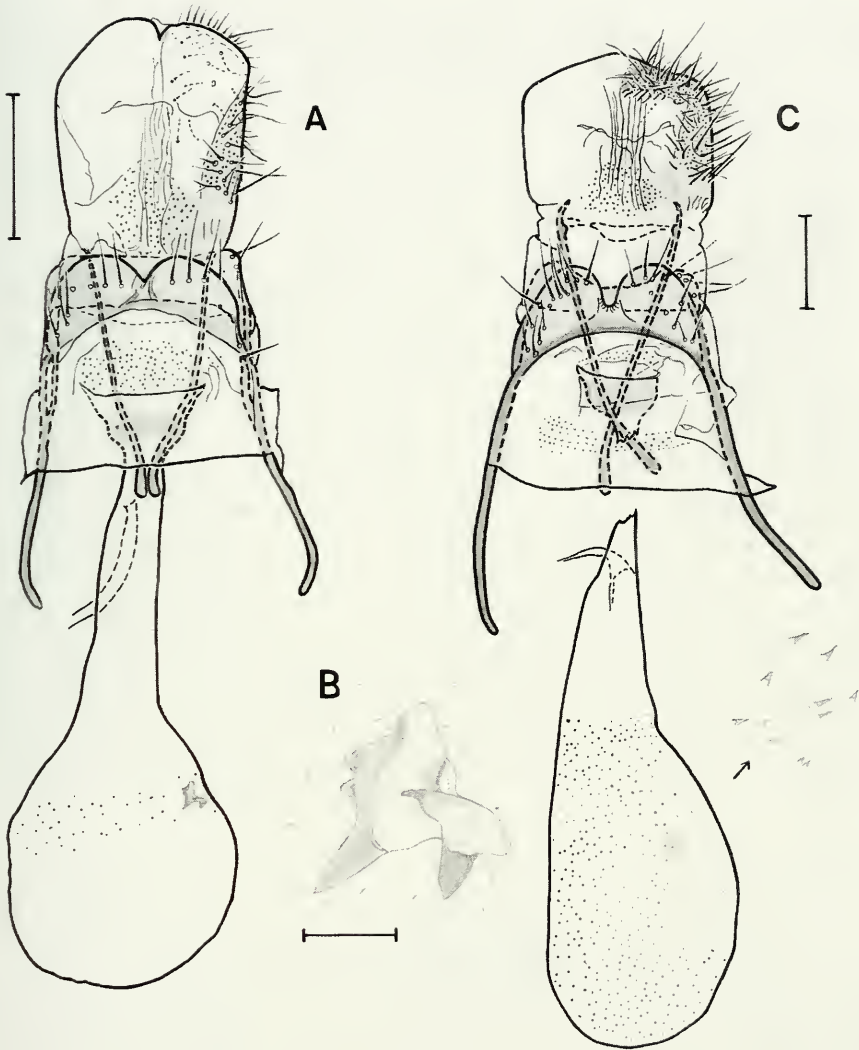


FIG. 32

Female genitalia. A, B. *Galagete pecki*: A. Whole genitalia (scale bar = 0.2 mm); B. Enlarged signum (scale = 0.02 mm). C. *Galagete seymourensis*, with broken ductus bursae and spicules enlarged to the right (scale = 0.2 mm).

median margins; emargination V-shaped or U-shaped, variable in width, slightly shorter than distance between apex of lobes and base of sternum. Apical margin of tergum VIII simple, slightly concave to slightly convex. Ostium bursae rather wide and strongly melanized along rim. Ductus bursae slightly constricted at base, subsequently expanding gently toward corpus bursae, without significant demarcation between ductus and corpus. Inception of ductus seminalis in constricted base of ductus bursae. Corpus bursae elongate, slightly enlarged to the right (signum side) and apically curved

to the right, spiculate; signum a small, circular to elongate plate set closer to middle than anterior end of corpus bursae, with a pair of large spines laterally and sometimes one or two additional spines on one or both sides.

*Etymology.* From Latin, refers to the similarity between *Galagete consimilis* and *G. darwini*.

*Biology.* Based on males only, *G. consimilis* was collected in February, March, and August from the lowest to the highest elevations. If the females are correctly associated the species was collected also in January, April, and May.

*Distribution.* Based only on males *G. consimilis* is known from Genovesa, Floreana, Isabela, and San Cristóbal. However, if the females are correctly associated, the species is found also on Fernandina, Santa Cruz, and Santiago.

*Remarks.* Because I cannot associate the sexes of *G. darwini* and *G. consimilis* with confidence, I have included only males in the type series. Nevertheless, for the purpose of describing them a male-female association is proposed on the basis of the reared series from Wolf Island, one of the remotest of the archipelago (see above under Remarks for *G. darwini*). Variation in the female genitalia is found in the shape of sternum VIII's apical margin and that of the signum (see figs 34 D-G, 35 A-C). *Galagete consimilis* is most closely related to *G. cinerea* as revealed by the cladistic analysis (decay index of 1). These two species form a clade with *G. darwini* (decay index of 1) on the basis of an exclusive apomorphic character state, viz. the long and narrow lateral arms of the transtilla (character 12, state 2 on Table 1). This interpretation of the phylogeny implies that character state 11-1 (the enlarged apex of the transtilla's median arm) and character state 14-1 (the presence of a process on the valva's costa) have appeared more than once in the evolution of *Galagete* species. The relationships of this clade of three species with other species of *Galagete* are unresolved.

### *Galagete cinerea* sp. n.

Figs 14, 35, 37

Holotype ♀ (dissected, BL 1307), Ecuador: Galápagos, Isabela, V[olcan] Darwin, 300 m elev., 15.v.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 2 ♂, 5 ♀ from Isabela. 1 ♀ with same collecting method and collector as holotype; 11 km N Puerto Villamil, 9.iii.1989; 1 ♂, 2 ♀ (both dissected, BL 1401, BL 1404), V[olcan] Alcedo, Los Guayabillos, Malaise [trap], 15.x.1999 (L. Roque); 1 ♂ (dissected, BL 1389), 1 ♀ (dissected, BL 1390), Volcán Darwin, 900 msnm, 5.iii.2000, Malayse [sic] Trap, LR # 2000-011 (L. Roque); 1 ♀ (dissected, BL 1408), Alcedo, lado N[orte] E[ste], plaja, night on bushes, 13.iv.2002 (B. Landry). (BMNH, CDRS, CNC, MHNG).

*Diagnosis.* *Galagete cinerea* is a relatively small grey species with poorly contrasting darker markings. It could be confused only with *G. seymourensis* (fig. 3), which is also mostly grey, but *G. seymourensis* has more contrasting markings, is slightly larger (wingspan between 13.0 and 14.0 mm), and has wider forewings. In the female genitalia, *G. cinerea* has a signum on the bursa (fig. 35 D-F), whereas *G. seymourensis* (fig. 32 C) does not. In the male genitalia, *G. cinerea* has the costa of the valva strongly melanized with a projection and a long transtilla (fig. 37) whereas *G. seymourensis* (fig. 23) has no process or stronger melanization on the costa of the valva and the transtilla is short.



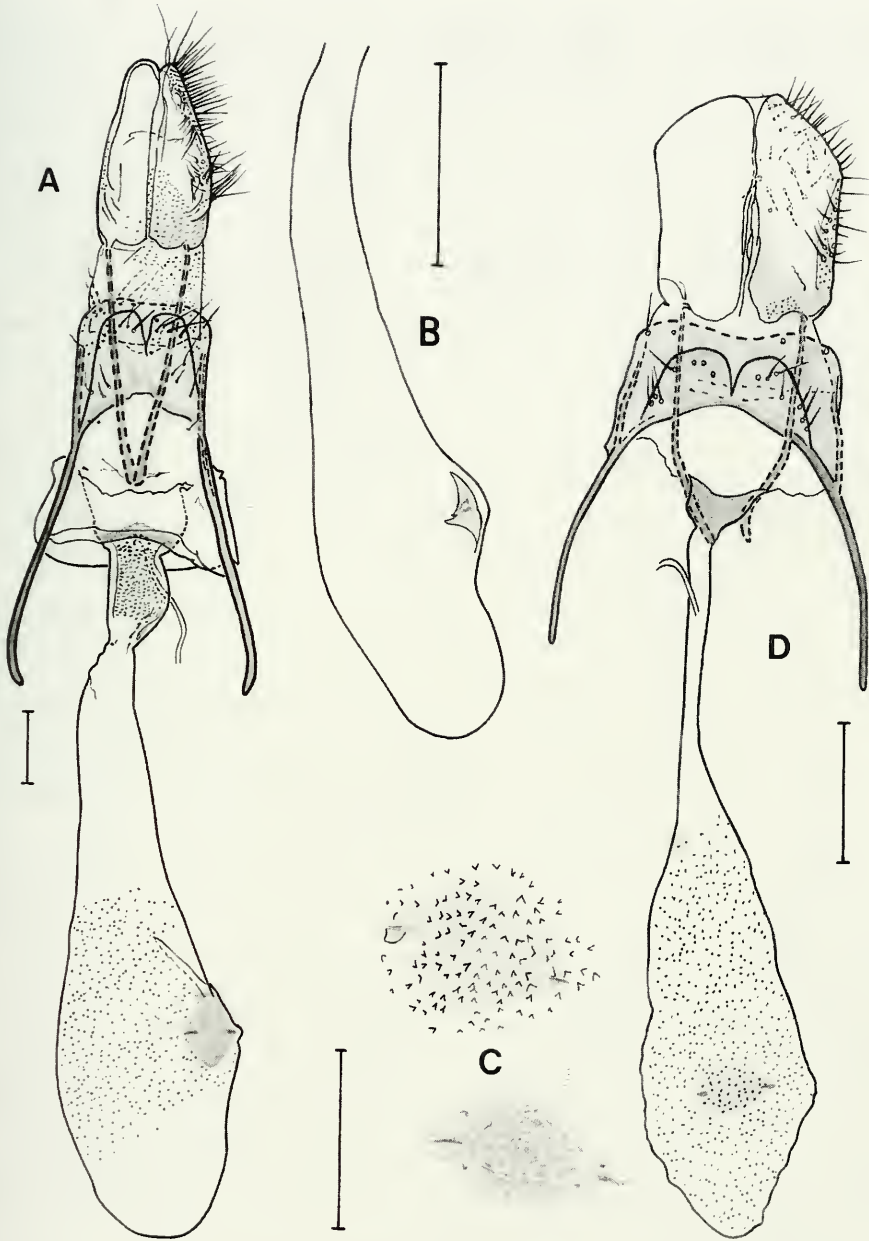


FIG. 33

Female genitalia. A, B. *Galagete turritella*: A. Whole genitalia (scale = 0.2 mm); B. Unflattened corpus bursae (scale = 0.5 mm). C, D. *Galagete cristobalensis*: C. Signum and spiculate membrane above and structure of signum below (scale = 0.1 mm); D. Whole genitalia (scale = 0.2 mm).

*Description.* Head shining pale greyish beige with few darker, brown scales at anterior and posterior margins of eye. Maxillary palpus and haustellum whitish beige. Labial palpus mostly beige, with a few greyish-brown scales laterally on first segment. Antennal scape pale greyish brown with beige scales apically; flagellum greyish brown, darker on basal 1/3. Thorax shining greyish brown, with darker brown scaling at base of tegula. Foreleg coxa greyish brown except for beige apex; femur darker greyish brown with a few whitish-beige scales at apex; tibia uniformly brown; tarsomeres I-III mostly greyish brown, darker on tarsomere I, with a single row of whitish-beige scales apically, tarsomeres IV and V beige. Midleg coxa beige; femur beige at base, greyish brown and darkening toward apex; tibia pale greyish brown with a few beige scales apically; tarsomere I pale greyish brown with beige at apex; tarsomeres II-V beige. Hindleg beige, with a slight pale greyish-brown tinge on tibia. Male wingspan (n=2): 8.5-10.0 mm; female's (n=6): 10.0-11.2 mm. Forewing (fig. 14) shining pale greyish brown, with slightly darker brown markings as a wide but short band at base on costa, a rather large spot submedially in middle and in cubital fold, and another medium-sized spot postmedially, also with greyish-brown scaling paler than markings (but darker than ground colour) on costa above spots, in apical sector, and on inner margin below postmedian spot; fringe pale greyish brown. Hindwing greyish white with whitish-beige fringe. Abdomen whitish grey, without modified scales.

Male genitalia (n=1) (fig. 37). Basal half of uncus at half right angle from second half; second half only slightly produced dorsally, apex only slightly concave; arms laterally compressed on basal half, apical half narrow with rounded apex; dorsal crests narrowly rounded, slightly protruding. Median hook of gnathos narrow, apically rounded, and slightly upturned. Dorsal connection of tegumen shorter than half length of pedunculi; pedunculi narrow. Lateral arms of transtilla long, narrow, laterally expanded at middle, evenly sclerotized, dorsally with fan-shaped scales, lateral edge rounded and setose, apically narrowing, apex pointed with one curved narrow scale; median arm as long as lateral arms, narrow, apex dorsoventrally compressed, upturned, enlarged, and rounded. Valva somewhat elongate and narrow, dorsal margin straight, ventral margin with short, basal, rounded projection followed by shallow rounded emargination, apex narrowly rounded; costa strongly melanized, apically with a short, rounded and flattened projection directed mediodorsally; sacculus short, flattened, strongly melanized, projecting mediodorsally, more or less rectangular with short narrow projection at dorsoapical corner. Juxta symmetrical, somewhat heart shaped, with shallow and broadly rounded median notch. Vinculum short and rounded, only slightly upturned. Aedeagus broadly down curved, with narrow basal half followed by narrower third quarter, distal quarter melanized only dorsally, laterally expanded, oval shaped, and curved to the right; coecum penis well demarcated; vesica without cornuti, with spinules of various sizes.

Female genitalia (n=5) (fig. 35). Papillae anales only slightly longer than wide in ventral view; not examined in situ; dorsobasal margin slightly melanized in middle. Posterior apophyses slightly curved inward, about equal in length to papillae anales, reaching slightly beyond sclerotized ring of ostium bursae. Free branch of anterior apophyses with or without slight inward curve; dorsal and free branches together slightly longer than posterior apophyses; ventral branches forming broadly convex and

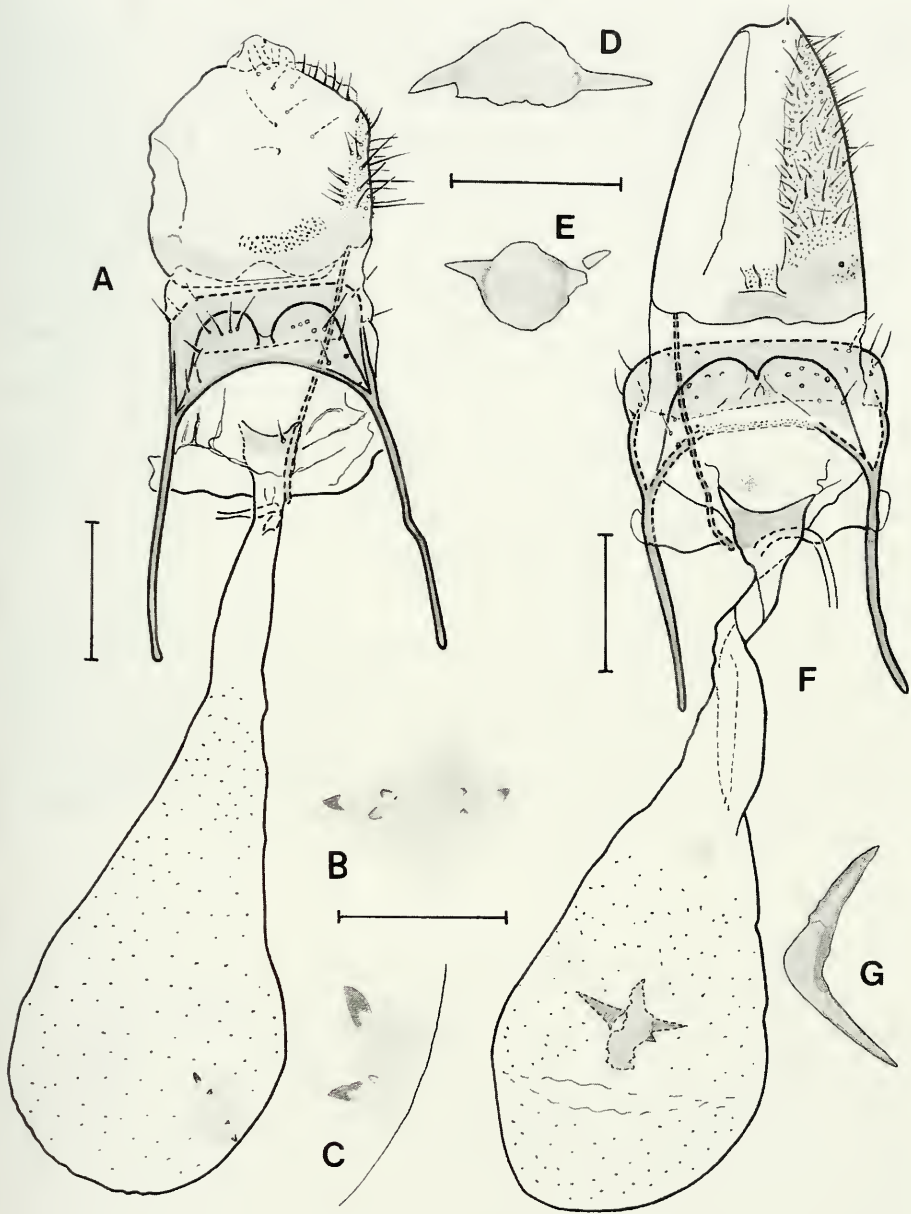


FIG. 34

Female genitalia. A-C. *Galagete darwini*: A. Whole genitalia without left posterior apophysis (scale = 0.2 mm); B, C. Signa of different specimens (scale = 0.1 mm). D-G. *Galagete consimilis*: D, E, G. Signa of separate specimens (scale = 0.1 mm); F. Whole genitalia without right posterior apophysis (scale = 0.2 mm).

rather wide melanized band medially along basal margin of sternum. Apical margin of sternum VIII with lobes rather short, broadly rounded (almost bluntly terminated); emargination rounded and short, reaching about 2/5 distance between apex of lobes and margin of sternum. Apical margin of tergum VIII with a slight, broad emargination medially. Ostium bursae in bowl-shaped depression with about 2 X wider than long sclerotized ring. Ductus bursae with slight basal constriction, subsequently enlarged to about 4/5 width of ostium's sclerotized ring and equal in girth for entire length, or enlarging from basal constriction. Inception of ductus seminalis at about 1/3 length of ductus bursae. Corpus bursae simply circular, about as long as ductus bursae and more or less clearly demarcated from it, depending on the specimens; signum more or less crescent shaped to potato shaped, with rather large and acute lateral spines and smaller additional spines pointing inward; with very little scobination near signum.

*Etyymology.* From the Latin *cinereus*, grey, referring to the colour of the forewing.

*Biology.* The moths were mostly collected at light from sea level to 900 meters in elevation in March, April, May, and October. One female was collected at night on the leaves of a bush after a rainfall. Individuals of other moths were also collected at that time, as if they were exposing themselves to dry.

*Distribution.* Found only on the island of Isabela, *Galagete cinerea* is believed to be endemic to the Galápagos.

*Remarks.* The holotype is a female because only two females were available for study when the description was first written. Additional material of both sexes became available after the manuscript had been submitted and it was incorporated here in the type series and description except for three females collected on Volcan Darwin on March 5, 2000 by L. Roque. These specimens either lacked their abdomen or the latter was in a gelatine capsule. *Galagete cinerea* is most closely related to *G. consimilis* and *G. darwini* as explained above under the Remarks for *G. consimilis*.

*Galagete levequei* sp. n.

Figs 10, 11, 28, 36

Holotype ♂. Ecuador: Galápagos, Santa Cruz, Finca Vilema, 2 km W Bella Vista, 1.iv.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 12 ♂, 19 ♀ from the Galápagos Islands, collected at MVL by B. Landry unless specified otherwise. 4 ♂ with same data as holotype; 2 more ♂, 6 ♀ from *Santa Cruz*: 1 ♂ (dissected, BL 1136), 1 ♀, 4 km N Puerto Ayora, 20.i.1989; 1 ♀, Tortuga Reserve, W Santa Rosa, 6.ii.1989; 1 ♂, 3 ♀ (one dissected, BL 1303), 2 km W Bella Vista, 27.ii.1989; 1 ♀, 5 km N Puerto Ayora, Transition Zone, 17.ix.2001, u[ltra] v[iolet] l[ight] (L. Roque). *Isabela*: 2 ♀, Puerto Villamil, 2.iii.1989; 1 ♂, 1 ♀, 11 km N Puerto Villamil, 9.iii.1989; 1 ♂ (dissected, BL 1304), 2 ♀, 8.5 km N Puerto Villamil, 11.iii.1989; 1 ♂, 2 ♀, 11 km N Puerto Villamil, 13.iii.1989; 2 ♀, Alcedo, lado N[orte] E[ste], 200 m. camp arida alta, 14.iv.2002, u[ltra] v[iolet] l[ight] (B. Landry, L. Roque); 1 ♀, Alcedo, lado N[orte] E[ste], ca. 100 m, day on *Opuntia* pad, 14.iv.2002. (B. Landry); 1 ♂, 3 ♀ (one dissected, BL 1305), ± 15 km N Puerto Villamil, 25.v.1992; 1 ♂ (dissected, BL 1391), Alcedo, Zona arida alta, Malaise Trap, 13.x.1999 (L. Roque); 1 ♂, Alcedo, arida alta, 200 m. Adulto en *Opuntia insularis*, 28.x.2000, Coll # 2000-016 (L. Roque) (BMNH, CDRS, CNC, MHNG).

*Diagnosis.* Within the genus, and among all Galápagos Lepidoptera, the forewing markings of *Galagete levequei* are unique. *Galagete cristobalensis* (fig. 12)



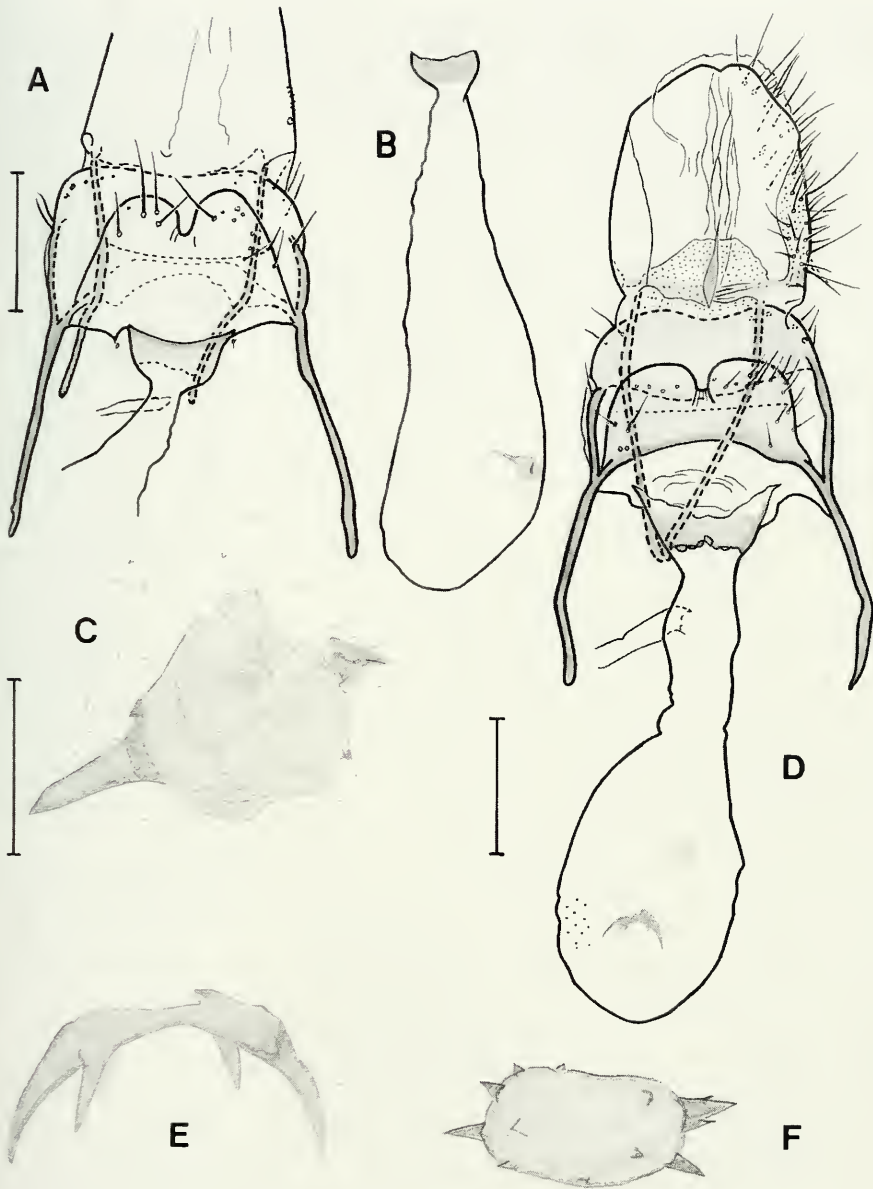


FIG. 35

Female genitalia. A-C. *Galagete consimilis*: A. Segment VIII and ostium bursae (scale = 0.2 mm); B. Unflattened corpus bursae; C. Enlarged signum of separate specimen than A or B (scale = 0.05 mm). D-F. *Galagete cinerea*: D. Whole genitalia (scale = 0.2 mm); E. Enlarged signum of same specimen; F. Enlarged signum of another specimen (some spines broken).

is the closest in wing markings, but, among several characters, it does not have the broad transverse band submedially, and it is generally smaller with a maximal wingspan of 7.3 mm, whereas 8.5 mm is the minimal wingspan in *G. levequei*.

*Description.* Head white with some dark-brown periorbital scales posteriorly and anteriorly, sometimes with pale-brown or beige periorbital scales dorsally. Haustellum and maxillary palpus white. Labial palpus white with dark brown laterally on first segment and basal half of second segment, and as rings postmedially and subapically on third segment; sometimes with a few brown scales subapically on second segment. Antennal scape mostly dark brown with white scales ventrally, especially at base and apex; basal third of flagellomere dark brown, subsequently paler brown. Thorax white with dark-brown band anteriorly, darker brown on tegula with anterior band somewhat extending laterally; metascutellum pale creamy white as abdomen. Foreleg coxa pale greyish brown with beige scales at base; femur dark brown with a narrow longitudinal line of beige ventrally; tibia dark brown with a few white or beige scales at base, apex, and sometimes middle; tarsomere I dark brown with beige at base and apex; tarsomeres II-IV dark brown, sometimes with beige at apex of tarsomere II; tarsomere V beige. Midleg beige with greyish brown at apex of femur, basally and subapically on tibia, and on most of tarsomeres, except tarsomere V, usually mostly beige. Hindleg mostly beige, including long dorsal scales on tibia, with greyish brown at base of tibia and base of tarsomeres II-IV, sometimes also at base of tarsomere I. Male wingspan (n=12): 9.0-10.0 mm; female's (n=20): 8.5-11.5 mm. Forewing (figs 10, 11) white to pale greyish brown with dark-brown markings as a broad basal triangle larger on costa, a broad submedian band that is more or less triangular and does not reach inner margin in Santa Cruz series (or that is more or less rectangular, reaching inner margin, and sometimes constricted below costa in Isabela series), and a small to large spot on costa at about 3/4 sometimes connected to a smaller spot below along middle line; the larger basal and submedian markings connected by thin dark-brown line on costa; area below submedian band usually pale yellowish brown in Santa Cruz series; sector at 3/4 variably suffused with pale yellowish brown to brown (scales being generally brown at base and beige on apical half, but rarely entirely dark brown to form a wide band), sometimes with a few dark-brown scales on inner margin (in Isabela series); apical sector more or less suffused with brown (scales being brown at base and beige on apical half) or pale yellowish brown or dark brown, sometimes with a darker brown area at apex, sometimes with evenly spaced paler spots along margin; fringe generally greyish brown, sometimes with double linear pattern in cases where scales are distinctly darker brown at base and paler apically. Hindwing uniformly pale grey; fringe creamy white. Abdomen dorsally and laterally whitish grey or pale yellowish grey, with variable amounts of modified pointed scales usually more yellowish, but not distinctly thicker, on terga III-VII; uniformly pale yellowish white ventrally and around genitalia.

Male genitalia (n=3) (fig. 28). Basal half of uncus only slightly angled from second half; second half not produced dorsally, apex smooth and rounded; arms of medium size, not laterally compressed, triangular, apically rounded; dorsal crests broadly rounded, poorly demarcated. Median hook of gnathos rather short and thick, only slightly upturned and pointed apically. Dorsal connection of tegumen very wide;

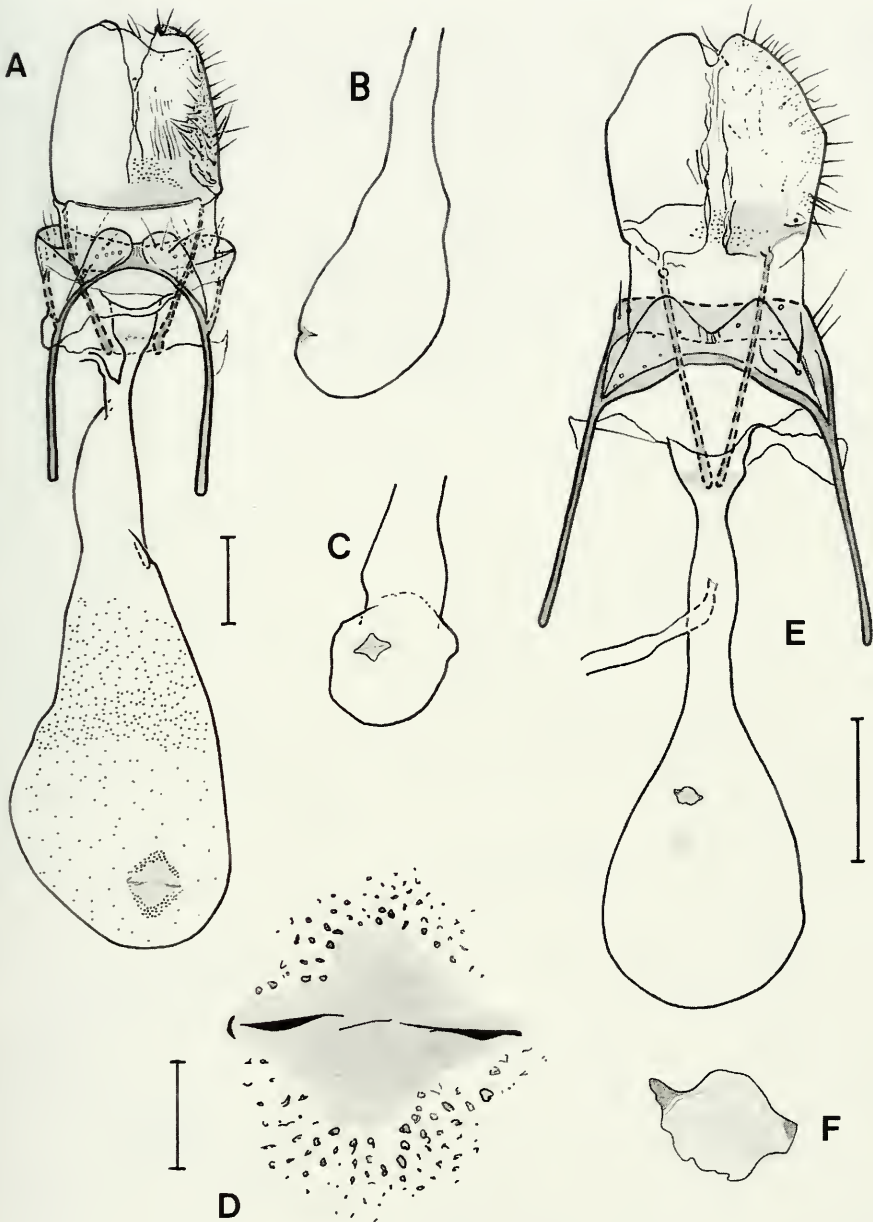


FIG. 36

Female genitalia. A-D. *Galagete levequei*: A. Whole genitalia (scale = 0.2 mm); B. Unflattened corpus bursae in ventral view; C. Unflattened corpus bursae in lateral view; D. Enlargement of signum of specimen figured in A-C (scale = 0.05 mm). E, F. Unassociated *Galagete* female: E. Whole genitalia (scale = 0.2 mm); F. Enlarged signum of same specimen.

pedunculi short, of medium width. Lateral arms of transtilla short, circular, evenly sclerotized, dorsally with rather long narrow scales not imbricated; median arm about twice as long as lateral arms, apically enlarged, blunt, compressed dorsoventrally, and slightly upturned. Valva rather long, dorsal margin only slightly angled ventrally near apex, ventral margin smooth, trending dorsally from about middle, apex narrowly rounded; costa only slightly more strongly melanized from base to almost apex; sacculus short, spoon shaped, narrowly pointed apicomediaally. Juxta symmetrical, more or less heart shaped, with deep circular notch. Vinculum short and broadly rounded, without dorsal projection medially. Aedeagus narrow, slightly arched, slightly larger on basal 2/5 with short coecum penis adorned with short medioventral crest; apical 1/3 open ventrally, dorsal wall not subapically enlarged, apically rounded and slightly bent to the right; vesica apically spiculate, without cornuti.

Female genitalia (n=2) (fig. 36). Papillae anales rather elongate (about 2 X longer than broad in ventral view), laterally compressed along margins in situ, narrowing gently toward apex, and narrowly rounded at apex in lateral view; dorso-basal margin not emarginate, broadly rounded. Posterior apophyses straight, slightly enlarged and curved at apex, about as long as papillae anales, reaching ostium bursae. Dorsal branch of anterior apophyses straight; dorsal and free branches together slightly longer than posterior apophyses; ventral branches forming broadly rounded, heavily melanized band, slightly diffused medially, along basal margin of sternum. Apical margin of sternum VIII with lobes broad; emargination rounded and shallow, reaching about 2/5 length between apices of lobes and margin of sternum. Apical margin of tergum VIII broadly and shallowly emarginate medially, without distinct lateral lobes. Ostium bursae with medium-sized (about 2 X wider than long) sclerotized ring. Ductus bursae constricted at base, subsequently medium sized and gradually enlarging into corpus bursae. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae not distinctly demarcated from ductus but with submedian slight constriction dividing medium-sized basal section and slightly broader apical section projecting to the left and apically rounded, with spicules especially evident around constriction dividing two parts of bursa, with strong scobination around signum; signum a lozenge-shaped plate with pair of short lateral, spinelike ridges, situated at apex of projected apical section.

*Etymology.* In recognition of the conservation efforts of Dr. Raymond Lévêque, Swiss ornithologist and first director of the Charles Darwin Research Station, between 1960 and 1962. The suggestion to name a new species for Dr. Lévêque came from the Galapagos Conservation Trust of England.

*Biology.* The moths were collected at light from sea level to 570 m in elevation between mid-January to the end of May, as well as in September and October. Two females collected on Isabela (Alcedo) by L. Roque in September 2001 (CDRS) probably belong to this species. Their labels mention "Barrenador [borer on] *Scalesia affinis*". These specimens were reared from dead leaves but the behaviour and food of the larvae are not known for certain (L. Roque, pers. comm.). Two other specimens collected on Santa Cruz (30.i.2002, R. Boada) (CDRS) are probably also *G. levequei*. Their labels mention "Minador [miner] *Scalesia retroflexa*." However, this appears to be an error and the moths can only be said to have been reared from dead leaves or



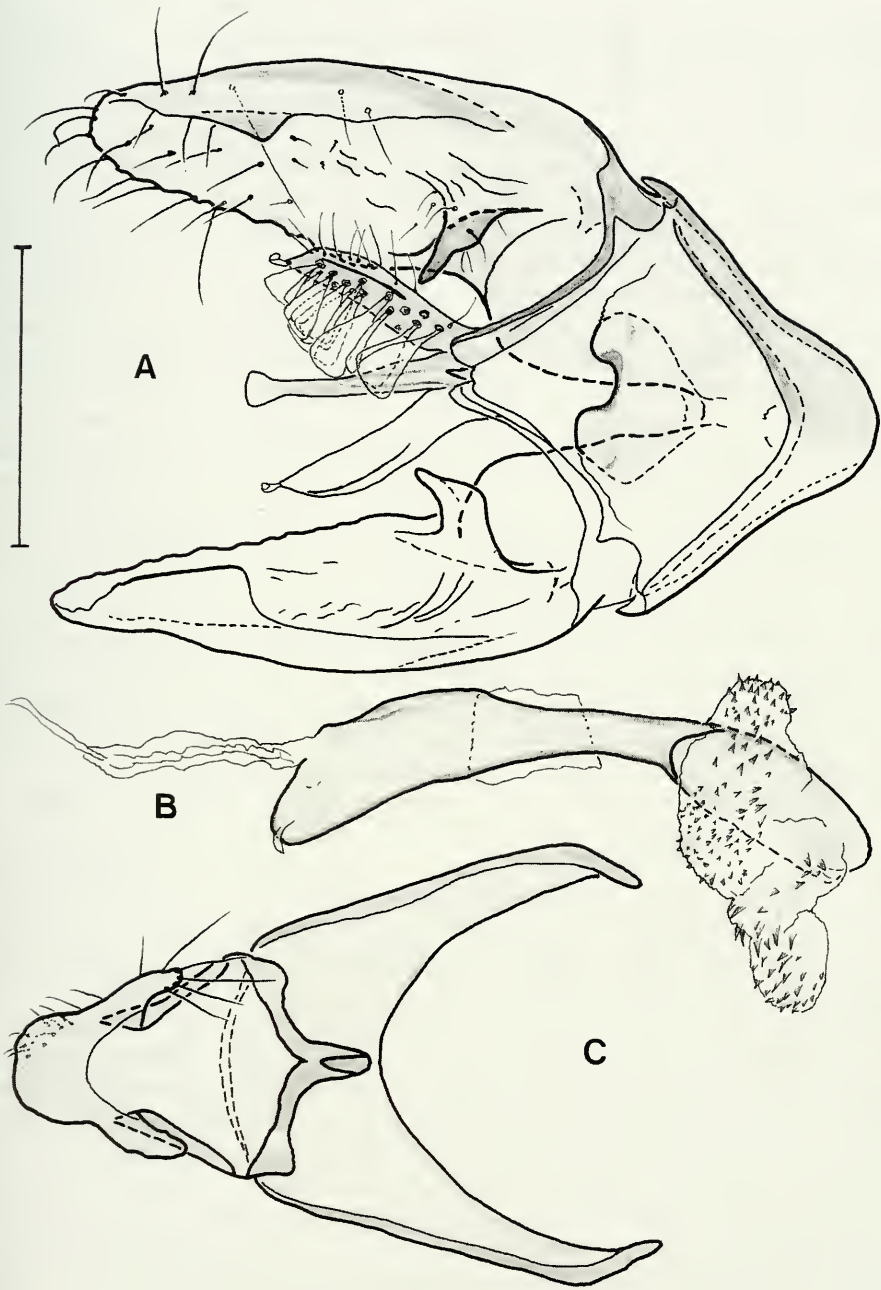


FIG. 37

Male genitalia of *Galagete cinerea*. A. Ventral parts (scale = 0.25 mm); B. Aedeagus; C. Dorsal parts.

branches of the plant (L. Roque, pers. comm.). One female was collected during the day while it was resting in the shade of an *Opuntia* pad standing at about one meter high. The male paratype for which the label mentions "Adulto en *Opuntia insularis*" was not reared but collected with an entomological aspirator (or pooter) among pads of the plant (L. Roque, pers. comm.).

*Distribution.* The only known collecting localities are on Santa Cruz and Isabela. I assume that this is an endemic species.

*Remarks.* The specimens collected on Isabela are generally darker than those collected on Santa Cruz, but since I could not detect any differences in the genitalia between the two series, I interpret the colour differences as infraspecific. The two females associated with *Scalesia affinis* (see Biology section) are not included in the type series because their metathorax and abdomen were detached and placed in a gelatine capsule. Also, although the genitalia of one of them show no appreciable differences with those of the two dissected female paratypes, they have much larger dark markings than the paratypes from Isabela. The male and female associated with *S. retroflexa* are not included as paratypes either because they are darker than the other known specimens from Santa Cruz, smaller (wingspan of 7.0-7.5 mm; perhaps due to the rearing condition), and the male genitalia show some differences with those of the dissected male paratypes. Another specimen is not included in the series of paratypes as it lacks the abdomen. It was collected on Isabela (Alcedo) at 570 meters in elevation by L. Roque in October 1998 (CDRS). The phylogenetic relationships of *G. levequei* to the other species of *Galagete* are unknown. However, as shown in five of the seven trees produced by the cladistic analysis, this species may be more closely related to *G. cristobalensis*. This relationship is supported by the whitish to cream-coloured forewing with dark-brown markings (character state 15-2 on Table 1).

*Galagete cristobalensis* sp. n.

Figs 12, 29, 33

Holotype ♂, Ecuador: Galápagos, San Cristóbal, 4 km SE Puerto Baquerizo, 12.ii.1989, M[ercury] V[apour] L[amp] (B. Landry), (CNC).

Paratypes, Ecuador: 6 ♂, 2 ♀ from the island of San Cristóbal, Galápagos Islands, collected at MVL by B. Landry, 3 ♂ (one dissected, BL 1145) with same data as holotype; 3 ♂ (one dissected, BL 1302), 1 ♀ from same locality as holotype, 20.ii.1989; 1 ♀ (dissected, BL 1301), base of Cerro Pelado, 22.ii.1989. (CDRS, CNC, MHNG).

*Diagnosis.* Among Galápagos moths, the wing pattern of *Galagete cristobalensis* is unmistakable. Only *Galagete levequei* (figs 10, 11) is somewhat similar, but it has an additional broad transverse band submedially, and it is generally larger, with a minimal wingspan of 8.5 mm, whereas the maximal wingspan of *G. cristobalensis* is 7.3 mm.

*Description.* Head cream coloured, with brown periorbital scales posteriorly, and usually also anteriorly and dorsally, the latter being sometimes yellowish brown or pale brown. Haustellum and maxillary palpus white or whitish beige. Labial palpus segment I brown dorsally and white ventrally; segment II whitish beige with dark-brown rings disconnected dorsally: one large on most of basal half and one smaller subapically; segment III whitish beige with complete dark-brown rings basally, post-medially, and subapically. Antennal scape dark brown with white ring apically, also

with white scaling at base and ventrally; flagellum dark brown at base, somewhat paler beyond base and with scales erect toward apex. Thorax cream coloured, with dark brown at base of tegula and apparently (where the minuten has been placed) as a small spot in the middle; metascutellum greyish white, shining. Foreleg coxa dark brown with large whitish-beige patch basally; femur mostly dark brown, with some white apically; tibia dark brown with a few white scales apically and postmedially; tarsomeres mostly dark brown with a few white scales at base and apex of tarsomere I, and with beige on most of tarsomere V. Midleg coxa mostly white; femur dark brown with a few white scales at base and apex; tibia dark brown with whitish beige to yellowish beige basally, postmedially, apically, and on spines; tarsomere I dark brown with whitish beige at base and apex; tarsomeres II and III basally dark brown, apically whitish beige; tarsomere IV basally dark brown, apically beige; tarsomere V beige. Hindleg coxa dark brown at base, white apically; femur dark brown with whitish beige at base and apically; tibia dark brown with whitish-beige or beige on spines, dorsal fringe of elongate scales, and apex; tarsomeres mostly beige, with dark brown on basal half of tarsomere I and at base of tarsomere II. Male wingspan (n=7): 7.0-7.5 mm; female's (n=2): 7.0-8.0 mm. Forewing (fig. 12) cream coloured with dark-brown markings as a broad, almost crescent-shaped band basally, slightly continuing on costa, a small costal spot submedially with another small spot below in cubital fold, a slightly larger costal spot postmedially, a medium-sized band submedially from inner margin to a little above midline, and a medium-sized apical spot on costa that sometimes extends slightly toward middle of wing; fringe cream coloured. One female specimen with slightly larger submedian, postmedian, and apical spots, the latter covering the entire apex of the wing as opposed to being only on the costa in the male specimens. Hindwing pale greyish brown, shining; fringe greyish brown on costa, cream coloured elsewhere except at base of inner margin, mostly white. Abdomen greyish white dorsally, shining, without modified pointed scales; brown laterally and ventrally, except around genitalia, whitish beige.

Male genitalia (n=2) (fig. 29). Basal half of uncus only slightly angled from second half; second half not produced dorsally, apex with or without a pair of very short points; arms not compressed laterally, sub-triangular, broad and short with rounded apex; dorsal crests broadly rounded, only slightly protruding. Median hook of gnathos of medium girth, apically rounded and not distinctly upturned. Dorsal connection of tegumen very wide; pedunculi short and wide. Lateral arms of transtilla short and slightly elongate, evenly sclerotized, dorsally with fan-shaped scales of medium length and not imbricated, apically rounded; median arm short, about 2/3 length of lateral arms, narrow, apically pointed. Valva rather short, dorsal margin only slightly angled ventrally toward apex, ventral margin with low basal bump, gently angled dorsally from middle, rather broadly rounded apically; costa only slightly more melanized from base to 2/3; sacculus a rather wide, laterally compressed square projecting apicodorsally and toward middle, with low supporting ridge perpendicular to it from base dorsally. Juxta symmetrical, more or less heart shaped, with rather deep narrowly rounded notch. Vinculum short and rounded, without dorsal projection medially. Aedeagus narrow, slightly angled from middle, slightly larger at base with short coecum penis sometimes adorned with short crest medioventrally; apical 1/3 open

ventrally, dorsal wall slightly enlarged subapically, apically rounded and slightly bent to the right; vesica apically with cluster of rather long spicules, without cornuti.

Female genitalia (n=1) (fig. 33). Papillae anales longer than broad (about 2 X longer than broad), laterally compressed along dorsal margin in situ, slightly narrowing toward apex, rather narrowly rounded at apex in lateral view and bent downward; dorsobasal margin interrupted by median longitudinal fold less strongly melanized than lateral setose papillae proper. Posterior apophyses slightly angled upward beyond middle, otherwise straight, apically curved slightly, reaching slightly beyond ostium bursae. Free branch of anterior apophyses only slightly curved inward near middle and subsequently parallel sided; dorsal and free branches together slightly longer than posterior apophyses; ventral branches forming narrow, heavily melanized and broadly rounded band, with slight emargination medially, at basal margin of sternum. Apical margin of sternum VIII with lobes rather broad; emargination deep and narrow, reaching slightly more than 2/3 distance between apices of lobes and basal margin of sternum. Apical margin of tergum VIII only very slightly depressed medially, without lateral lobes. Ostium bursae with bowl-shaped (about as long as wide) sclerotized ring with slightly emarginate apicoventral margin. Ductus bursae constricted at base, subsequently narrow to corpus bursae. Inception of ductus seminalis shortly after basal constriction of ductus bursae. Corpus bursae apparently medium sized, slightly enlarging toward apex, and apically rounded (but corpus folded on dissected specimen), heavily spiculate; signum an oval-shaped plate placed sideways, situated subapically, with pair of short lateral, spinelike ridges.

*Etymology.* The name of *G. cristobalensis* is derived from the name of the island where it was found, which in turns derives from the name of the passionate explorer, Christopher Columbus.

*Biology.* The moths were collected at light in February at median elevations.

*Distribution.* So far found only on San Cristóbal Island of the Galápagos, this species is currently believed to be endemic to the archipelago, and possibly to that single island.

*Remarks.* The phylogenetic relationships of *G. cristobalensis* to other species of *Galagete* are unknown. However, see above under Remarks for *G. levequei*.

### *Galagete pecki* sp. n.

Figs 13, 30, 32

Holotype ♂, Ecuador: Galápagos, Isabela, ± 15 km N [uer]to Villamil, 25.v.1992, M[ercury] V[apour] L[amp] (B. Landry), (MHNG).

Paratypes, Ecuador: 12 ♂, 2 ♀ from Isabela, collected at MVL by B. Landry. 1 ♂ (dissected, BL 1340) with same data as holotype; 1 ♂, 11 km N Puerto Villamil, 9.iii.1989; 1 ♂, 8.5 km N Puerto Villamil, 11.iii.1989; 9 ♂, 2 ♀ (one dissected BL 1341), 13 km N Puerto Villamil, 13.iii.1989 (CDRS, CNC, MHNG).

*Diagnosis.* This is a small beige species with dark-brown markings variable in size. This combination of size, colour, and markings is unique. Some specimens of *G. darwini* (figs 7, 8) and *G. consimilis* (fig. 9) are of the same range in size, but their background colour is brown and the markings are not strongly contrasted. Some specimens of *G. turritella* (figs 4, 5) may look similar also, but they are larger (wingspan: 9.2-11.7 mm) and the wing markings and colour are different.



*Description.* Head beige with a few dark-brown periorbital scales anteriorly near mouthparts and posterodorsally, also with a few greyish-brown tipped scales at medial bases of antennae and sometimes on occiput and vertex. Maxillary palpus beige. Haustellum whitish beige, sometimes with dark brown at base. First segment of labial palpus pale greyish brown; second segment mostly beige medially, usually with a dark-brown spot subapically and sometimes also near middle, laterally beige with dark-brown base and subapical spot; third segment beige with dark-brown rings basally, postmedially, and subapically. Antennal scape dorsally dark brown with apical row of white scales, ventrally white; flagellum dark brown on basal third, subsequently paler greyish brown. Thorax dorsally mostly beige with scales variably darker brown tipped, with shining greyish-brown row of scales basally, dark brown on basal half of tegulae and at apex of mesoscutellum medially, and shining greyish beige on meta-scutellum. Foreleg coxa greyish beige; femur dark brown with white apical spot; tibia dark brown with white spots at base and beyond middle, and beige at apex; tarsomeres dark brown with beige at apex of first, second, and last. Midleg coxa and femur as for proleg; tibia dark brown with a few white scales at base and rather large patches of beige postmedially and apically; all tarsomeres with dark brown at base and beige at apices, last tarsomere sometimes all beige. Hindleg mostly beige, sometimes with greyish brown to dark brown laterally on tibia, especially at base, and dorsally on most of tarsomere I except apex, and bases of tarsomeres II-IV. Male wingspan (n=13): 7.5-8.7 mm; female's (n=2): 8.2-8.3 mm. Forewing (fig. 13) beige with most of the beige scales brown tipped, with dark-brown markings as a large basocostal triangle reaching cubital fold, a small patch at base of inner margin, a small submedian costal spot joined with basal triangle by dark greyish-brown or dark-brown costal line, another small spot below and beyond submedian costal spot (slightly above midline), a larger spot in cubital fold directly below submedian costal spot, and a pair of small spots above each other, but sometimes joined, on each side of midline at about 2/3; with dark greyish brown to dark brown as a large costal triangle postmedially and along margin of wing's apical 1/5; also with paler brown scales of various shades more or less extensively distributed, but mostly below postmedian costal triangle, in apical 1/5, below pair of spots at 2/3, and below submedian large spot; fringe greyish brown at apex and inner margin, mostly greyish beige on outer margin. Hindwing pale greyish brown; fringe concolorous at apex and outer margin, greyish beige on inner margin. Abdominal terga pale greyish beige with whitish-beige apical rows of scales, without distinct modified scales; sterna pale whitish beige.

Male genitalia (n=2) (fig. 30). Basal half of uncus almost at right angle from posterior half; second half not produced dorsally, apical margin with pair of short points; arms not laterally compressed, triangular, short and broad, apically rounded; crests rather well demarcated and broadly rounded. Median hook of gnathos of medium size and girth, a rounded "V" in lateral view, very slightly pointed and upturned apically. Dorsal connection of tegumen wide; pedunculi short and broad but narrowing from apical margin subbasally. Lateral arms of transtilla short, almost circular, slightly elongate, with more strongly sclerotized median margin, dorsally with short to elongate scales of narrow to medium width, not imbricating; median arm longer than lateral arms and very narrow for whole length, broadly curved upward,

narrowly pointed apically and dorsoventrally compressed. Valva of medium length and width, dorsal margin angled ventrally from about  $2/3$ , ventral margin angled dorsally from about  $2/3$  and with subbasal notch, apex narrowly rounded; costa strongly melanized from base to about  $2/3$ , with apical narrow and pointed crest directed apically, dorsally, and posteriorly; sacculus an apically rounded crest of medium length and width directed mediodorsally, with short but tall supporting ridge from base dorsally. Juxta symmetrical, almost circular to slightly elongate, with rounded but not very deep notch. Vinculum short and broadly rounded apically, without dorsal projection medially. Basal half of aedeagus angled at about half right angle from second half, about twice girth of median constricted section, with narrower coecum penis adorned with short crest; apical  $2/7$  not distinctly angled upward, slightly asymmetrical, opening ventrally and slightly more to the left, dorsal wall slightly enlarged to the right laterally before narrowly rounded apex; vesica with abundant spicules.

Female genitalia ( $n=1$ ) (fig. 32). Papillae anales only slightly longer than largest width in ventral view, in situ an elongate cone in dorsal view, narrow for whole length and apically rounded in lateral view; dorsobasal margin not melanized medially at longitudinal depression. Posterior apophyses straight with slightly enlarged and curved apices, only slightly longer than papillae anales, reaching slightly beyond ostium bursae. Free branches of anterior apophyses slightly divergent but curved inward at apex; free and dorsal branches together as long as posterior apophyses; ventral branches forming distinct, heavily melanized, and broadly rounded band along basal margin of sternum. Apical margin of sternum VIII with lobes short and broadly rounded, emargination shaped as a broad "V," shallow, reaching almost  $1/2$  distance between apices of lobes and margin of sternum. Ostium bursae in bowl-shaped depression with narrow sclerotized ring. Ductus bursae slightly constricted at base, subsequently enlarged slightly and only very slightly enlarging toward corpus. Inception of ductus seminalis at about  $1/4$  from base of ductus bursae. Corpus bursae simply rounded, with little spiculation at level of signum; signum an irregular-shaped plate with medium-sized spine on each lateral side and with smaller spines at base of larger ones.

*Etymology.* With much gratitude I name this species in honour of Dr. Stewart B. Peck, assuredly one of the pillars of entomological studies in the Galápagos for the last 15 years. Without him, I would never have collected a single specimen of Lepidoptera on the archipelago, and our expeditions together were among the greatest experiences of my life as a scientist.

*Biology.* The moths came to light at midelevations on Isabela in March and May.

*Distribution.* The species was only found on the Galápagos island of Isabela, from where it may be endemic.

*Remarks.* Two females from Santiago and Santa Cruz may be *G. pecki* based on genital features (fig. 36), but their wing pattern is different enough that I have decided to leave them unnamed for the moment. These two specimens are deposited in MHNG. The phylogenetic relationships of this species to other species of *Galagete* are unknown.

## ACKNOWLEDGEMENTS

I am very thankful to the authorities of Galápagos National Park and those of the Charles Darwin Research Station for allowing fieldwork and for logistical support in 1989, 1992, and 2002. I am grateful to the Charles Darwin Foundation and the Galápagos Conservation Trust of England for providing financial support for my investigations at the BMNH in 2000 and in the Galápagos in 2002. I am especially thankful to Lazaro Roque-Albelo for his invitation and hospitality in the Galápagos in April and May 2002. I have a great deal of gratitude for Prof. Stewart B. Peck, Carleton University, Ottawa, for inviting me to join his 1989 and 1992 Galápagos expeditions. This fieldwork was supported by an operating grant to Dr Peck from the Natural Sciences and Engineering Research Council of Canada for field research on arthropod evolution. I am very appreciative to the following people for their help and pleasant company in the field: Novarino Castillo, Charlotte Causton, Joyce Cook, Moraima Inca, Ricardo Palma, S. B. Peck, L. Roque-Albelo, Bradley J. Sinclair, and Eduardo Vilema. I thank curators Kevin Tuck and Klaus Sattler (BMNH) for their help in the examination of specimens and for providing vital information; Dr Sattler generously helped to determine that the species described above were new, and provided useful information on the placement of these species to genus and family. I am thankful to Jean-François Landry, Agriculture and Agri-Food Canada, for his multi-faceted help while I was in Ottawa working on Galápagos moths, to Florence Marteau for making the first three plates, and to Gilles Roth for inking my drawings. Finally, I am deeply appreciative of Ronald W. Hodges, Jean Mariaux, K. Sattler, and Andreas Segerer for their comments on the manuscript.

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## ***Pseudaparopion*, new genus of Curculionidae from southern Caspic region (Coleoptera, Curculionoidea, Molytinae)**

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***Pseudaparopion*, new genus of Curculionidae from southern Caspic region (Coleoptera, Curculionoidea, Molytinae).** - A new genus, *Pseudaparopion*, from southern Caspic region, is described. It includes two species: *P. aequale* (Reitter, 1883) from Lenkoran (Azerbajdzan) and *P. kadleci* sp. n. from Mazandaran (Iran). *P. aequale* was originally described by Reitter (1883) as *Aparopion aequale* but clearly does not belong in that genus on the basis of intervals not raised and structure of VIII sternite of female. A lectotype and paralectotype are here designated for *P. aequale*; this species is transferred from genus *Aparopion* as *Aparopion aequale*. Drawings of male and female genitalia for all species are provided. Taxonomic account and an identification key to the species are given.

**Key-words:** Curculionidae - Molytinae - *Pseudaparopion* - new genus - new species.

### INTRODUCTION

Reitter (1883) described *Aparopion aequale* Reitter, 1883, from Lenkoran, differentiated from the other species of genus *Aparopion* Hampe, 1861, and in particular from *A. costatum* (Fåhræus, 1843) from Caucasus and southern Europe, by intervals on elytra not raised. The original description did not mention male and female genitalia. A second, more complete description (Reitter, 1886) followed the first one and a third contribution (Reitter, 1891), added a key to the three species of *Aparopion*: *A. costatum* (Fåhræus, 1843), *A. aequale* Reitter, 1883 and *A. suturidens* Reitter, 1891. No taxonomic accounts are available for genus *Aparopion* up to 1999, when Zuppa & Osella validated *A. chevrolati* Jacquelin du Val, 1868 (France and Italy) and described *A. numidicum* Zuppa & Osella, 1999 (Algeria). The authors excluded *A. aequale* from *Aparopion* because the intervals on elytra are not raised and structure of VIII sternite of female (only known sex). However, a new genus was not described as no male specimen was known at the time. One of the authors (RB), found among Curculionidae from Mazandaran (northern Iran) collected by Stanislav Kadlec, a Molytinae closely related to *A. aequale*, whose symmetric aedeagus strongly differed from the asymmetric aedeagus of *A. costatum*. It is thus possible to describe *Pseudaparopion* gen. n., which includes *P. aequale* (Reitter) and *P. kadleci* n. sp.

Specimens are deposited in the following collections:

- (HNHM) Hungarian Natural History Museum, Budapest, Hungary
- (MSNM) Museo Civico di Storia Naturale, Milano, Italy
- (MSNV) Museo Civico di Storia Naturale di Verona, Italy
- (MHNG) Muséum d'histoire naturelle, Genève, Switzerland
- (OS) Giuseppe Osella – Department of Environmental Science, University of L'Aquila, Italy
- (RB) Roman Borovec private collection
- (MM) Massimo Meregalli private collection

*Pseudaparopion* gen. n.

Type species: *Aparopion aequale* Reitter, 1883.

*Description.* Body oval, rusty brownish, with short microscopic yellowish setae. Rostrum cylindrical, in lateral view a bit curved, a bit longer than pronotum, almost parallel-sided, weakly enlarged at apex. Dorsal surface densely punctured, ventral surface with three keels, the middle one narrower and smaller than the lateral ones. Scrobes, in dorsal view, only visible at apex, in lateral view with upper margin better developed than bottom one, very slightly curved, reaching lower border of eye. Eye small, weakly vaulted, elliptic. Head punctured, punctures as on rostrum, with a weak transversal depression between eyes. Antenna with slender scapus, in apical part widened, reaching anterior border of eye; funicle 7-jointed, slender, all segments longer than wide; club slender, with yellowish setae. Pronotum wider than long, a bit constricted behind anterior border, with arcuated sides without lateral lobes, densely punctured. Scutellum very small or invisible. Elytra oval, shoulder rounded, sides regularly arcuated, with 10 striae. Striae irregularly punctured, deeper than intervals with irregular row of small granules. Prosternum bow-shaped. Procoxae semi-globular, equidistant from anterior and posterior border of prosternum. Mesocoxae semi-globular, distance between them about 2/3 of diameter of mesocoxa. Mesepisternum and mesepimeron fused, without suture. Metepisternum invisible. Metasternum very wide and short, distance between mesocoxae and metacoxae shorter than diameter of mesocoxae. Metacoxae oval, transverse, distance between them about 2.5 times diameter of metacoxae. Ventricle 1 as long as ventricle 2; this longer than ventricles 3+4 and about the same length as ventricle 5. Suture between ventricles 3 and 4 deep, sutures of other ventricles shallow. The whole ventral sides of body densely and roughly punctured with rare, fine, short yellowish setae. Legs feebly robust. Trochanters small, triangular-shaped, femora untoothed. Tibiae curved on inner side, punctured, apex of anterior tibia with row of short yellowish setae and with one large, inside curved hook-shaped spine. Tarsi slender, article 3 wider than the others, bilobated, claws free.

Sexual dimorphism. Male with rostrum shorter and wider than female; in females ventricle 5 longer at apex, regularly arcuated.

Male genitalia symmetrical, well sclerotised; tegmen with short manubrium. Female genitalia with sternite VIII well sclerotised, with apical setae; spermatheca c-shaped.

*Etymology.* The name *Pseudaparopion* (Pseudo = false) refers to the similarity with *Aparopion*.

*Distribution.* *Pseudaparopion* seems to be endemic to coasts along Caspic sea, from Lenkoran in the north to montane and sub-montane areas in Damavand and Ala-Dagh, northern Iran, in the south. It is replaced in Caucasus by *Aparopion*.

*Ecology.* No information is available for *P. aequale*. *P. kadleci* sp. n. was collected in superficial soil litter in broad-leaved forests, namely beech (*Fagus orientalis* Lipsky, 1898). *Pseudaparopion* seems to colonize the same habitat as *Aparopion*, although more researches are necessary for a complete knowledge of its ecology. Host plants for larva and adult are not known. Larva of *Aparopion* is xylophagous (Zuppa & Osella, 1999).

*Pseudaparopion aequale* (Reitter, 1883) comb. n.

Figs 1-2b

*Aparopion aequale* Reitter, 1883: 9.

Reitter, 1883: 9. Reitter, 1886: 231. Reitter, 1891: 249. Heyden *et al.*, 1891: 301. Heyden *et al.*, 1906: 652. Dalla Torre & Schenkling, 1932: 89. Winkler, 1932: 1572. Zuppa & Osella, 1999: 2.

*Type Locality:* Lenkoran (Azerbaijan).

*Type Series.* Lectotype female, dissected, here designated, labelled "Lenkoran, Leder (Reitter)/coll. Reitter/Holotypus 1884 *Aparopion aequale* Reitter" (HNHM). Paralectotype female, labelled "Lenkoran, Leder (Reitter)/coll. Reitter/Paratypus 1884 *Aparopion aequale* Reitter" (HNHM). Paralectotype female, labelled "Lenkoran, Leder (Reitter)/ *Aparopion* n. sp. coll. Reitter" (HNHM). Paralectotype female, labelled "Caspic M. Gebiet, Leder (Reitter)/ *Aparopion aequale* Reitt. coll. Jekel" (MSNM).

A lectotype is designated out of the syntypic series in order to fix unambiguously the status of this species.

*Description.* Body oval, light reddish, scarcely glossy, with short reclined golden setae on the whole body excluding rostrum and scape. Rostrum scarcely glossy, cylindrical at base, slightly widened at apex, weakly curved, barely longer than pronotum (female specimens), densely punctured; lacking distinct keels. Scrobes visible from above only in posterior part. Antenna with slender scape, weakly widened at apex. Funicle with all segments longer than wide, of moderately increasing largeness; club elliptical, first segment slightly glossy, longer than the two remaining; these last shortly setose. Eye elliptical, flat or weakly convex. Pronotum as typical of the genus. Scutellum invisible. Elytra elliptical, longer than wide, scarcely convex, shoulders rounded. Striae more impressed in basal third, scarcely impressed towards apex; first 5 with deep punctures, more distinct in basal third, shallow and scarcely distinct towards apex; intervals wider than striae, weakly raised in basal third, with small punctures and short setae. Legs weakly robust, punctured, with stiff gold setae at apex. Tarsus with segment 1 longer than wide; segment 2 triangular; segment 3 bilobate. Onychium strongly curved, with slender free claws.

Female genitalia. Sternum VIII with few apical setae, long, slender; arms broad, apically convergent, with outer margins almost parallel; fenestral area open, elongate, triangular. Apodemes broadly divergent, contiguous to base. Spermatheca with ramus distinct, extended slightly past insertion of spermathecal duct, set off from body by marked emargination; nodulus more or less slightly convex (Fig. 2b).

Measurements. Lectotype female. Total length without rostrum = 3.75 mm; rostral length from hind margin of the ocular dimple to apex = 1.16 mm; rostral width inclusive of scrobes = 0.31 mm; rostral width except scrobes = 0.25 mm; rostral width under scrobes = 0.28 mm; head



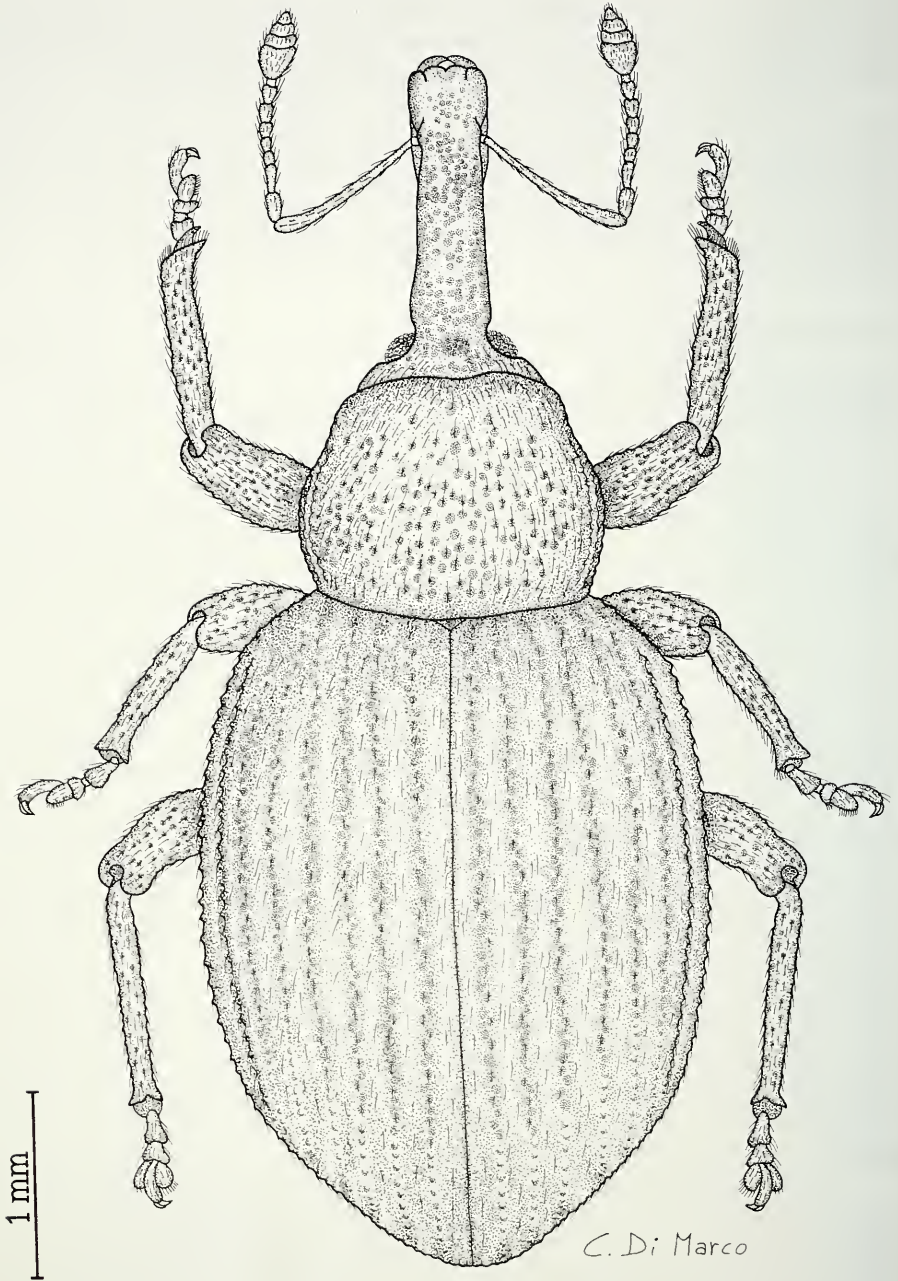


FIG. 1

Habitus of *Pseudaparopion aequale* (Reitter, 1883) (Lectotypus): Lenkoran (Azerbaijan).



width = 0.59 mm; scape length = 0.69 mm; funicular length = 0.59 mm; club length = 0.28 mm; funicular joint 1 length = 0.12 mm; joint 2 length = 0.14 mm; joint 3 length = 0.06 mm; joint 4 length = 0.06 mm; joint 5 length = 0.06 mm; joint 6 length = 0.06 mm; joint 7 length = 0.06 mm; interocular distance = 0.29 mm; pronotal length = 1.09 mm; pronotal maximum width = 1.31 mm; fore margin of pronotum width = 0.94 mm; elytral length = 2.62 mm; elytral maximum width = 2.03 mm; elytral base width = 1.31 mm.

Paralectotype female. Total length without rostrum =  $3.25 \pm 0.4$  mm; rostral length from hind margin of the ocular dimple to apex =  $1.03 \pm 0.05$  mm; rostral width inclusive of scrobes =  $0.3 \pm 0.02$  mm; rostral width except scrobes =  $0.23 \pm 0.03$  mm; rostral width under scrobes =  $0.26 \pm 0.02$  mm; head width =  $0.55 \pm 0.03$  mm; scape length =  $0.65 \pm 0.09$  mm; funicular length =  $0.57 \pm 0.1$  mm; club length =  $0.22 \pm 0.03$  mm; funicular joint 1 length =  $0.1 \pm 0.01$  mm; joint 2 length =  $0.11 \pm 0.006$  mm; joint 3 length =  $0.06 \pm 0.006$  mm; joint 4 length =  $0.06 \pm 0.006$  mm; joint 5 length =  $0.06 \pm 0.006$  mm; joint 6 length =  $0.06 \pm 0.006$  mm; joint 7 length =  $0.06 \pm 0.006$  mm; interocular distance =  $0.29 \pm 0.02$  mm; pronotal length =  $1.03 \pm 0.16$  mm; pronotal maximum width =  $1.2 \pm 0.05$  mm; fore margin of pronotum width =  $0.81 \pm 0.06$  mm; elytral length =  $2.22 \pm 0.27$  mm; elytral maximum width =  $1.91 \pm 0.08$  mm; elytral base width =  $1.2 \pm 0.05$  mm.

*Pseudaparopion kadleci* sp. n.

Figs 2a-2c

*Type Locality:* Mazandaran (Iran).

*Type Series.* Holotype male: North Iran, Mazandaran, 10 Km S Calús, 36°34'N, 51°22'E, 250-400 m, 21-23.vi.2000, lgt. S. Kadlec (MSNV). Paratypes: 4 males (1 ♂ MHNG, 1 ♂ MM, 1 ♂ RB), 2 females (1 ♀ OS, 1 ♀ RB).

*Description.* Body oval, rusty brownish, tarsus and antenna lighter. Whole body excluding rostrum and scapus with short, reclined yellowish setae. Rostrum robust, glossy, cylindrical, in lateral view a bit curved, in both sexes slightly longer than pronotum. Rostrum in basal half anteriorly tapered, widened towards apical half anteriorly enlarged. Eye oval, feebly convex. Antennae with scapus slender, only in apical part enlarged. 1 segment of funicle longer than wide, a bit wider and shorter than the second one, that is longer than wide. Segments 3-6 wider than long, segment 7 longer than wide. Club about as long as last three funicle segments, slender, pointed. Pronotum wider than long, characters as in genus description. Elytra longer than wide. Scutellum inconspicuous. Every interval brings two irregular rows of yellowish setae, placed on small granules. The same setae placed in each puncture of striae. Femurs un-toothed. Tibiae double curved in inner side, apex of tibia with row of short, yellowish setae. Tarsi slender; segment 1 longer than wide, conical; segment 2 wider than long; segment 3 strongly bilobated, much wider than the others. Onychium longer than segment 3. Claws free.

Male genitalia. Median lobe with dorsal surface, excluding orificial area, sclerotized; ventral surface sclerotized, parallel-side; extreme apex elongate, slightly rounded, curved outside, in lateral view curved; dorsobasal margin distinct, deeply emarginate. Apodemes as long as median lobe. Tegmen without parameres (Fig. 2a). Female genitalia as in *A. aequale* except fenestral area open, short, subelliptical (Fig. 2c).

Measurements. Holotype male. Total length without rostrum = 4.16 mm; rostral length from hind margin of the ocular dimple to apex = 1.16 mm; rostral length inclusive of scrobes = 0.5 mm; rostral width except scrobes = 0.28 mm; rostral width under scrobes = 0.31 mm; head width = 0.62 mm; scape length = 0.84 mm; funicular length = 0.69 mm; club length = 0.34 mm; funicular joint 1 length = 0.12 mm; joint 2 length = 0.16 mm; joint 3 length = 0.06 mm; joint 4

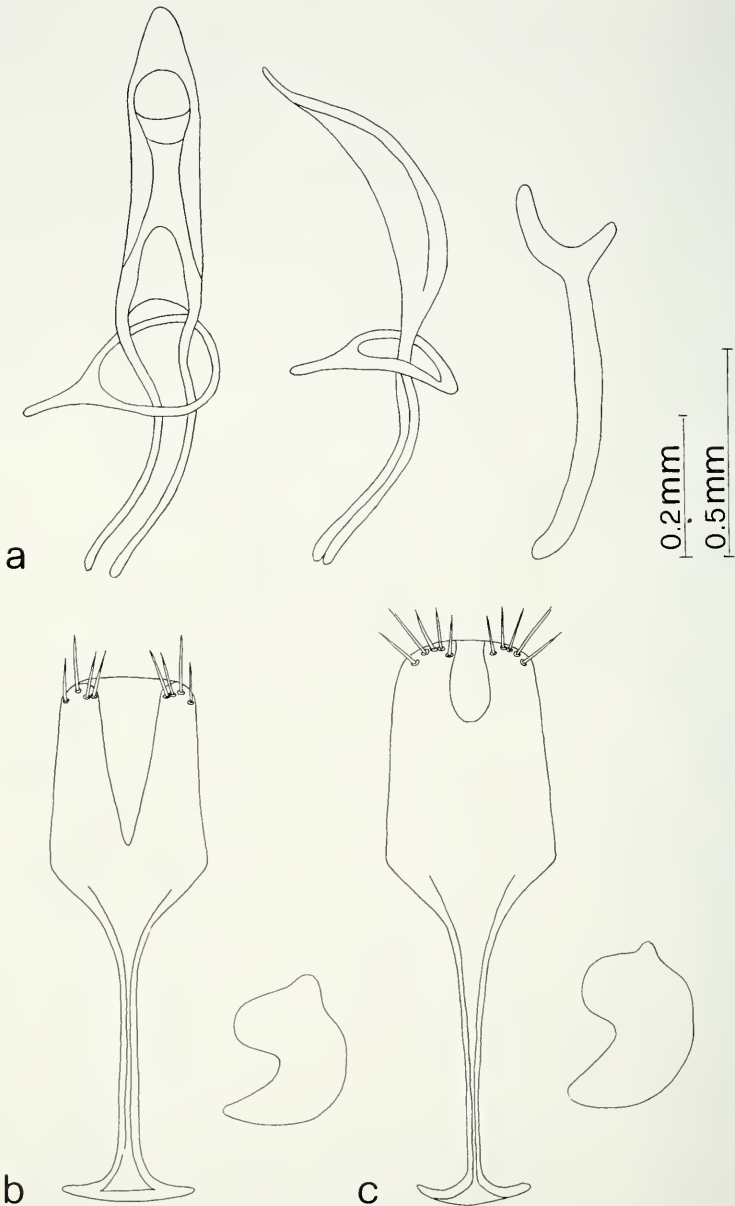


FIG. 2

Aedeagus (dorsal and lateral view) and spiculum gastrale of *Pseudaparopion kadleci* sp. n. (Holotypus): North Iran, Mazandaran (a) (scale line 0.5 mm); spiculum ventrale (scale line 0.2 mm) and spermatheca (scale line 0.5 mm) of *Pseudaparopion aequale* (Reitter, 1883) (Lectotypus): Lenkoran (Azerbaijan) (b) and *Pseudaparopion kadleci* sp. n. (Paratypus): North Iran, Mazandaran (c).

length = 0.06 mm; joint 5 length = 0.06 mm; joint 6 length = 0.06 mm; joint 7 length = 0.06 mm; interocular distance = 0.31 mm; pronotal length = 1.12 mm; pronotal maximum width = 1.41 mm; fore margin of pronotum width = 0.97 mm; elytral length = 3.03 mm; elytral maximum width = 2.25 mm; elytral base width = 1.41 mm.

Paratype male. Total length without rostrum =  $3.58 \pm 0.43$  mm; rostral length from hind margin of the ocular dimple to apex =  $1 \pm 0.05$  mm; rostral width inclusive of scrobes =  $0.39 \pm 0.04$  mm; rostral width except scrobes =  $0.24 \pm 0.03$  mm; rostral width under scrobes =  $0.30 \pm 0.03$  mm; head width =  $0.60 \pm 0.08$  mm; scape length =  $0.82 \pm 0.07$  mm; funicular length =  $0.64 \pm 0.07$  mm; club length =  $0.30 \pm 0.03$  mm; funicular joint 1 length = 0.09 mm; joint 2 length = 0.12 mm; joint 3 length = 0.06 mm; joint 4 length = 0.06 mm; joint 5 length = 0.06 mm; joint 6 length = 0.06 mm; joint 7 length = 0.06 mm; interocular distance =  $0.30 \pm 0.03$  mm; pronotal length =  $1.01 \pm 0.13$  mm; pronotal maximum width =  $0.98 \pm 0.49$  mm; fore margin of pronotum width =  $0.86 \pm 0.1$  mm; elytral length =  $2.56 \pm 0.3$  mm; elytral maximum width =  $2.03 \pm 0.23$  mm; elytral base width =  $1.28 \pm 0.11$  mm.

Paratype female. Total length without rostrum =  $3.95 \pm 0.16$  mm; rostral length from hind margin of the ocular dimple to apex =  $0.67 \pm 0.69$  mm; rostral width inclusive of scrobes = 0.34 mm; rostral width except scrobes = 0.22 mm; rostral width under scrobes = 0.28 mm; head width =  $0.5 \pm 0.31$  mm; scape length =  $0.8 \pm 0.02$  mm; funicular length =  $0.64 \pm 0.03$  mm; club length = 0.28 mm; funicular joint 1 length =  $0.11 \pm 0.02$  mm; joint 2 length =  $0.14 \pm 0.03$  mm; joint 3 length = 0.06 mm; joint 4 length = 0.06 mm; joint 5 length = 0.06 mm; joint 6 length = 0.06 mm; joint 7 length = 0.06 mm; interocular distance =  $0.32 \pm 0.02$  mm; pronotal length =  $1.03 \pm 0.06$  mm; pronotal maximum width =  $1.28 \pm 0.18$  mm; fore margin of pronotum width =  $0.83 \pm 0.11$  mm; elytral length =  $2.66 \pm 0.09$  mm; elytral maximum width =  $2.25 \pm 0.08$  mm; elytral base width =  $1.39 \pm 0.07$  mm.

*Etymology.* The new species is named after Stanislav Kadlec who collected all known specimens.

*Taxonomic account.* Suprageneric systematics in Molytinae is far from being understood regardless to the numerous attempts (Zherichin, 1987; Kuschel, 1987). A precise classification is made complex by the large number of known taxa (about 1400 up to 1978, according to O'Brien & Wibmer, 1978), differences in descriptions, difficulty of finding materials for a complete revision, scarce level of faunistic knowledge, particularly in the case of extra-palaeartic faunas.

*Aparopion* Hampe, 1861 has always been included in Curculioninae (at present Molytinae = Hylobiinae) (Bedel, 1888; Reitter, 1912; Reitter, 1916). Within this subfamily, *Aparopion* was ascribed to Plinthini, Curculionini or Anchonini and, at subtribal rank, to Plinthina, Leiosomatina, Cycloterina or, as recently proposed (Alonso-Zarazaga & Lyal, 1999), Typoderina. This last subtribe was described by Voss (1965) for *Typoderus* Marshall, 1953 (Angola). Zherichin (1987) recognized an "Anchonidium-group" for some Himalayan Molytinae. The author suggested that this informal group, to be named Typoderina, includes *Anchonidium* Bedel, 1884, *Pseudoancho-nidium* Osella, 1979, *Aparopion* Hampe, 1861, *Caulomorpha* Faust, 1886, *Echinomorpha* Fauvel, 1889, *Microcopes* Faust, 1886, *Orinanchonus* Voss, 1965, *Aparopionella* Hustache, 1939, *Typoderus* Marshall, 1953 and *Microplinthus* Zherichin, 1987. However, Zherichin did not formalize the proposal. Alonso-Zarazaga & Lyal (1999) accepted Zherichin's opinion, without any critical justification, and added several genera to Typoderina: *Neoancho-nidium* Hoffmann, 1968, *Subancho-nidium* Hoffmann, 1968, *Cotasteridius* Péringuey, 1908, *Merunymus* Hoffmann, 1965, *Miopus* Marshall, 1949, *Niphadomimus* Zherichin, 1987, *Oromia* Alonso-Zarazaga, 1987, *Pentaparopion* Morimoto, 1982, *Plessinellus* Hoffmann, 1964, *Styphlo-deres*

Wollaston, 1873, *Entypoderus* Voss, 1965. *Caulomorphus* Faust, 1886 was transferred to *Plinthina*; *Echinomorphus* Fauvel, 1889 and *Microcopes* Hustache, 1930 to *Cossoninae* Dryotribini. *Typoderina* sensu Alonso-Zarazaga & Lyal (1999) appears to be a rather heterogeneous group. M. Meregalli (Torino, personal communication), who is presently revising some Himalayan genera of *Molytinae*, confirms relationships between Himalaya and Central Africa for some genera of *Molytinae*, as is the case of *Niphades* Pascoe, 1871. However, he notes that sternite VIII of females differs between *Typoderus* and other palaeartic genera ascribed to the tribe. The attribution of *Aparopion* to *Cycloterina*, suggested by Solari (1941), Marshall (1932) and Alonso-Zarazaga (1987) does not seem acceptable for morphological and biogeographical considerations: *Cycloteres* Schönherr, 1843 is a genus with 97 known species from Madagascar and Comores Islands (Richard, 1981); the subtribe is mainly tropical afro-american (Alonso-Zarazaga & Lyal, 1999). Thus, inclusion of *Pseudaparopion* gen. n. in *Typoderina* only basing on its presumed affinity with *Aparopion* is only hypothetical. For the present time, we ascribe *Pseudaparopion* to the "Anchonidium group" sensu Zherichin (1987).

#### KEY TO SPECIES OF *PSEUDAPAROPION* GEN. N.

- 1     Size smaller (3.25 mm). Scutellum invisible. Intervals wider than striae, with small punctures and short setae. Tarsus with segment 2 as wide as long and segment 3 bilobate. Lenkoran (Azerbajdzan) . . . *P. aequale* (Reitter)
- Size larger (3.95 mm). Scutellum very small. Intervals as wide as striae, with small granules and two rows of setae. Tarsus with segment 2 wider than long; segment 3 strongly bilobate. Mazandaran (Iran) . . . . *P. kadleci* sp. n.

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**Revision of the genus *Anonconotus* Camerano, 1878 (Orthoptera: Tettigoniidae) with description of *A. pusillus* sp. n. and *A. baracunensis occidentalis* ssp. n.**

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**Revision of the genus *Anonconotus* Camerano, 1878 (Orthoptera: Tettigoniidae) with description of *A. pusillus* sp. n. and *A. baracunensis occidentalis* ssp. n.** - The three species known to date are redescribed. The taxonomic importance of morphological characters is discussed; characters taken one by one are generally difficult to use, but the combination of several characters can be used successfully for identification. No taxonomic change occurs in either *A. alpinus alpinus* (Yersin, 1858) or in *A. a. italo-austriacus* Nadig, 1987. *A. apenninigenus* (Targioni-Tozzetti, 1881) is redescribed; this species is shown to be limited to the Apennine mountains and is not present in the Alps as previously thought. The Alpine populations which were considered as *A. apenninigenus* actually belong to *A. pusillus* sp. n. (populations north of Susa Valley) and to *A. baracunensis occidentalis* ssp. n. (south of Susa Valley). *A. b. baracunensis* Nadig, 1987 is limited to a very small area near the Mon Viso Mountain. A distribution map shows the updated distribution ranges of these allopatric(-parapatric) taxa in the Alps and in the Apennine mountains.

**Key-words:** Orthoptera - Tettigoniidae - Platycleidini - *Anonconotus* - identification - taxonomy - distribution.

INTRODUCTION

The diagnostic characteristics of the genus *Anonconotus* Camerano, 1878 are the wrinkled upper surface of the pronotum and the relatively short antennae and post-femora. The type species of the genus is *A. alpinus* (Yersin, 1858). The genus is endemic to the Alps and to the Apennine mountains (Harz, 1969). Few studies of this small genus of bush-crickets (Tettigoniidae) have been performed and many past misidentifications make previous references difficult to use. The main references are Griffini (1892), Chopard (1952), Baccetti (1954) and Harz (1969) for general remarks

on the genus, and Dreux (1962) and especially Nadig (1987) for the redescription, distribution and ecology of the different species. The song has been recorded and described by Heller (1988) and Ragge & Reynolds (1998).

Until 1987, the genus included only two described species, *A. alpinus* (Yersin, 1858), described from the Swiss Alps, and *A. apenninigenus* (Targioni-Tozzetti, 1881), described from the Apennine Mountains. For a long time, the distinction between the two species was considered difficult, as the very brief original description of *A. apenninigenus* lacked any kind of diagnostic character and, being based on a single ♀, was of limited value. The characters given by Chopard (1952) were not distinctive either. Both species were even synonymised by La Greca (1985). In 1987, a third species, *A. baracunensis* Nadig, 1987, was described from the Italian Alps.

In 1999, we discovered some populations of *Anonconotus* in the Grées Alps (North-Western Italian Alps) whose morphological characteristics did not match any of the two previously described species. We extended our study area and examined Apennine and other Western-Alpine populations, and soon faced further difficulties in identification. Harz (1969) and mainly Nadig (1987) redescribed *A. apenninigenus* on the basis of Alpine specimens. Actually, as we quickly noticed, topotypical and Alpine populations do not belong to the same species. Moreover, we observed that the Alpine populations of "*A. apenninigenus*" included not one but two different taxa. It therefore appeared very useful to us to redescribe all taxa of this genus and to provide a new identification key.

## MATERIAL AND METHODS

We indicate the origin of the studied material in the descriptions of the species and in the Appendix. The collections of Nadig and Harz that we examined are deposited in the Muséum d'histoire naturelle of Geneva (Switzerland) and the collection of La Greca in the Museo Civico di Storia Naturale of Milano (Italy). The *Anonconotus* collected by Yersin are distributed between Geneva (most of the specimens), Lausanne (Musée zoologique) and Zürich (Eidgenössische Technische Hochschule Zürich). Unfortunately there has been no access to the important collection of Dreux (Museum national d'Histoire naturelle of Paris).

Our own specimens were collected mainly between 1998 and 2001, at several localities in the Western Alps, especially in the Hautes-Alpes, Alpes de Haute-Provence (France), Aosta Valley, Piemonte and Apennine (Italy). For the body color analysis, some specimens were photographed. All photos were taken by the authors unless otherwise stated.

Part of the collected and examined material was used for biometrical measurements. Sizes are given in mm. Using a micrometric lens, we measured the length of the postfemur and of the pronotum. Measurements were mainly taken from ♂♂ specimens, which hold most of the taxonomic characters and are of greater help for identification than ♀♀. As the measured specimens were not sampled randomly, we did not carry out statistical tests but rather presented the results in a scatter diagram, which gives a good view of the variability.

The shape of the titillators is a useful character if their tridimensional ultra-structure can be visualized properly. The apical part of the titillator is the toothed part,



the rest is named the basal part. Some pairs of titillators, which were relevant to show intra- and interspecific variability, were micrographed with a SEM in the Muséum d'histoire naturelle of Geneva (see acknowledgements). The titillators of most of our ♂♂ were extracted within a few hours or days of collection. They were quickly cleaned in alcohol to avoid distortion and then displayed on cards which were pinned below the insect.

Preliminary notes on morphology and abbreviations used in the "Description of species and subspecies" section:

coll.	collection
DOBA	dorso-abdominal median band (upper surface of the abdomen, forming a band often limited by the DOLI)
DOLI	dorso-lateral abdominal lines (pale-colored lines running along the abdomen, between the dorsal and lateral parts of the abdomen: see Figs 2e and 2f for examples)
EL	elytra
META	metanotum
Paranota	lateral lobes of the pronotum
PF	postfemora
PR	pronotum
TIT	titillators
T1	first abdominal tergite
T2	second abdominal tergite

## RESULTS

### TAXONOMICALLY IMPORTANT CHARACTERS

Nadig (1987) rightly emphasized the importance of body size, size and venation of elytra, titillators shape and, to a lesser extent, body color and pattern for identification. The color of the titillators of mature specimens is, for one species (*A. pusillus* sp. n.), a useful character. Coloration of the elytra, as well as pronotum size and shape, are also important characters for us. Harz (1969) and Bellmann & Luquet (1995) use the protruding part of the elytra to separate *A. alpinus* from *A. apenninigenus*. The size of elytra is indeed a very important character, but can also be misleading, as the length of the pronotum and the elytra may vary independently and the elytra may appear more or less protruding depending on the size of the pronotum. We recommend observing the elytra from a lateral or slightly dorsolateral view.

### TAXONOMIC DECISIONS

The Alpine populations of "*A. apenninigenus*" are described as *A. pusillus* Carron & Sardet sp. n. and *A. baracunensis occidentalis* Carron & Wermeille ssp. n. *A. baracunensis* Nadig, 1987 is a polytypic species with two subspecies. *A. apenninigenus* (Targioni-Tozzetti, 1881) only exists in the Apennine mountains. The taxonomic status of *A. alpinus alpinus* (Yersin 1858) and *A. alpinus italoaustriacus* Nadig, 1987 remains unchanged. Syntypes are designated for *A. a. alpinus*. *Anonconotus ghiliani* Camerano, 1878 is considered as a synonym of *A. alpinus alpinus* (Yersin, 1858).

IDENTIFICATION KEY TO THE SPECIES AND SUBSPECIES OF THE GENUS *ANONCONOTUS**Male*

- 1 Elytra cream-white with at most a faint buffish or yellowish tinge (which disappears on dry specimens in collections); pronotum elongated at the rear, more than 5 mm in length . . . . . 2
- Elytra distinctly yellow; pronotum shorter, less than 6 mm . . . . . 4
- 2 Apex of elytra reaching at least 4/5 of the first abdominal tergite, usually reaching the first 1/5 of the second tergite; apical part of titillators brown, elongated and pointed, with many medium-sized teeth, basal part black and long, flattened, generally widened basally, shape as in Fig. 7-8. 3 (*alpinus*)
- Elytra shorter, not reaching the middle of the first abdominal tergite; apical part of the titillators very elongated, regularly curved, pointed, with many small teeth, basal part brown, not or less flattened, regularly curved in a U-shape, as in Fig. 12a-b . . . . . *apenninigenus*
- 3 Basal part of the titillators strongly widened in the middle, tapering towards the very narrow tip (according to Nadig, 1987) *alpinus italoaustriacus*
- Basal part of the titillators not or only slightly widened in the middle, of subequal width to the broadly rounded tip . . . . . *alpinus alpinus*
- 4 Titillators (Fig. 15-16) smaller, with a brown, short, fine, pointed apical part with medium-sized teeth; basal part light brown, thick and not flattened, regularly curved, never twisted; in living specimens stature slender, larva-like, abdomen distinctly narrower, parallel-sided as seen from above; two light buff-whitish dorso-lateral abdominal lines always present, dorso-abdominal median band brown or reddish-brown, rarely brownish olive; pronotum and hind femora shorter (Fig. 3); elytra smaller, deep or, generally, light yellow . . . . . *pusillus*
- Titillators larger, with a brown, pointed or rounded (with intermediates) apical part with large teeth; basal part usually black or dark brown, flattened and twisted, or simply bent or curved; in living specimens stature plumper, with wider abdomen, more convex-sided as seen from above; light buff dorso-lateral abdominal lines generally absent, dorso-abdominal median band always green except in rare, completely brown ind.; pronotum and hind femora longer (Fig. 3); elytra larger, generally deep yellow . . . . . (*baracunensis*)
- 5 Apical part of titillators broadly rounded, appearing truncated, basal part generally not twisted (Fig. 12c) . . . . . *baracunensis baracunensis*
- Apical part of titillators different, pointed or slightly rounded, basal part of variable shape, generally twisted (Fig. 13-14) . . . *baracunensis occidentalis*

*Female*

- 1 Elytra distinctly cream-white, reaching the hind margin of the metanotum (very rarely only the 2/3), often the first 1/5 of the first abdominal tergite . . . . . *alpinus*
- Elytra whitish, greyish or yellowish, not reaching the hind margin of the metanotum, color less distinct because of reduced size . . . . . 2

- 2 Identification possible only of populations, not of single specimens.  
More than 50 % (usually 99 %) of the ind. of a population with continuous, buffish-white dorso-lateral abdominal lines . . . . . *pusillus*
- Less than 50 % (usually about 10 %) of the ind. of a population with continuous, buffish-white dorso-lateral abdominal lines 3 (separation of following species difficult)
- 3 Elytra larger, whitish, never yellowish, usually visible; postfemora usually flesh-colored with pinkish or greenish (never yellowish ?) tinge; pronotum on average more elongated . . . . . *apenninigenus*
- Elytra smaller, greyish, whitish or yellowish, usually not visible; postfemora flesh-colored or light brown often with a yellowish tinge; pronotum on average less elongated . . . . . *baracunensis*

## DESCRIPTION OF THE SPECIES AND SUBSPECIES

1. *Anonconotus alpinus* (Yersin, 1858)*Pterolepis alpina* Yersin, 1858*Analota alpina* (Yersin, 1858) – Brunner von Wattenwyl, 1882*Anonconotus glilianii* Camerano, 1878 **syn. n.**1. 1. *A. alpinus alpinus* (Yersin, 1858)

Type designation: the material collected by Yersin which comprises 28 adults and larvae of *A. alpinus alpinus* had been considered as “unknown” until we discovered it in Geneva, in April 2002. We designated and labelled as syntypes the 10 specimens collected in the locus typicus (explicit individual label). Of the 18 remaining, one was collected in the Jura mountains (Reculet) but there is no indication of the collecting site for the 17 others so we decided as a precaution to expressly exclude them from the type series. In the original description Yersin (1858) explicitly writes “The *Pterolepis* which I used for my description come from the summits of the Alps near Morcles...”.

Syntypes (with original labelling): adult ♂, “*Analota alpina* Yers., 27.IX, Alp Rosseline”; adult ♀ “Morcles Alpes, a/1666”; adult ♀ “*Pterolepis alpina* Yersin, coll. Yersin, Morcles Alpes, a/1666”; two larvae males and one larva ♀ “*Ptero. alpina* Yers., coll. Yersin, Morcles Alpes, a/1666” (all in the Museum of Geneva). One pair “*Pterolepis alpina* Yers., ♂ and ♀, Alp. Rosseline D<sup>e</sup> de Morcles, Yersin” (Zürich). One pair “Morcles, Alpes” (Lausanne).

Type depositories: Muséum d’histoire naturelle of Geneva, Switzerland (6 specimens); Eidgenössische Technische Hochschule Zürich (one pair), Switzerland; Musée zoologique of Lausanne, Switzerland (one pair).

Locus typicus: Switzerland: Alps near Morcles in the canton of Vaud.

Material examined (no. of imagoes of both sexes): 63 in coll. Carron, 3 in coll. Harz, 306 in coll. Nadig and about 200 in coll. La Greca; material from many localities covering the whole distribution range, including the locus typicus (Appendix).

Size: ♂ (n = 78): PF 10.7-14.9; PR 5.3-8.0; ♀ (n = 19): PF 12.5-14.8 (15.3 in Harz, 1969), PR 6.3-7.1 (7.8 in Harz, 1969). See Fig. 3. ♂ with largest PR/PF are from lowland localities of the southern part of the range: Col de Perty, 1100-1300 m, Mont Ventoux, 1450-1650 m, Col de Maure, 1346 m. Smallest ♂ mostly from the Alps of the canton of Vaud, at the type locality.

PR shape: variable but longer, posteriorly more elongated and wider than in other species (Fig. 3, 4d, 5d).

Elytra: ♂: shape and venation in Nadig (1987) and Heller (1988). EL (Fig. 4d and 6d) reaching 4/5 of T1 to 1/3 of T2. EL cream-white with, especially in northern populations, a light yellowish tinge which disappears on dry specimens. Venation less

reduced than in other species. ♀: EL (Fig. 5d) usually reaching 1/5 to 1/3 of T1, always visible in living specimens, rarely completely hidden under the PR in some dry specimens; EL color as in ♂♂.

Titillators: variation in shape and size given in Fig. 7-8. Apical part light or dark brown, straight, typically fine and elongated, with small and medium-sized teeth; basal part deep shining black, flattened, more or less elongated and widened in the middle, never twisted.

Body color and pattern: variable species, with background color varying from dark brown to light green (Fig. 1a-d). DOLI not continuous, mostly formed by series of black and buffish spots, rarely forming uninterrupted buff-whitish lines. Ventral part of paranota whitish, rather dull, usually lacking the bright yellowish or mint-green tinges of *pusillus* sp. n. and *baracumensis* - if present, usually limited to the anterior part of the paranota, behind the head. PF (♂, ♀) flesh-colored with pinkish tinge, generally without yellowish tinge. See also Nadig, 1987. The beautiful original painting by Alexandre Yersin himself, published in the *Annales de la Société Entomologique de France* in 1858, is reproduced here (Fig. 6e-f) with the kind permission of the *Rédaction des Annales de la Société Entomologique de France*.

Song: succession of echemes each lasting 1.5 to 2.5 (1-3) seconds (Heller, 1988; Ragge & Reynolds, 1998).

Distribution: see Fig. 17 and Appendix. External side of the alpine Arc, from the Département of Alpes Maritimes (col de la Cayolle) and Vaucluse (Mont Ventoux) to the Swiss Western Prealps and Alps. There is an erroneous reference by Chopard (1952) in Saint-Martin Vésubie which refers to *A. baracumensis occidentalis* ssp. n. In the Western Alps, *A. a. alpinus* enters Italy only in Susa Valley, Col of the Petit-Saint-Bernard and eastwards through the northern side of the Aosta Valley as far as the Biella region. Also a few data exist from the Eastern Alps, in Austria (Arlberg, N-Tirol) and Italy (S-Tirol) (synthesis in Nadig, 1987); more research is needed in this region.

## 1. 2. *A. alpinus italoaustriacus* Nadig, 1987

Holotype ♂ (examined). Well preserved, dry specimen with titillators mounted on card. Collected by Nadig on 3. IX. 1982.

Locus typicus: border Austria / Italy: Southern Tirol, Pustertal: Strickberg above Innichen, 2050-2150 m.

Type depository: Muséum d'histoire naturelle of Geneva, Switzerland.

Other material examined: paratypes (4 ♂, 2 ♀) in coll. Nadig.

Titillators: basal part of the TIT strongly widened in the middle, tapering towards the very narrow tip (see drawing in Nadig, 1987). The shape of the TIT is the only character separating this ssp. from the nominotypical ssp.

Distribution: E-Tirol (Austria) and S-Tirol (Italia / Austria) (Fig. 17).

FIG. 1

Left: *A. alpinus*. Topotypical ♂ (a) and ♀ (c), Switzerland, Portail de Fully, September 1999; ♂ (b) ♀ (d), France, Col d'Allos, August 2001. Right: *A. apenninigenus*: ♂ (e - f) and ♀ (g - h), Italy, Monti Sibillini, Val Bolognola, September 2001. Note whitish elytra of both sexes. (Photos f and h by Bertrand Baur).





## 2. *Anonconotus apenninigenus* (Targioni-Tozzetti, 1881)

*Omalota apenninigena* Targioni-Tozzetti, 1881

*Analota apenninigena* (T.-Tozzetti, 1881) – Brunner von Wattenwyl, 1882

*Anonconotus alpinus*; La Greca 1985 (partim) (nec Yersin, 1858) – misidentification

Holotype ♀ (examined). Specimen in alcohol, dissected in the middle of the abdomen, shape also altered by long conservation in alcohol (Fig. 10). Original label (Fig. 9): “*Omalota apenninigena*. M. 484. Coll. [361. ? unreadable]. 1866. St. Ilario. R. Museo di Fis.e St. Nat. Di Firenze”. Along with the original label, two other, recently created (by whom?) labels: “0546 Holotypus ♀” and “La Specola - Firenze, *Omalota apenninigena* n. sp. Targ. Tozz. 1881, Olotipo e allotipo, S. Ilario (Fi)”.

Type depository: Museo zoologica “La Specola” of Firenze, Italy.

Locus typicus: Italy: Apennine mountains, precise locality unidentified (indications from Targioni-Tozzetti doubtful).

Other material examined (no. of imagos of both sexes): 3 in coll. Carron and 24 in coll. Nadig, all from Italy Monti Sibillini, Val Bolognola; 2 in coll. La Greca, from Italy Monti Reatini, Jaccio Crudele.

We assume that Targioni-Tozzetti collected only two specimens as there is no other specimen in the entire Firenze museum material with the exception of a pair of *A. pusillus* sp. n. collected by “Isp. For. Di Torino in Torino” in 1879. Targioni-Tozzetti did not designate any types in his description of the species, or on the label joined to his material. As his description clearly refers to a single ♀ specimen (one value for each measurement given, no indication on variability), there is no reason to think that this is not the holotype. Along with the holotype, a subadult male is labelled as “allotype” (Fig. 11).

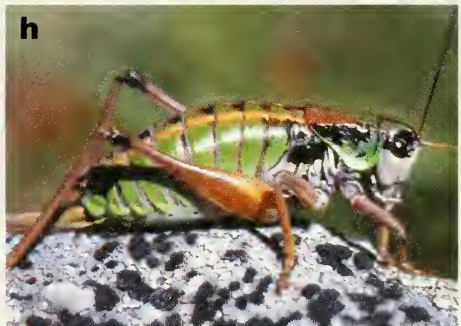
The precise locus typicus should be considered as doubtful. The only indication in the original description is “In subapenninis prope Florentiam reperta” (found in the lower Apennine near Firenze). In our research we could not find any Santo Ilario (or Sant’Ilario) above 800 m a.s.l. in the whole Tuscany region, nor any locality bearing this name situated close to a mountain where the species could live. Later, Targioni-Tozzetti (1898) mentioned *Analota apenninigena* from Roccaforte (Firenze). Baccetti (1954) found that these specimens, identified by T.-Tozzetti and labelled *Anatola apenninigena* were *Pholidoptera*. Moreover, in spite of our thorough research, no Roccaforte was to be found in the Tuscany region. Furthermore, a new label has recently been placed with these *Pholidoptera*, indicating that they were collected in 1878 by Cavanna in “Roccaforte RC = Reggio Calabria”, thus in the extreme south of Italy.

Interestingly, in a report of a meeting of the Italian Entomological Society, Cavanna (1881) wrote these words: “Il Presidente prof. Targioni Tozzetti describe le seguenti specie nuove di Ortoteri italiani: 1 *Ectobia*..., 6 *Thamnotrizon Brunneri* della Majelletta in Abruzzo, 7 *Omalota apenninigena* della Consuma, 8 *Pezotettix brutius* del Monte Morrone in Abruzzo...” The mention of “Consuma” does not correspond

FIG. 2

Left: *A. baracunensis occidentalis* ssp. n.; a-b = ♂, d = ♀, Italy, colle dell’Assietta, August 1998. Note plump outline and green upper-side of abdomen of ♂♂; c = ♂ with rare grey-brownish coloration on whole body. France, col de Montgenèvre, August 2000. Right: *A. pusillus* sp. n.: e-f = ♂, h = ♀, Italy, Aosta Valley, Lillaz, August 1999. Note slender outline and striped pattern of ♂♂; g = ♂ with unusual brownish olive upper-side of abdomen, Italy, Canavese, Santa Elisabetta, August 2000.





with the locality given 15 years before by T.-Tozzetti, and it is difficult to understand the origin of this record. It certainly refers to the Passo del Consuma, 27 km west of Firenze, situated at an elevation of 1060 m, where the collecting site might have been. Nevertheless, there is still some reason to doubt. In September 2001, we visited all the higher meadows in the Pratomagno Chain and the Monte Falterone, very close to Consuma, and, although we might have missed the species, we found neither *Anonconotus* nor suitable habitats. Potentially suitable sites were found in the pastures of Monte-Secchieta – Poggio Uomo di Sasso and on the Monte Falco, where some alpine relicts like the flower *Gentiana verna* can be found. Secondly, we can not exclude an error in the labeling of the material. As Cavanna reports, T.-Tozzetti described in the same period species from Monte Morrone and Majelletta. These mountains are situated close to the Maiella region which is situated 280 km south of Firenze and where alpine habitats are known to exist. Moreover, there is a locality named Sant'Ilario (Sangro) in this exact region! However, Baccetti (1959) studied the Orthoptera of the Maiella and did not find *Anonconotus* so the question is still open.

To our knowledge, no *Anonconotus* specimen except those of T.-Tozzetti has been collected in the Tuscany by any orthopterist. The locality closest to Firenze, where *A. apenninigenus* can presently be found is the Monti Sibillini (Marche region), where it was first discovered by Galvagni (1959) and where Nadig (and we) collected some specimens. In conclusion, we consider the locus typicus as the "Apennine mountains", with the precise locality unidentified.

Size: ♂ (n = 15): PF 11.3-12.5; PR 5.3-5.9; ♀ (n = 14): PF 12.4-14.3; PR 5.9-6.7. Holotype (♀): PF 13.4; PR 5.2 abnormally wrinkled (Fig. 10) and contracted, probably by conservation in alcohol. These values give an incomplete aspect of the variability because of few specimens measured, but values tend to be intermediate between *alpinus* and *baracmensis* (Fig. 3).

PR shape: intermediate between *alpinus* and *baracmensis*, moderately elongated (Fig. 3, 4c, 5c).

Elytra: ♂ (Fig. 4c and 6c): a little shorter than in *A. alpinus*, apical part and anal field reduced. In lateral view, apex reaching 9/10 of the META to 1/4 of T1. EL cream-white or white with a light buffish tinge, without yellowish tinge; apical, colored part reduced. In dorsal view, only apical part of EL protruding from under the PR. ♀: EL (Fig. 5c) reaching 1/3 to 2/3 of the META, thus usually clearly visible in living specimens; EL whitish or grey whitish, never yellowish. Holotype: EL reaching about 1/4 of the META, protruding from under the PR.

TIT: we could see only 6 pairs of TIT in specimens from the Monti Sibillini (Val Bolognola) and one pair in a ♂ from another Mountain Massif, the Monti Reatini, 50 km S-W of the Monti Sibillini. The three-dimensional structure and the shape are clearly different from those in other species (Fig. 12a-b). All brown in color; apical part typically very elongated, curved, pointed with many small teeth; basal part only slightly flattened, regularly curved in a U-shape, twisted or not.

Body color and pattern: ♂ dark brown with reddish tinge (Fig. 1e-f), ♀ green (Fig. 1g-h) or completely brown; DOLI buff-whitish, not continuous. PF (♂, ♀) flesh-colored with greenish or pinkish tinge.



Song: around mid-day on 9. X. 2001, after 4 weeks of silent captivity in Carron's office, a ♂ suddenly produced three echemes of about 3 (beginning missed), then 6 and 8 seconds, respectively. The observer could directly watch the ♂ sing and observe the movements of the EL. During the song the PR was raised to give space to the moving EL, and the subgenital plate was strongly lowered and the usually hidden soft parts of the abdomen's apex were somewhat protruded. The song could be heard from a distance of 40 cm only. These three echemes were the only ones that we heard, in spite of long observations afterwards. The echemes are distinctly longer than in *A. alpinus* (1.5-2.5 seconds: Heller, 1988). It seems that the factor inducing the song was the exposure to bright sun light. These are the first observations ever reported on the song activity of this species.

Distribution: Fig. 17; Apennine: verified data only from Monti Sibillini (Marche region) and Monti Reatini (Lazio region).

### 3. *Anonconotus baracunensis* Nadig, 1987

#### 3. 1. *Anonconotus baracunensis baracunensis* Nadig, 1987

Holotype ♂ (examined). Well preserved, dry specimen with titillators mounted on card. Collected by Nadig on 30. VIII. 1985.

Type depository: Muséum d'histoire naturelle of Geneva, Switzerland.

Locus typicus: Italy: Piemonte: V. Carbonieri, under Cle. Baracun, 2020 m.

Other material examined (no. of imagos of both sexes): paratypes (7 ♂, 4 ♀), 70 from locus typicus; from France, Queyras, Belvédère du Viso; from Italy, Val del Po, Pian del Re, all in coll. Nadig; 16 in coll. Carron from France. Queyras, Belvédère du Viso and from Italy, Val del Po, Pian del Re; 2 in coll. La Greca from Italy, Val del Po, Pian Melzé and Rocce Losere.

Size: ♂ (n = 34): PF 10.0-13.1 (holotype: 13.5\*); PR 4.2-5.3 (holotype: 5.0\*); ♀ (n = 5): PF 13.2-14.1; PR 5.3-5.7. Values give an incomplete aspect of the variability because of few measured specimens. See Fig. 3. [\* = values given by Nadig (1987).]

TIT: (Fig. 12c). Brown or dark brown, not (never ?) black; apical part typically broadly rounded and bent outwards, appearing truncated, with a variable number of large teeth, sometimes also with small teeth between the large ones; basal part variably flattened and widened in the middle, generally not twisted but simply bent.

Song: no spontaneous song was recorded by Heller (1988).

Other characters: see *A. b. occidentalis*.

Distribution: Fig. 17 and Appendix; distribution area limited to a very small region north of the Mon Viso Mountain.

#### 3. 2. *Anonconotus baracunensis occidentalis* Carron & Wermeille ssp. n.

*Anonconotus apenninigenus*; Chopard 1952, Harz 1969, Nadig 1987 (partim) (nec Targioni-Tozzetti, 1881) - misidentifications

*Anonconotus alpinus*; La Greca 1985 (partim) (nec Yersin, 1858) - misidentification

Holotype ♂. France: Hautes-Alpes, Col d'Izoard, 10. IX. 2000, leg G. Carron. Dry specimen with titillators mounted on card.

Type depository: Muséum d'histoire naturelle of Geneva, Switzerland.

Locus typicus: France: Hautes-Alpes, col d'Izoard (north-exposed side, near Refuge Napoléon), 2300-2400 m.

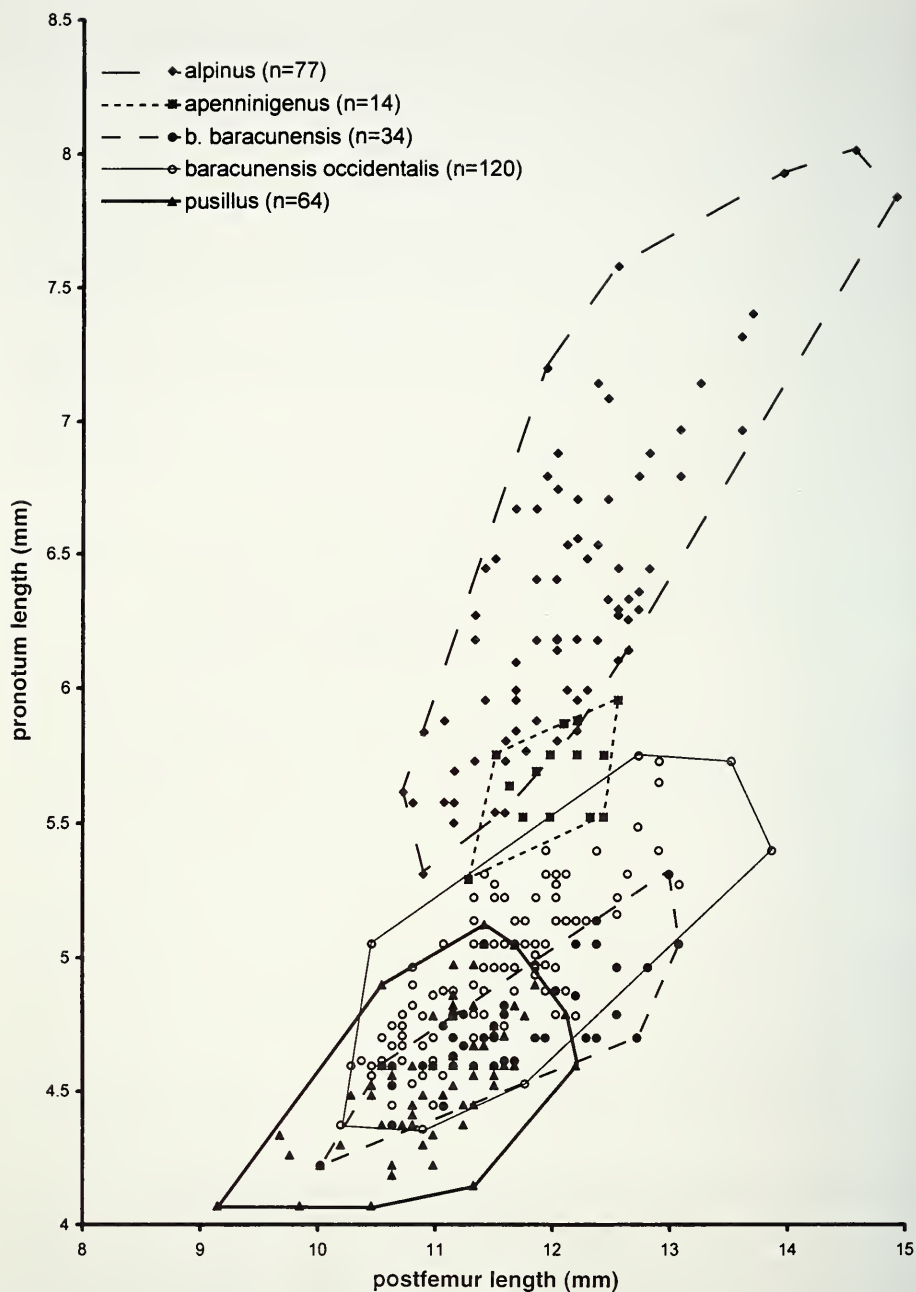


FIG. 3

Scatter diagram of postfemur (x) and pronotum (y) lengths. Scale of Y-axis expanded. "Convex polygons" drawn by joining "extreme" values. Large variability in all species; less interspecific overlap on pronotum than on postfemur length.

Paratypes from the locus typicus (8 ♂, 1 ♀, same date), and from France: Col de Montgenèvre, north-exposed slopes south of the col (5 ♂, 1 ♀ 9. IX. 2000); in Mus. Geneva.

Other material examined (no. of imagos of both sexes): 27 in coll. Carron, 2 in coll. Harz, 403 in coll. Nadig and about 250 in coll. La Greca; material from many localities covering the whole distribution range (Appendix).

Derivatio nominis: *occidentalis* = “western”; the species name refers to the distribution area of the taxon, which is endemic to the Western Alps. This geographically “broad” term has been chosen to indicate that it is much more widespread than the nominotypical ssp.

### *Differential diagnosis*

♂ easily distinguishable from those of *A. alpinus* and *A. apenninigenus* by the yellow (instead of whitish) EL and shorter pronotum, and from *A. pusillus* by the larger, plumper body structure, green DOBA and absence of DOLI. It can also be separated from all other taxa by the color, size and shape of the TIT, although differences are sometimes rather indistinct.

♀: very similar to those of other species, with the exception of *A. alpinus*, which has much larger EL; isolated specimens impossible to identify with certainty. *A. pusillus* ♀ have continuous DOLI. Populations with less than 20 % of the ♀ with continuous DOLI undoubtedly belong to *A. baracunensis* or *A. apenninigenus*. *A. apenninigenus* has larger EL, a slightly more elongated PR (averages = 6.2 vs. 5.4), and lacks a yellowish tinge on PF (often present in *A. baracunensis*).

### *Description of the holotype*

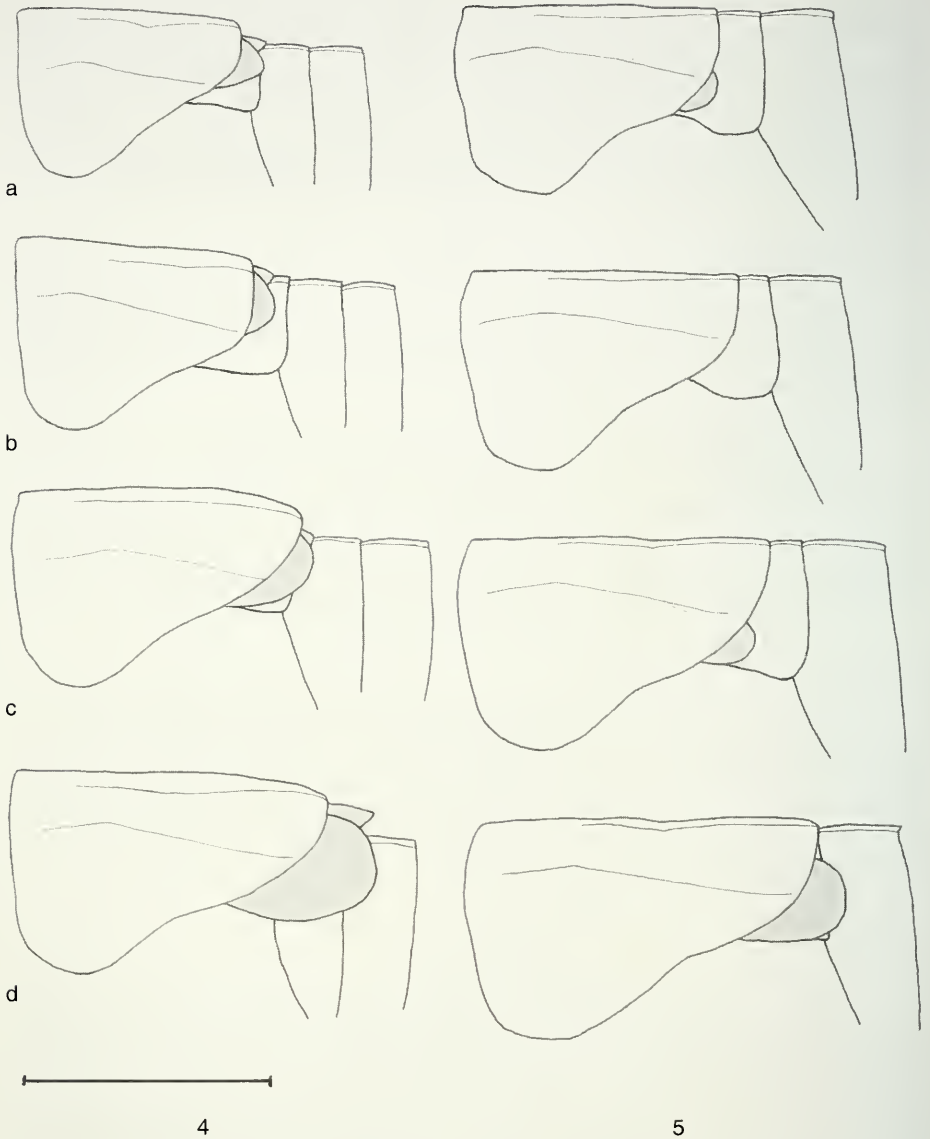
Size: PF 11.0; PR 5.0. EL: left reaching 4.5/5, right EL reaching 4/5 of the META, both clearly protruding from under the pronotum. DOBA green, DOLI buff-whitish, visible only on the first abdominal tergites. PR: paranota black, only ventrally whitish. TIT: apical part brown, conical, with blunt apex, with 5 teeth on each TIT; basal part brown-black, forming an angle with the apical part, flattened, widened basally, medially bent-twisted, becoming more slender distally.

### *Variation*

Size: ♂ (n = 121): PF 10.2-13.9; PR 4.4-5.7; ♀ (n = 21): PF 11.8-14.1; PR 4.6-5.5 (values for ♀ give an incomplete aspect of the variability because of few measured specimens). Important intraspecific variation of PF/PR lengths within and between localities. Largest PF found in the south-eastern part of the range (Italy: Valle dell'Arma, 1300-1600 m) and shortest in the north-western part (France: Col d'Izoard, 2400 m). This suggests a latitudinal gradient, but altitude also has a strong influence on size (shortening with increasing altitude). See Fig. 3.

PR shape: variable, not elongated at the rear (Fig. 3, 4 b, 5 b).

EL: in ♂ (Fig. 4b, 6b) reaching 3/4 of the META to 1/4 of the T1; smaller than in *A. apenninigenus*, with apical part more reduced and venation even more indistinct. See also the drawing by Nadig (1987), which was given for the Alpine “*apenninigenus*” and actually refers to *b. occidentalis*. EL generally deep, bright yellow, with a waxy appearance. ♀ (Fig. 5b): EL reaching usually 1/5 to 1/4 of the META, usually completely hidden under the PR; whitish, yellowish or grey.



FIGS 4-5

Pronotum, metanotum, elytra (shaded) and first abdominal tergites of ♂ (Fig. 4) and ♀ (Fig. 5) *Anonconotus* spp.; lateral, slightly from above view; a = *A. pusillus* sp. n., b = *A. baracunensis*, c = *A. apenninigenus*, d = *A. alpinus*. Scale = 5 mm. These figures show "average" morphology, species are difficult to separate on the basis of only these characters (see text for variability).



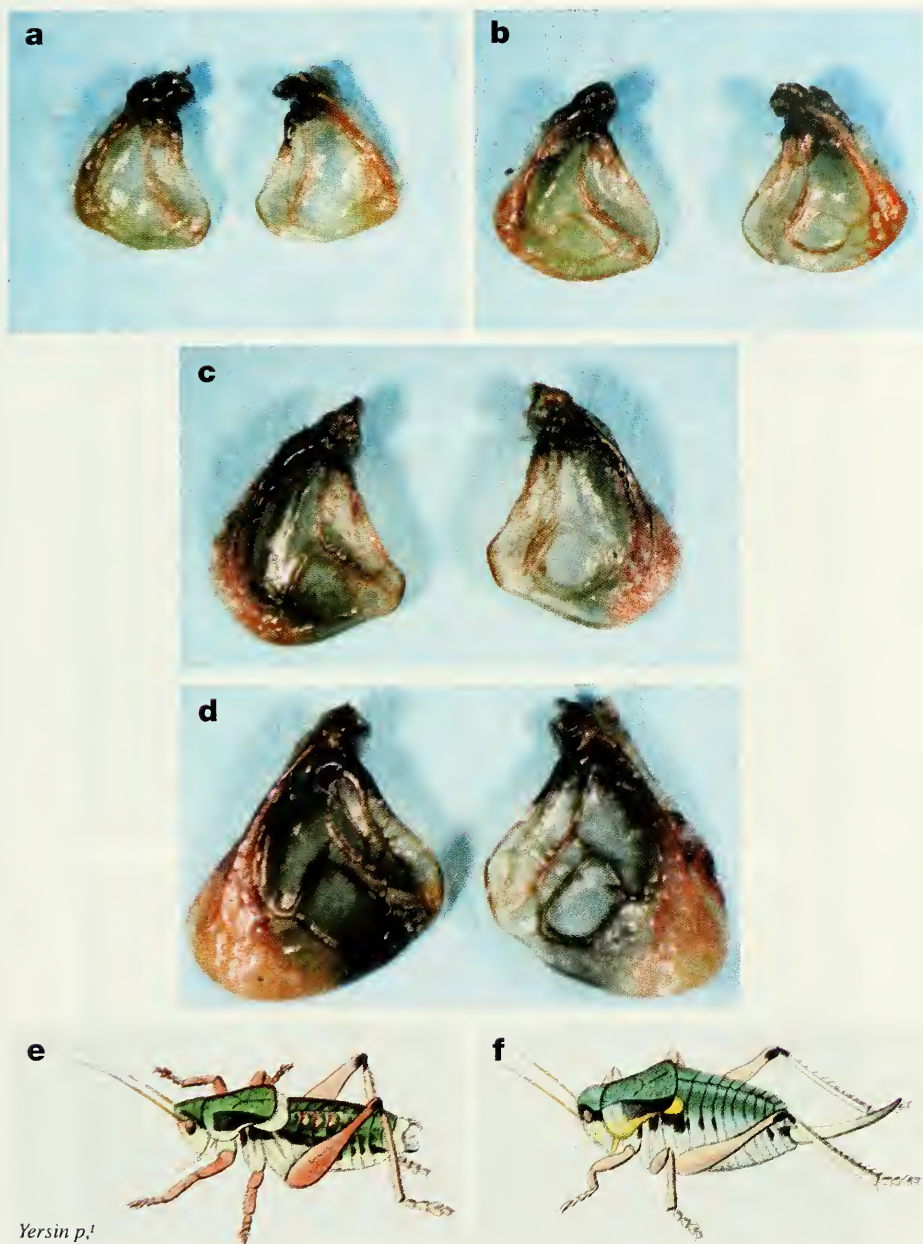


FIG. 6

a-d: Elytra of *♂* *Anonconotus* spp., a = *A. pusillus* sp. n., b = *A. baracunensis*, c = *A. apenninigenus*, d = *A. alpinus*; e-f: *♂* and *♀* of *A. alpinus alpinus* painted by Yersin (1858) himself.

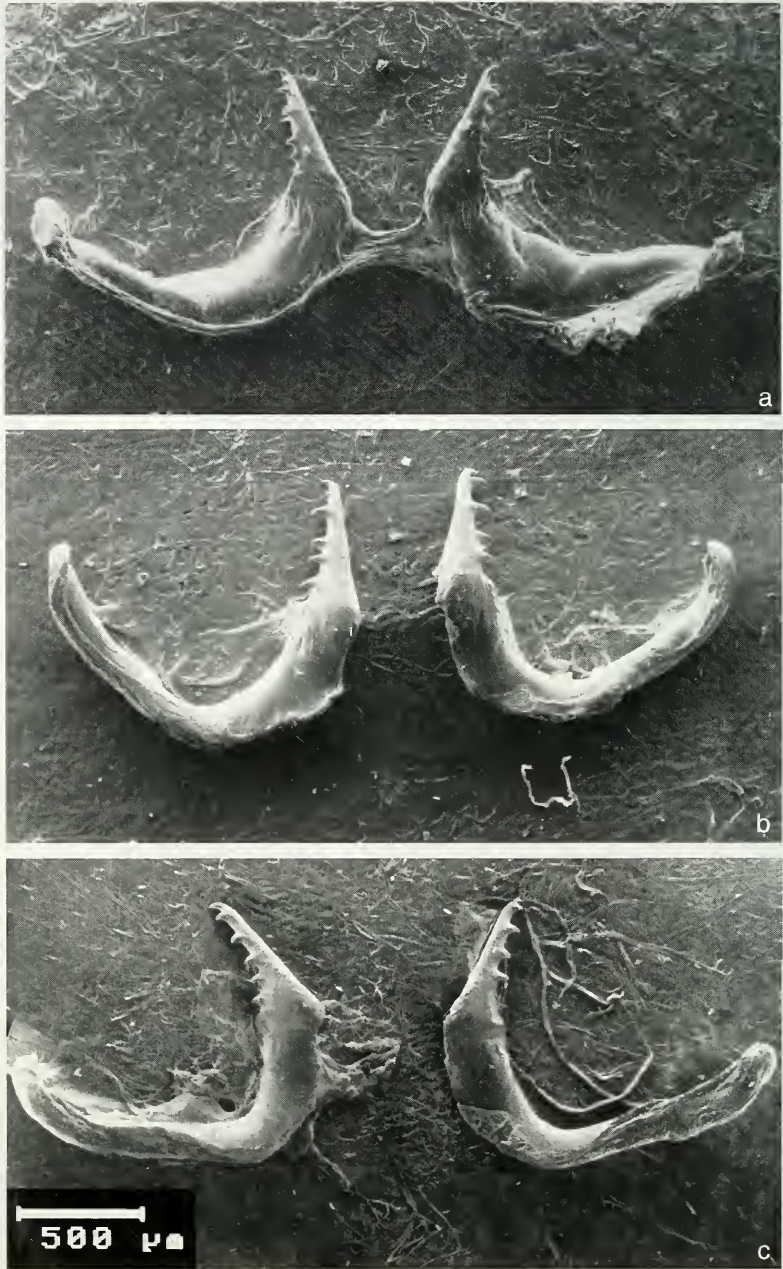


FIG. 7

Titillators of *A. alpinus*: a = Italy, Aosta Valley, Gressoney; b-c France, Col d'Allos.



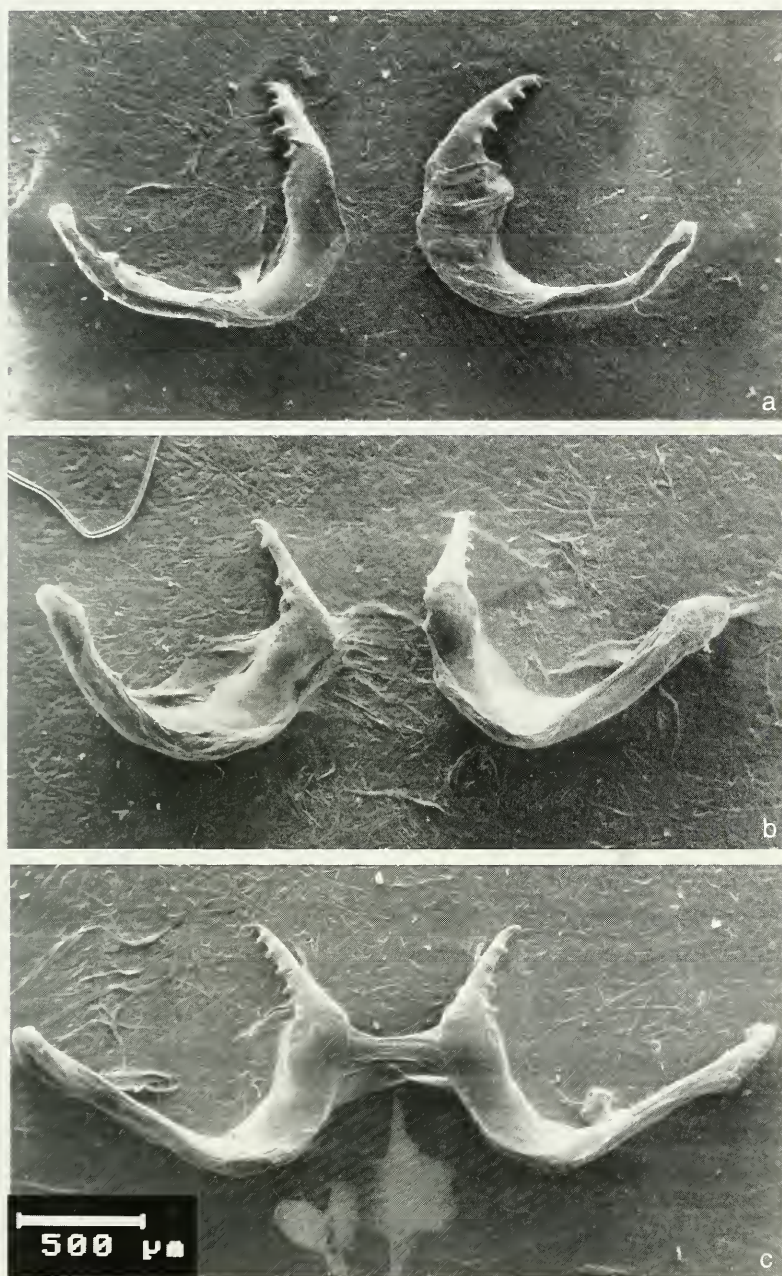


FIG. 8

Titillators of *A. alpinus*; a = France, Col d'Allos; b = F. Col du Galibier; c = F. chaîne du Jura, Reculet.

TIT: variation in shape and size given in Fig. 13-14; apical part light brown or brown, conical, more or less elongated and pointed, widening a little (Fig. 13a-c), or strongly (Fig. 14c-d) towards the base, apex usually with a small, curved tooth but sometimes with the apex more broadly rounded (Fig. 14a-b) and somewhat similar to the nominotypical ssp.; teeth large; basal part dark brown or of a deep shining black, flattened, variably widened basally or medially, generally with two angles: one at the base of the apical part, and a second inflexion / torsion in the middle, giving a typical twisted upside-down shape (Fig. 13a-b). Populations from the Maritime Alps (F, I) have smaller, stouter, less twisted TIT, sometimes similar to those of *A. alpinus* (compare Fig. 13c with Fig. 7b).

Body color and pattern: ♂: green often with a yellowish tinge, more or less darkened with black laterally, abdomen dorsally shining light green in 98 % of ind. (Fig. 2a-b); rarely body color light brown (Fig. 2c); never green with brown reddish DOBA; DOLI generally indistinct or limited to the first 4 tergites, very rarely continuous, if so greenish rather than buffish. ♀ (Fig. 2d) very variable, green or olive to light brown with buff or reddish tinges, also mottled with brown and green; DOLI buff-whitish or greenish, continuous in about 5-15 % of ind. PF (♂, ♀) flesh-colored or light brown with a yellowish or pinkish tinge, generally whitish interno-inferiorly.

#### *Song*

A few echemes of only 1-2 seconds were recorded in the laboratory by Heller (1988), no song was heard in nature.

#### *Distribution*

Fig. 17 and Appendix; Italian and French South-Western Alps, south of the Durance (F) and the Susa (I) Valleys; most western known locality: Col de la Bonette (a pair in coll. Harz). The mention of Col d'Allos by Azam (1901) was an error: we checked this population and found that it belongs to *alpinus*.

#### 4. *Anonconotus pusillus* Carron & Sardet sp. n.

*Anonconotus apenninigenus* (Targioni-Tozzetti) (partim) - Nadig, 1987; nec *Anonconotus apenninigenus* (Targioni-Tozzetti, 1881)

Holotype ♂. Italie: Val d'Aoste, Val Champorcher, Chardonney, 12. IX. 1999 leg G. Carron. Dry specimen with titillators mounted on card.

Type depository: Muséum d'histoire naturelle of Geneva, Switzerland.

Locus typicus: Italy: Aosta Valley, Champorcher Valley, Chardonney, Laris, 2000-2300 m.

Paratypes from the locus typicus (3 ♂, 4 ♀, same date) and also from Piemonte, Colle della Colombardo, N-side (5 ♂, 2 ♀, 8. IX. 2000), Sant'Elisabetta in Canavese (2 ♂, 2 ♀, 7. IX. 2000), Piamprato in Val Soana (2 ♀, 8. IX. 2000) (all in Italy); in Mus. Geneva.

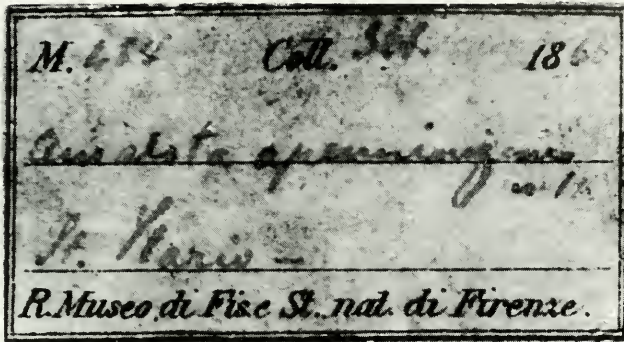
Other material examined (no. of imagos of both sexes): 82 in coll. Carron, 116 in coll. Nadig and about 10 in coll. La Greca; material from several localities covering the whole distribution range (Appendix).

Derivatio nominis: *pusillus* = "small, incompletely grown"; the species name refers to the small, larva-like body of the ♂.

#### *Differential diagnosis*

♂ easily distinguished from other taxa with yellow-EL by the small, slender, larva-like stature, by the brown and striped upper-side of the abdomen (light green in *A. baracunensis*), and by the very diagnostic small, brown TIT (which resemble very small *A. alpinus* TIT).





FIGS 9-11

9. Original label of *Omalota apenninigena*, written by Targioni-Tozzetti. 10. Holotype of *Anonconotus apenninigenus* (in alcohol). 11. Larva of *Anonconotus* (in alcohol), designated as "allotype" of *A. apenninigenus*.

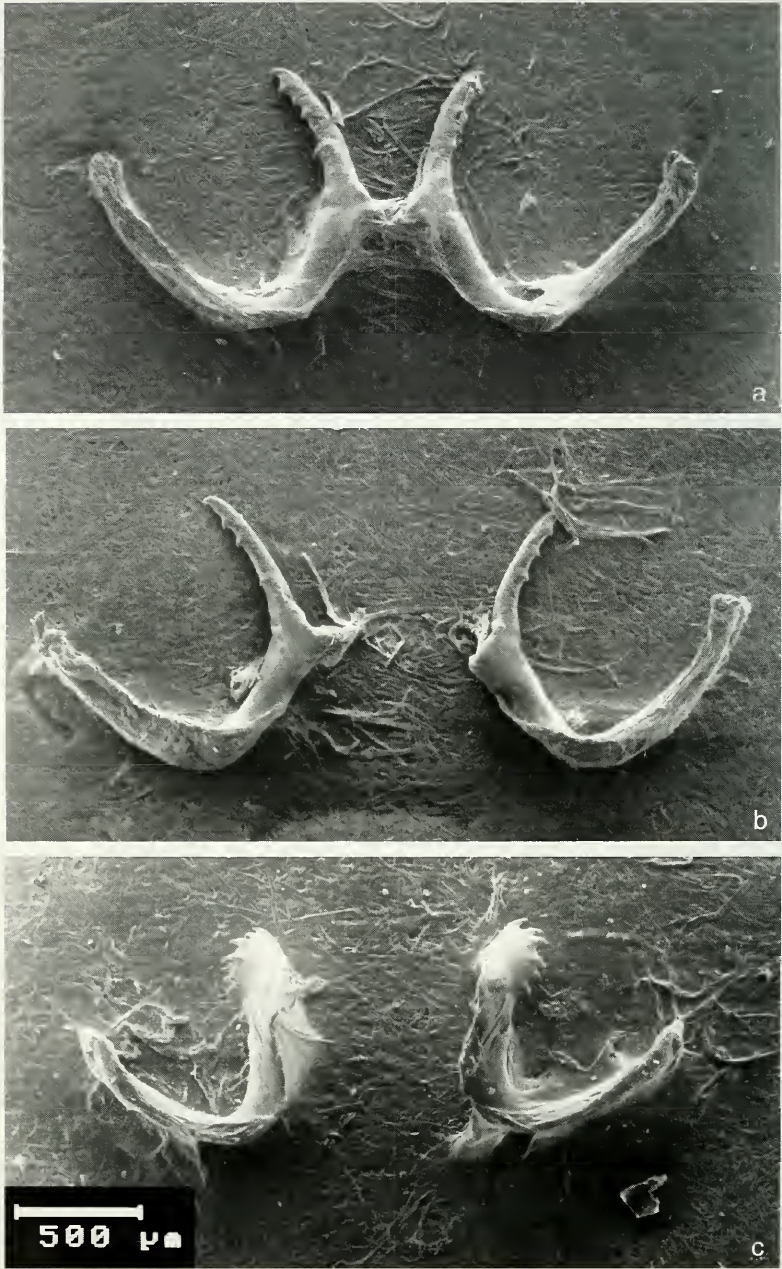


FIG. 12

Titillators of *A. apenninigenus* (a-b) and *A. b. baracunensis* (c); a-b: Italy, Monti Sibillini (Apennine), Val Bolognola, note long, curved, finely toothed apical part; c = I, Alto vallo del Po, Pian del Ré, note widened apical part.



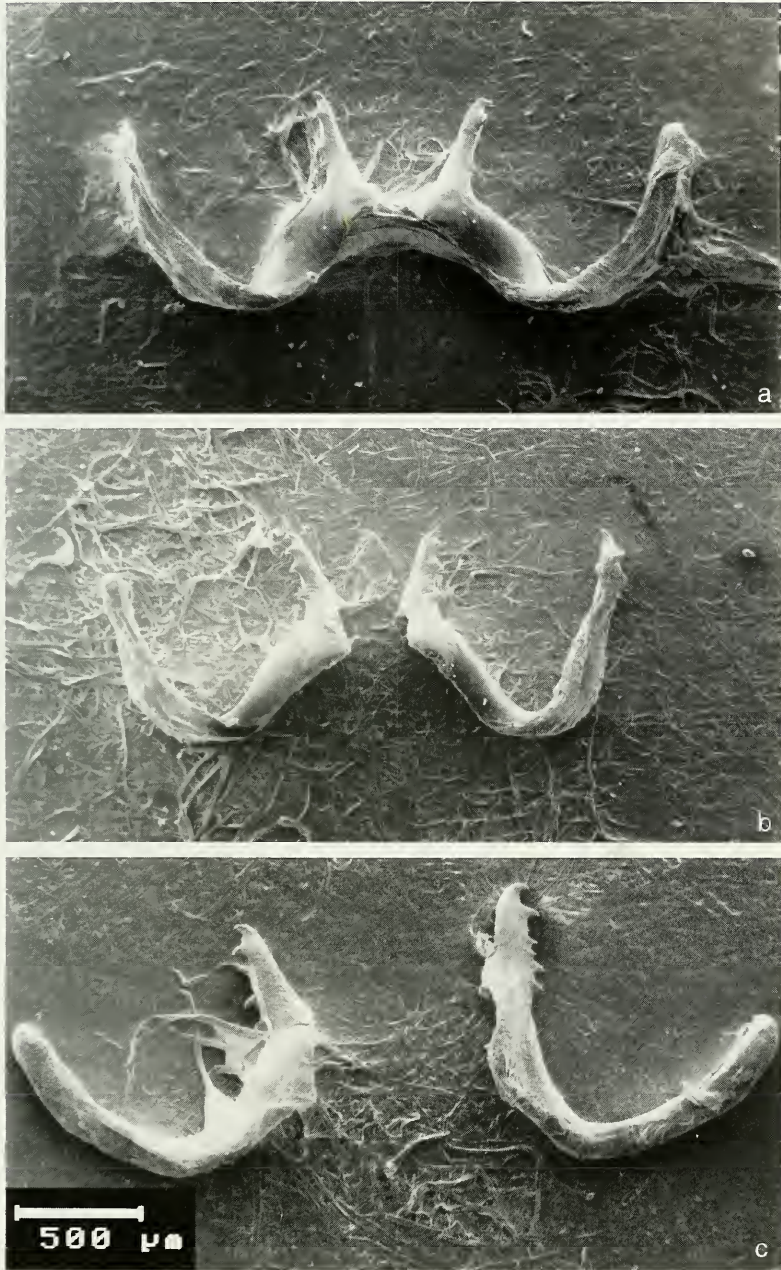


FIG. 13

Variation in shape of titillators of *A. baracunensis occidentalis* ssp. n.; a = France, Col de Montgenèvre; b = F, Col d'Izoard (locus typicus); c = F, Alpes maritimes, Mercantour, atypical shape similar to that of *A. alpinus* (compare with Fig. 7b) but larger teeth distinctive.

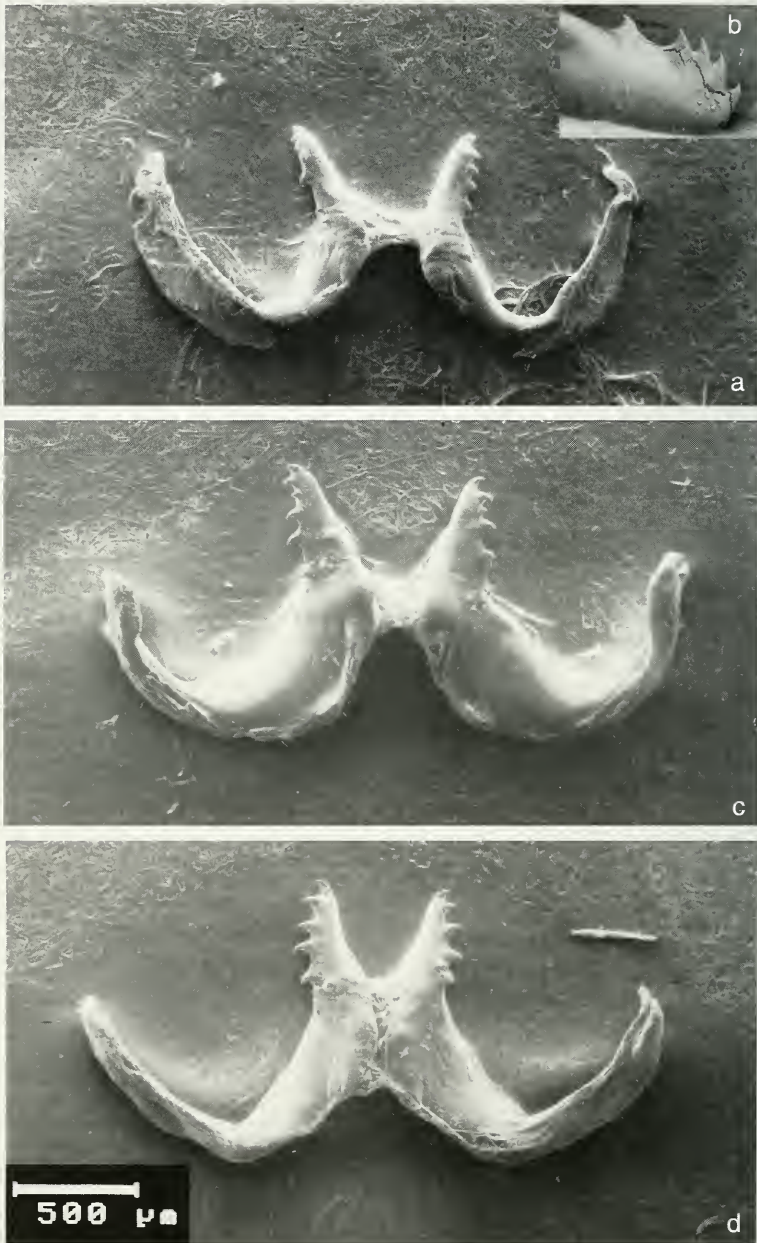


FIG. 14

Variation in shape of tiullators of *A. baracunensis occidentalis* ssp. n.; a = Italy, Piemonte, val Chisone, Fenestrelle, note small size; b = enlargement to show atypical, not pointed apical part; c = I. Piemonte (Cuneo), Frabosa, Prato Nevoso; d = I. Piemonte (Cuneo), Monesi - Colle Rossa; c and d from the Italian Maritime Alps, showing a particular, smaller, stouter shape than in other populations.



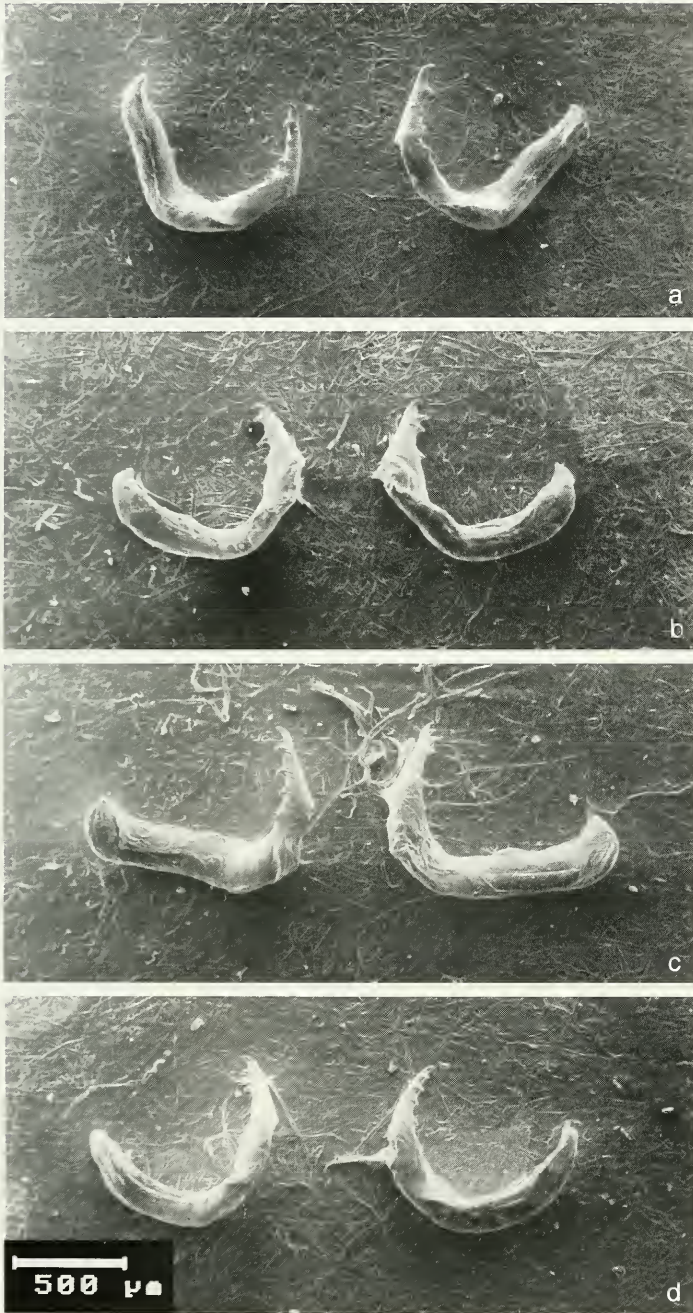


FIG. 15

Variation in shape of titillators of *A. pusillus* ssp. n.: a-d = Italy, Piemonte, Canavese, Santa Elisabetta. Note small size and thick basal part.

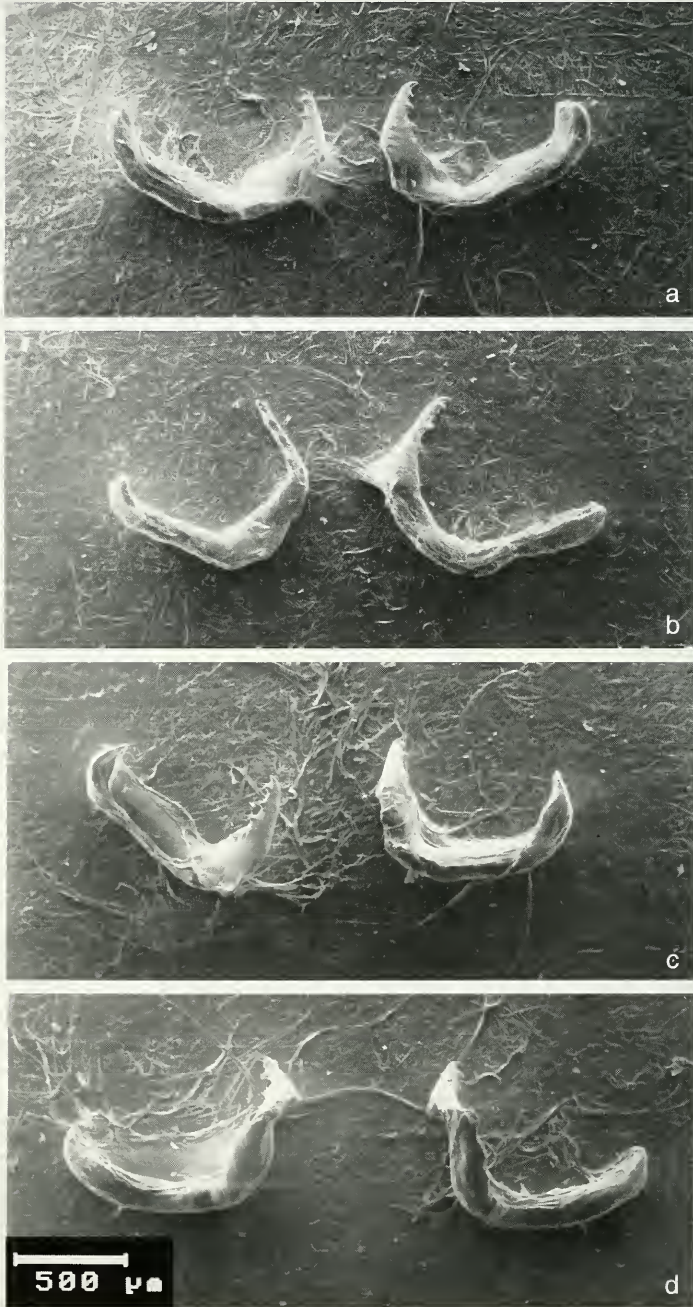


FIG. 16

Variation in shape of titillators of *A. pusillus* ssp. n.: a, c, d = Italy, Piemonte, Canavese, Santa Elisabetta; b = I, Piemonte, Canavese, Piamprato, note shape similar to that of a small *A. alpinus* (compare with Fig. 7c).

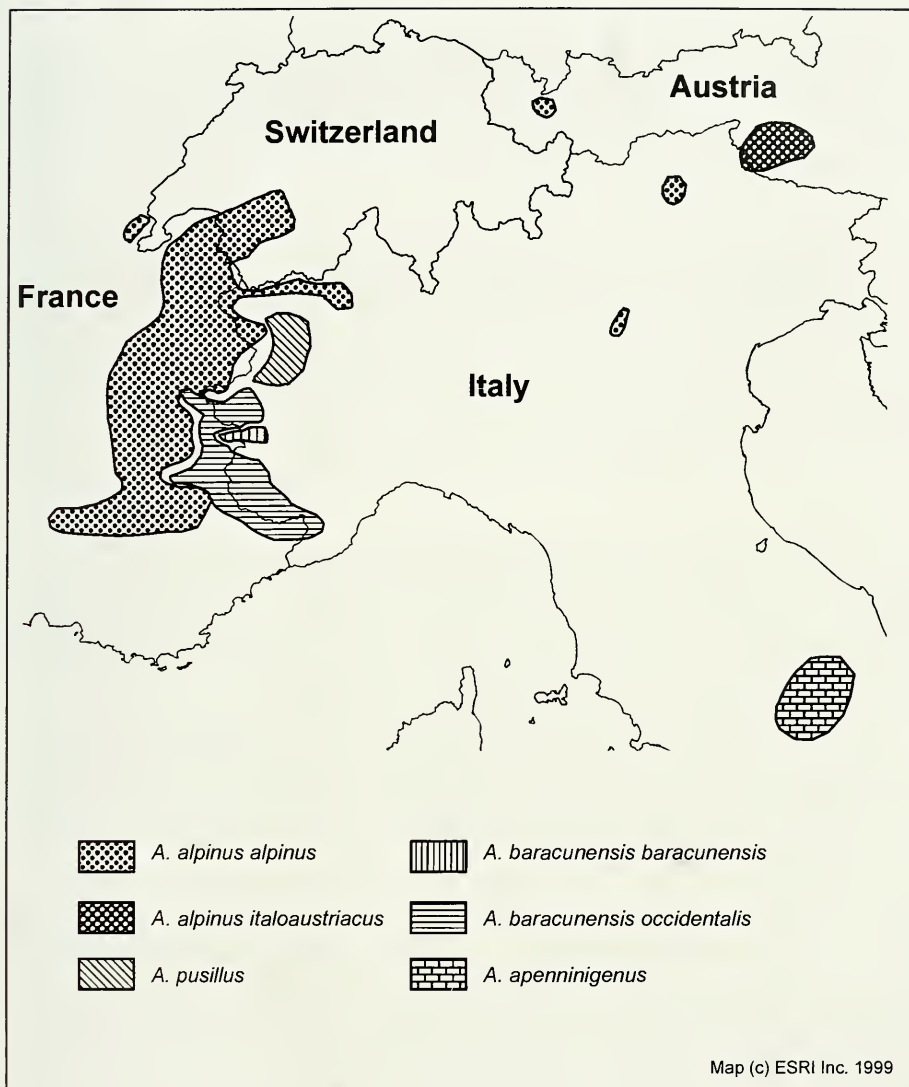


FIG. 17

Distribution areas of *Anonconotus* species and subspecies, according to the present revision.

♀: with the exception of *A. alpinus*, which has much larger EL, other species are very similar and isolated specimens are impossible to identify with certainty. Populations with more than 50 % of ♀ with continuous DOLI undoubtedly belong to *A. pusillus* sp. n.



### Description of the holotype

Size: PF 9.6; PR 4.4. EL hidden under the PR. PR reddish-brown on disc, lighter on metazona; paranota black, margin broadly bordered with light mint-green anteriorly, with greenish white ventrally and posteriorly. TIT: all brown, apical parts with 4 and 5 teeth, respectively.

### Variation

Size: ♂ (n = 66): PF 9.1-12.2; PR 4.1-5.2; ♀ (n = 43): PF 12.2-14.8; PR 4.7-5.7). Important intraspecific variation of PF/PR lengths within and between localities. Partially overlapping with *A. baracunensis* in PF and PR lengths but tending to have smaller values (Fig. 3). Stature of ♂ distinctly slender (Fig. 2), body short and narrow, abdomen parallel-sided as seen from above; adult ♂ very resembling a subadult of another species of *Anonconotus* ! General stature of ♀ similar with that of *A. baracunensis*. Sexual dimorphism striking, much more pronounced than in other species.

PR shape: similar to that of *A. baracunensis*, although smaller on average (Fig. 3, 4a, 5a).

EL: ♂ (Fig. 4a, 6a): reaching 3/4 of META to 1/4 of T1; smallest EL of all *Anonconotus*. EL light or deep yellow, often more translucent than in *A. baracunensis* because of weakest venation. ♀ (Fig. 5a): EL reaching 1/5 to 1/2 of the META, generally protruding but sometimes completely hidden under the PR; whitish, yellowish or grey. EL usually more visible than in *A. baracunensis* because of slightly smaller pronotum (averages: 5.2 vs. 5.4, n = 43 and 21 respectively).

TIT: variation in shape and size given in Fig. 15-16; apical part generally brown, short, conical, more or less elongated, teeth medium-sized; basal part always brown or light brown, not flattened but thick, more half-cylindrical, generally slightly widened basally, prolonging the apical part without any angle, then bent and regularly curved ventrally, never twisted.

Body color and pattern: ♂: overall very shining (Fig. 2e-g); background color green, more or less black laterally on abdomen (melanism), pleura and paranota; DOBA a warm, slightly reddish brown (Fig. 2e-f), sometimes a cold greenish brown (Fig. 2g), rarely mottled olive green/brown; DOLI light buffish-white, continuous along the abdominal tergites T1-T9, very striking when bordered externally with black; PR: prozona greenish or brown, metazona generally brown; margin of paranota largely light green or mint-green anteriorly, whitish ventrally and extending posteriorly as a fine, bright mint-green line. Very typical "tricolor-striped" (brown/buff/black) appearance. ♀ very variable, green or olive to light brown with buffish tinge, also mottled with brown and green; DOLI buff whitish continuous in about 99 % of ind. (Fig. 2h). PF (♂, ♀) a honey-like color, light yellowish-brown, generally with a yellowish streak inferiorly.

### Song

Unknown.

### Distribution

Italy, endemic to the Grées Alps, in the sector delimited by the Aosta Valley and the Susa Valley, at the eastern margin of the Gran Paradiso Massif.



## DISTRIBUTION

All checked data are given in the Appendix. Fig. 17 shows the distribution ranges of all species. They are allopatric-(parapatric) with rare, very small areas of sympatry. *A. alpinus* and *A. baracunensis occidentalis* occur at the same site but not in the same habitat and altitude at two localities. Nadig (1987) reports the case of the south-exposed slopes north of the Col de Montgenèvre (France near the Italian border, Hautes-Alpes): *alpinus* from 1850 m a.s.l. to about 1930 m, *b. occidentalis* from 1930 m upwards. Harz (1969) reports a similar situation from the Col de la Bonette (France, Alpes Maritimes / Alpes de Haute-Provence border: *A. alpinus* at 1200 m, *A. b. occidentalis* at 2000 m. *A. alpinus* and *A. pusillus* occupy the western and eastern parts of the Gran Paradiso Massif (North-Western Italian Alps), respectively; we did not find any zone of sympatry, but they occur very close to each other in Val dell'Orco (Val Locana). The Susa Valley separates *A. pusillus* (north) and *A. b. occidentalis* (south). The two ssp. of *A. baracunensis* have never been found together on the same mountain (Nadig, 1987).

## DISCUSSION

We agree with Dreux (1962) and Nadig (1987) that the structure of the prosternum and the number of spines on the fore tibiae are very variable and cannot be considered as reliable characters. The size of the ♂♂ cerci varies interspecifically proportionally with the body size but this character is difficult to use to separate species; furthermore, we found that their shape, the presence or absence of an apico-external tooth and the shape of the apico-internal tooth are more variable characters than previously considered (by Nadig, 1987, for instance). The shape of the titillators is an important taxonomic character. Nevertheless, the titillators show a considerable intraspecific variability, and in the case of closely related species (as in our *Anonconotus*), their intraspecific variability sometimes obliterates interspecific variability. In some rare cases, we were confronted with *Anonconotus* specimens which could not be identified with certainty using only this character. Finally, the song is an important taxonomic character. However, the squamipterous ♂♂ of *Anonconotus* seem to have a reduced song activity and their song is difficult to record. So far, only the song of *A. alpinus* has been recorded and described (Heller, 1988; Ragge & Reynolds, 1998). Some observations of singing specimens of different populations indicated that this character could also be of taxonomical value for the *Anonconotus* species but more research is needed. As a general rule, we recommend the collection of males, which possess most of the diagnostic characters for identification of species, and the use of a combination of several characters rather than only one.

*Anonconotus ghiliani* Camerano, 1878 was first considered as a variety of *Anonconotus alpinus* (Yersin, 1858) by Chopard, 1952, then by following authors (Harz, 1969; Nadig, 1987). It is still considered as a distinct species by Otte (1997). This "species" has been described by Camerano (1878) on the basis of only one pair of specimens caught in Oropa near Biella (Italy). We studied topotypical material of *A. ghiliani* and the redescription of this "species" given by Griffini (1892) and came to the same conclusion as Nadig's (1987): this entity is only a dark-colored variety of *A. alpinus alpinus*.

Taxonomic studies on allopatric populations often need a concept other than the biological species concept. One could collect specimens from different mountains and undertake laboratory experiments to study mate choice, interbreeding and fertility of offspring, but artificial conditions cause artifacts and the specimens may be interfertile in the laboratory but not under natural conditions. Interfertility is not a definitive criterion in the phylogenetic and evolutionary concepts of species.

The ranking (species / subspecies) of allopatric populations depends on the species concept that one considers. In the Western Alps, the distribution areas of the *Anonconotus* species and subspecies have boundaries separated by only a few kilometers and overlap sometimes, but so far no hybridization has been observed. Although intraspecific variability in some characters can be rather high, due to isolation of populations during the Holocene or the last glacial period, the taxa examined retain their diagnostic characteristics all over their distribution area. As we do not have intermediate populations with intergrading character states, the described taxa may all be good species. Nevertheless, we defined species and subspecies in the present work. We did so by comparing the amount of morphological difference between the taxa, i.e. the number of taxonomically important characters. All characters were given the same weight. We think that allopatric taxa distinguished by only one versus several characters should not be given the same taxonomic rank. Consequently, we treated the Gran Paradiso populations, which accumulate several characteristics, as a distinct species (*A. pusillus* sp. n.). On the other hand, the former Alpine "*A. apenninigenus*" and *A. baracuniensis* sensu Nadig, 1987 differ only by a single character and were treated as ssp. of a single polytypic species.

Within the family Tettigoniidae, the shape of the titillators allows for the identification of externally very similar taxa but in our opinion this single character does not, by itself, give any information on the taxonomic rank. Two distinct species may have similar titillators, and different populations of a single species may show very different ones (as in *Ephippiger ephippiger* Fiebig, 1784, Ephippigerinae). Considering the taxonomic characters generally used in our group, the European Platycleidini (Tettigoniinae), it seems that no case exists where a difference in the titillators is the only character for separating two species. There is no case where the gene flow between two sympatric and syntopic sibling species is interrupted by a single difference in titillators. Regarding allopatric taxa, the numerous allopatric species of *Parnassiana* Zeuner, 1941 of the Greek mountains differ at least in one other character besides the titillators (Harz, 1969; Willemse, 1985). Titillators seem to be the only reliable character to distinguish some Mediterranean *Eupholidoptera* Ramme, 1951 species (see Willemse, 1984, 1985 for examples), but these are all allopatric taxa with very limited distribution areas (a single mountain or a single small island) and the taxonomic status of these allopatric taxa may be questionable.

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APPENDIX. Checked distributional data for *Anonconotus* spp. based on re-identified material (some *A. a. italoaustriacus* and a few literature data have not been checked). All geographic names are given in the local language. Localities are geographically ordered, from the Southern to the Northern and Eastern Alps.

Obs. = observator or/and collector; year = year of collection; cou. = country; A = Austria, CH = Switzerland, F = France, I = Italy; col. = examined collection (1 = Harz, 2 = Nadig, 3 = Carron, 4 = La Greca); alt. = altitude in meters above sea-level.

obs.	year	cou.	col.	region (A, I), canton (CH), department (F)	locality	site	alt.	reference if published
<i>alpinus alpinus</i>								
Walther	1965	F	1	Vaucluse	Mont Ventoux	Mont Ventoux		
Nadig	1975	F	2	Vaucluse	Mont Ventoux	Mont Ventoux	1450- 1650	Nadig, 1987
Nadig	1977	F	2	Vaucluse	Mont Ventoux	Mont Ventoux	1000- 1400	Nadig, 1987
Carron & Wermelle	1997	F	3	Vaucluse	Mont Ventoux	Mont Ventoux		
Eckerlein	1956	F	1	Alpes de Haute- Provence	Sisteron (south of)	Montagne de Luge (sic) = Lure		
Nadig	1975	F	2	Alpes de Haute- Provence	Seyne (south of)	Col de Maure	1346	Nadig, 1987
Nadig	1975	F	2	Alpes de Haute- Provence	Seyne	Col du Fanget	1600	Nadig, 1987
Nadig	1975	F	2	Alpes de Haute- Provence	Seyne	Tête grosse	1700- 1750	Nadig, 1987
Nadig	1975	F	2	Alpes de Haute- Provence	Col de la Cayolle	Col de la Cayolle, S- side	2000- 2100	Nadig, 1987
Carron & Sardet	2001	F	3	Alpes de Haute- Provence	Allos	Col d'Allos	2270	
Heller	1984	F		Alpes de Haute- Provence	Jausiers (Hte vallée de l'Ubaye)	Col de la Bonette		Heller, 1988
		F		Alpes de Haute- Provence	Jausiers (Hte vallée de l'Ubaye)	Col de la Bonette	1200	Harz, 1969
Nadig	1975	F	2	Drôme, Ouvèze springs	Buis les Baronnies	Col de Perty	1100- 1300	Nadig, 1987
Nadig	1991	F	2	Hautes-Alpes	Montgenèvre (Briançon)	Col de Montgenèvre, E Bois des Suffins	1900- 2110	
Nadig	1984	F	2	Hautes-Alpes	Montgenèvre (Briançon)	Col de Montgenèvre	1850- 1930	Nadig, 1987
Meduni	1966	I	4	Piemonte (Val di Susa)	south of Bardonecchia, near Melezet	Punta Colomion	1600	
Meduni		I	4	Piemonte (Val di Susa)	Bardonecchia	Bardonecchia	1300	
Meduni	1966	I	4	Piemonte (Val di Susa)	Bardonecchia	Monte Jafferau	2000	
Carron & Sardet	2000	I		Piemonte (Val di Susa)	Oulx (Savoix)	under rochers de l'aigle (near M. Jafferau)	2350	
Meduni		F	4	Hautes-Alpes	Chapelle St Hippolyte	Vallée étroite (Briançon)	1790	
Carron & Sardet	2001	F		Hautes-Alpes	Col du Lautaret	Col du Lautaret	2100	

obs.	year	cou.	col.	region (A, I), canton (CH), department (F)	locality	site	alt.	reference if published
Carron & Sardet	2001	F		Hautes-Alpes	Col du Lautaret - Col du Galibier, road between	Col du Lautaret - Col du Galibier, road between	2340	
Carron & Sardet	2001	F	3	Hautes-Alpes	Col du Galibier, S-side	Col du Galibier, S-side	2555	
Carron & Sardet	2001	F		Hautes-Alpes / Savoie	Col du Galibier	Col du Galibier	2770	
Sardet	1999	F		Savoie, Maurienne	Valmorel (near Moutiers)	Col du Gollet	1970	
Coin	1991	F		Savoie, Maurienne	Modane, Valfréjus (Maurienne, N Fréjus)	lacs de Sainte-Marguerite (Mt Thabor)	2400	Bellmann & Luquet, 1995
Nadig	1984	F	2	Savoie	Val d'Isère	Col d'Iséran, N-side	2180-2320	Nadig, 1987
Sardet		F		Savoie	Val d'Isère	Col d'Iséran	2320	
Sardet	2000	F		Savoie	Val d'Isère	Tête d'Arolla	2533	
Sardet	1997	F		Savoie	Tignes	Croix du Bano	1980	
Sardet	2000	F		Savoie	Tignes	Grande Sassièrè, Plan du cheval	2500	
Nadig	1984	F	2	Savoie	Bourg St-Maurice	Col du Petit St Bernard, S-side	2070-2100	Nadig, 1987
Carron & Sardet	2001	F		Haute-Savoie	Mieussy	Pointe de Chavasse	1500-2000	
Nadig	1990	I	2	Val d'Aoste	V. Veni (west of Courmayeur)	V. Veni (west of Courmayeur)	1960-2000	
Nadig	1990	I	2	Val d'Aoste	La Thuile, Courmayeur	Chadura above La Thuile	2200	
Nadig	1990	I	2	Val d'Aoste	La Thuile, Courmayeur	La Thuile main road	1960	
Nadig	1991	I	2	Val d'Aoste	La Thuile, Courmayeur	under the Col	2100	
Nadig	1990	I	2	Val d'Aoste	La Thuile, Courmayeur	M. Belvedera	2400-2640	
La Greca	1967	I	4	Val d'Aoste	La Thuile, Courmayeur	Col du Petit St Bernard	1950-2150	
La Greca	1967	I	4	Val d'Aoste	La Thuile, Courmayeur	Les Suches (= La Souche, la Thuile?)	2200	
Goidanich	1952	I	4	Piemonte (Val dell'Orco)	Ceresole reale	Ceresole (haut val dell'Orco)	1700	

obs.	year	cou.	col.	region (A, I), canton (CH), department (F)	locality	site	alt.	reference if published
Goidanich	1953	I	4	Piemonte (Val dell'Orco)	Ceresole reale	la Merola (above Ceresole)	2000	
La Greca	1967	I	4	Val d'Aoste (Valtoumenche)	Chamois	Chamois	2000	
Nadig	1990	I	2	Val d'Aoste (Valle d'Ayas - Verrès)	Champoluc	Ostafa above Champoluc	2100- 2350	
Carron & Praz	1999	I	3	Val d'Aoste (Val di Gressoney)	Gressoney	Gressoney-la-Trinité		
Nadig	1985	I	2	Val d'Aoste (Val di Gressoney)	Gressoney	Bettaforca	1950- 2350	Nadig, 1987
La Greca	1967	I	4	Val d'Aoste (Val di Gressoney)	Gressoney	Mont Gabiet (Gressoney-la- Trinité)	2300	
Nadig	1917	I	2	Piemonte (Val Sesia)	Alagna- Valsesia	Alagna	2000- 2300	Nadig, 1987
Nadig		I		Piemonte (Val Sesia)	Biella	Oropa		Nadig, 1987
Ghiliani		I		Piemonte (Val Sesia)	Biella	Monti Biellisi		Fruhstorfer, 1921
Frey- Gessner		F		Ain	Thoiry	Reulet		Fruhstorfer, 1921
Carron & Sardet	2001	F	3	Ain	Thoiry	Reulet	1700	
Carron	1994 ?	CH		Ct. Valais	Vouvry	Miex-Col de Verne	1500- 1600	
Praz	1997	CH	3	Ct. Valais	Champéry	Col de Bretolet	2000	
Fruhstorfer		CH		Ct. Vaud	Montreux / Veytaux	Dent de Jaman		Fruhstorfer, 1921
Nadig	1922	CH	2	Ct. Vaud	Montreux / Veytaux	Rochers de Naye		Nadig, 1987
Frey- Gessner		CH		Ct. Vaud	Montreux / Veytaux	Rochers de Naye		Fruhstorfer, 1921
Nadig	1978	CH	2	Ct. Vaud	Lavey-Morcles	Le Crêtelet - La Tourche	1950- 2250	Nadig, 1987
Yersin, Meyer-Dür		CH		Ct. Vaud / Valais	Lavey-Morcles / Fully	Dent de Morcles	2000	Fruhstorfer, 1921
Carron	1999	CH		Ct. Valais	Dorénaz	Lui - Scix Carro	2100- 2300	
Carron	2001	CH	3	Ct. Valais	Dorénaz	Lui - Scix Carro	2100- 2300	
Gams	1919	CH		Ct. Valais	Dorénaz	Pacoteires above Alesses	2100	Fruhstorfer, 1921
Carron	1999	CH		Ct. Valais	Fully	Lui, Portail de Fully	2200- 2300	
Carron	2001	CH		Ct. Valais	Fully	Lui, Portail de Fully	2200- 2300	

obs.	year	cou.	col.	region (A, I), canton (CH), department (F)	locality	site	alt.	reference if published
Fruhstorfer		CH		Ct. Valais	Fully	Grand Château (above Fully)	2000	Fruhstorfer, 1921
Fruhstorfer		CH		Ct. Valais	Fully	Grand Chavalard	2000- 2500	Fruhstorfer, 1921
Nadig	1982	CH	2	Ct. Valais	Leytron	Ovronnaz, Châtillon	1820- 1980	Nadig, 1987
Carron	1995	CH		Ct. Valais	Conthey	Col du Sanetsch	2280	
Carron	1999	CH		Ct. Valais	Conthey	Col du Sanetsch	2280	
Carron	1999	CH	3	Ct. Valais	Conthey	Col du Sanetsch	2280.0	
Baur (B & H)	1988	CH		Ct. Berne, Niedersimmental	Boltigen	Vordere Reidigen	1420	
Baur (H)	1988	CH		Ct. Berne, Niedersimmental	Boltigen	Chlusalp above Reidenbach	1200	
Roesti		CH		Ct. Berne, Engstligental	Adelboden			
		A		N-Tirol (Arlberg)	St. Anton			Harz, 1969
	1988	A		N-Tirol (Arlberg)	St. Anton			Luquet, 1995
Krauss / Nadig	Nadig 1985	A	2	N-Tirol (Arlberg)	St. Anton	Ulmerhaus	2280	Krauss, 1909; Nadig, 1987
Krauss / Nadig	Nadig 1985	A	2	N-Tirol (Arlberg)	St. Anton	Ob. Steissbachtal	2000- 2200	Krauss, 1909; Nadig, 1987
Nadig	1985	A	2	N-Tirol (Arlberg)	St. Anton	near Gampen	1800	Nadig, 1987
Krauss	1909	I		Veneto, S-Tirol	Schlem	Schlem	2200	Krauss, 1909
Ramme	1921	I		Veneto, S-Tirol	Schlem	Schlem	2200	in Nadig, 1987
Nadig	1987	A	2	Kärnten Reiseckgr.	Kaponiktal	Kaponiktal	1800- 2000	
<i>alpinus</i> ssp. ?								
Krauss	1900	I		Veneto, Monte Baldo	Monte Baldo	Altissimo di Nago	2076	Krauss, 1909
<i>alpinus italoaustriacus</i> (all from Nadig, 1987)								
Wemer	1929	A		E-Tirol, Schober- Gruppe	Zettlersfeld	above Biedner-Hütte	2000- 2200	Wemer, 1929, 1931, 1934
Wemer	1930	A		E-Tirol, S-Seite der Hohen Tauern	Kaiser Törl	Kaiser Törl	2000	Wemer, 1931



obs.	year	cou.	col.	region (A, I), canton (CH), department (F)	locality	site	alt.	reference if published
Franz	1940	A		Kärnten, Sonnblickgruppe	Gr. Fleiss		1900	in Nadig, 1987
Nadig	1986	I	2	S-Tirol, Sexten-Tal	Hahnspielhü.- Helm	Hahnspielhü.-Helm	2050- 2350	
Nadig	1982	I	2	Veneto, S-Tirol, Pustertal, Deferegggen-Gebirge	Strickberg	above Innichen	2050- 2150	Nadig, 1987
<i>probably alpinus italoaustriacus (all from Nadig, 1987)</i>								
Werner	1930	A		E-Tirol	Ederplan (Lienz)	under Annahütte and Gipfelplateau	1950	Werner, 1931, 1934
Hölzel	1943	A		Sandnig-Sonnblick- Gruppe				Hölzel, 1955
<i>apenninigenus</i>								
La Greca	1966	I	4	Lazio, Monti Reatini	Monte Terminillo	Jaccio Crudele	1900	
Baccetti	1966	I		Lazio, Monti Reatini	Monte Terminillo	Jaccio Crudele	1900	Baccetti, 1971
Baccetti	1966	I		Lazio, Monti Reatini	M. Porcini	M. Porcini	1900	Baccetti, 1971
Baccetti	1967	I		Lazio, Monti Reatini	Colle delle Pozze	Colle delle Pozze	1900	Baccetti, 1971
Baccetti	1967	I		Lazio, Monti Reatini	M. di Cambio	M. di Cambio	1900	Baccetti, 1971
Galvagni / Nadig	1979	I	2	Marche, Monti Sibillini	val Bolognola	Fonte Bassette	1500- 1700	Nadig, 1987
Carron & Wermelle	2001	I	3	Marche, Monti Sibillini	val Bolognola	Monte Rotondo, val Bolognola		
Galvagni	1954	I		Marche, Monti Sibillini	Monti Sibillini	path from Forca Viola to Lago Pilato Monti, Monti Sibillini	1900	Galvagni, 1959
<i>baracunensis baracunensis</i>								
Carron & Sardet	2000	F	3	Hautes-Alpes	Ristolas	Belvédère du Viso- Le Sellard, Sommet de l'Olive	1900- 2550	
Nadig	1991	F	2	Hautes-Alpes	Ristolas	Monviso N-side, Petit Belvédère du Viso (Torrent du Pisset)	1775	Carron & Sardet, 2001
Nadig	1991	F	2	Hautes-Alpes	Ristolas	Monviso N-face, above Belvédère du Cirque	2130- 2380	Carron & Sardet, 2001
Carron & Praz	1998	I	3	Piemonte (Alto Valle del Po)	Crissolo	Pian del Ré, Pò springs	2200- 2400	

obs.	year	cou.	col.	region (A, I), canton (CH), department (F)	locality	site	alt.	reference if published
La Greca	1967	I	4	Piemonte (Alto Valle del Po)	Crissolo	Pian Melzé (between Crissolo et Pian del Ré)	1750	
Nadig	1991	I	2	Piemonte (Alto Valle del Po)	Crissolo	above Pian del Re	2150-2500	
La Greca	1967	I	4	Piemonte (Alto Valle del Po)	Crissolo	Rocce Losere	2050	
Heller	1987	I		Piemonte (val Pellice)	Bobbio Pellice	Rif. Barbara, 8 km S of B. Pellice		Heller, 1988
Nadig	1985	I	2	Piemonte (Valle Pellice)	Bobbio Pellice, Val Carboneri	under Cle Baracun, above Rifugio Barbara	2020	Nadig, 1987
Nadig	1991	I	2	Piemonte (Valle Pellice)	Bobbio Pellice, Val Carboneri	Cle Baracun	1900-2000	
Nadig	1991	I	2	Piemonte (Valle Pellice)	Bobbio Pellice, Val Carboneri	Cle Baracun	2000-2150	
<i>baracunensis occidentalis</i>								
Nadig	1986	I	2	Liguria	Monte Saccarello	M. Saccarello-Redentore, E-side	1900-2150	
Nadig	1986	F	2	Alpes Maritimes	Monte Saccarello	M. Saccarello, W.-side	1730	
Nadig	1985	I	2	Piemonte (Cuneo)	Ormea	de Termini	2000	
Nadig	1985	I	2	Piemonte (Cuneo)	Monesi	Colla Rossa E-side (Monesi) (= Monte Saccarello)	1830	Nadig, 1987
Harz		F / I		Alpes maritimes / Piemonte	Mont Bertrand	Mont Bertrand	1800	Harz, 1969
Nadig	1985	I	2	Piemonte (Cuneo)	C. del Becco N-side	C. del Becco N-side	2160	Nadig, 1987
Nadig	1985	I	2	Piemonte (Cuneo)	Vecchie (Col de la Celle)	Colle Vecchie - Rifugio Barbera	2090-2130	Nadig, 1987
Nadig	1985	F / I	2	Alpes maritimes / Piemonte	Col di Boana, S-side	C. di Boana S-side	2160	
Ferraris	1957	F / I		Alpes maritimes / Piemonte	Col de Tende	Col de Tende		Galvagni, 1959
Lombardo	1981	I	4	Piemonte (Valle Stura)	Valdieri	Termini di Valdieri	1700	
Nadig	1986	F	2	Alpes Maritimes	St Martin Vésubie	M. Fenestre	1900-2050	
Lombardo	1981	F	4	Alpes-Maritimes	St Martin Vésubie	Madonne de Fenêtre	2000	
La Greca	1967	I	4	Piemonte (Valle Stura)	Demonte	Passo Gardetta	2330	

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La Greca	1967	I	4	Piemonte (Valle Stura)	Demonte	Valle dell'Arma	2000-2200	
Nadig	1978	I	2	Piemonte (Valle Stura)	Demonte	Valle dell'Arma, towards Colle del Mulo	1300-1600	Nadig, 1987
Nadig	1976	F	2	Alpes Maritimes	Col de la Lombarde, S-side	Col de la Lombarde, S-side	2050-2250	Nadig, 1987
La Greca	1967	I	4	Piemonte (Valle Stura)	Vinadio	vallone S. Anna	1700	
Nadig	1978	I	2	Piemonte (Cuneo)	Frabosa	Prato Nevoso, under Rif. Balma	1780	Nadig, 1987
Nadig	1986	F	2	Alpes Maritimes	Mercantour	V. d. Casterne	1750	
Nadig	1986	F	2	Alpes Maritimes	Mercantour	Fontanalbes	2000-2200	
La Greca	1981	F / I	4	Piemonte / Alpes de Haute-Provence	Argentera	Colle Maddalena = Col de Larche	2000	
Nadig	1975	F / I	2	Piemonte / Alpes de Haute-Provence	Argentera	Colle Maddalena = Col de Larche	1850-2000	Nadig, 1987
Walther	1966	F	1	Alpes de Haute-Provence	Jausiers (Hte vallée de l'Ubaye)	Col de la Bonette	2000	Harz, 1969
Nadig	1975	F	2	Alpes de Haute-Provence / Hautes-Alpes	Jausiers (Hte vallée de l'Ubaye)	Col de Vars	1700-2100	Nadig, 1987
Nadig	1985	I	2	Piemonte (Val Grana)	Val Grana	Monte Reina, S-Hang	1960	Nadig, 1987
Nadig	1985	I	2	Piemonte (Val Grana/Val Maira)	Marmora	Colle d'Esische-Cle. Mulo	2100-2500	Nadig, 1987
Nadig	1985	I	2	Piemonte (Val Maira)	Val Maira	Elva	1600	Nadig, 1987
Nadig	1985	I	2	Piemonte (Val Maira)	Val Maira	Col de Sampeyre, S-side	2280-2300	Nadig, 1987
La Greca	1967	I	4	Piemonte (Val Varaita)	Sampeyre	Col de Sampeyre	2300	
Carron & Praz	1998	I	3	Piemonte (Val Varaita)	Sampeyre	Col de Sampeyre		
Nadig	1985	I	2	Piemonte (Val Varaita)	Sampeyre	Col de Sampeyre, N-side	1900	Nadig, 1987
Carron & Praz	1998	I	3	Piemonte (Val Varaita)	Casteldelfino (Sampeyre)	Chiazale, val Varaita di Rui, Monte Mongioia	2600	
La Greca	1967	I	4	Piemonte (Val Varaita)	Casteldelfino (Sampeyre)	Chiazale	2000	
La Greca	1967	I	4	Piemonte (Val Varaita)	Pontechianale	Le Conce (Monte-)	2400	

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La Greca	1967	I	4	Piemonte (Val Varaita)	Pontechianale	Chianale	1800	
Nadig	1985	I	2	Piemonte (Val Varaita)	Pontechianale	Cle del Agnello, SE- side (near Chianale)	2180	Nadig, 1987
Nadig	1991	I	2	Piemonte (Val Varaita)	Pontechianale	Cle del Agnello, SE- side (near Chianale)	2100	
Nadig	1985	I	2	Piemonte (Val Varaita)	Pontechianale	Cle del Agnello	2700- 2900	Nadig, 1987
Nadig	1991	F	2	Hautes-Alpes (Queyras)	St Véran	Cle del Agnello, NW side	2100- 2500	
Nadig	1991	F	2	Hautes-Alpes (Queyras)	Château Queyras	Sommet Bucher	2200- 2250	Carron & Sardet, 2001
Nadig	1975	F	2	Hautes-Alpes	Col d'Izoard	Col d'Izoard	2300- 2456	Nadig, 1987
Nadig	1991	F	2	Hautes-Alpes	Col d'Izoard	Col d'Izoard	2300- 2420	
Carron & Sardet	2000	F		Hautes-Alpes	Col d'Izoard	Col d'Izoard	2400	
Carron & Sardet	2000	F	3	Hautes-Alpes	Col d'Izoard, N- side	Refuge Napoléon	2300	
La Greca	1967	I	4	Piemonte (Val Germanasca)	Ghigo	Câppello d'Envie (Punta Cialancia)	2550	
Nadig	1985	I	2	Piemonte (Val Germanasca)	Ghigo	Tredici laghi - Punta Cialancia	2250- 2750	Nadig, 1987
Nadig	1985	I	2	Piemonte (Val Germanasca)	Ghigo	above Ghigo	1740- 1800	Nadig, 1987
La Greca	1967	I	4	Piemonte (Val Germanasca)	Perrero	Ribba, Pinerolo (?)	1700	
Nadig	1985	I	2	Piemonte (Val Germanasca)	Perrero	Conca Cialanca (= Punta Cialancia)	2260	Nadig, 1987
Nadig	1985	I	2	Piemonte (Val Germanasca)	Perrero	road to Co. Cialancia	1600	Nadig, 1987
Heller	1987	I		Piemonte (Val Germanasca)	Perrero	Conca Cialanca (= Punta Cialancia)		Heller, 1988
La Greca	1967	I	4	Piemonte (Val Chisone)	Cumiana	Monte Uia, Cumiana, Pinerolo	2100	
La Greca	1967	I	4	Piemonte (Val Chisone)	Fenestrelle	Rif. Selleries	2020	
Nadig	1975	I	2	Piemonte (Val Chisone)	Fenestrelle	Cle Finestre	2100- 2200	Nadig, 1987
Carron & Praz	1998	I		Piemonte (Val Chisone)	Fenestrelle	Col Blegier		
Nadig	1975	I	2	Piemonte (Val Chisone)	Fenestrelle	Col Blegier	2400- 2550	Nadig, 1987
Carron & Praz	1998	I	3	Piemonte (Val Chisone)	Pragelato	Col de l'Assietta		



obs.	year	cou.	col.	region (A, I), canton (CH), department (F)	locality	site	alt.	reference if published
La Greca	1967	I	4	Piemonte (Val Chisone)	Pragelato	Col de l'Assietta	2470	
Nadig	1975	I	2	Piemonte (Val Chisone)	Pragelato	Col de l'Assietta	2300- 2550	Nadig, 1987
La Greca	1967	I	4	Piemonte (Val Chisone)	Sestrière	Colle Basset	2200- 2400	
La Greca	1967	I	4	Piemonte (Val Chisone)	Sestrière	M. Sises	2700	
Nadig	1975	I	2	Piemonte (Val Chisone)	Sestrière	Sestrière	2300- 2550	Nadig, 1987
Carron & Praz	1998	I		Piemonte (Val Chisone)	Sestrière	Colle Basset	2420	
La Greca	1967	I	4	Piemonte (Val di Susa)	Torinese (Oulx)	Colle Bercia (Cesana Torinese)	2250	
La Greca	1967	I	4	Piemonte (Val di Susa)	Torinese (Oulx)	Colle Bercia (Cesana Torinese)	1700	
Nadig	1991	I	2	Piemonte (Val di Susa)	Cesana Torinese (Oulx)	Monti della luna, C. Bercia, above Sagna Longa	2260	
Nadig	1991	I	2	Piemonte (Val di Susa)	Clavière (Col Montgenèvre)	Pian Gimont	2080	
Nadig	1984	F	2	Hautes-Alpes	Montgenèvre (Briançon)	Col de Montgenèvre	1930	Nadig, 1987
Carron & Sardet	2000	F	3	Hautes-Alpes	Montgenèvre (Briançon)	north-exposed slopes	1850- 2000	
Nadig	1984	F	2	Hautes-Alpes	Montgenèvre (Briançon)	Durance springs - Plateau Gondran	2070- 2300	Nadig, 1987
<i>pusillus</i>								
Carron & Sardet	2000	I	3	Piemonte	Col Colombardo	Col de Colombardo, N-side	1410 (?)	
Nadig	1985	I	2	Piemonte	Col Colombardo	Col de Colombardo	1850- 1900	Nadig, 1987
Nadig	1985	I	2	Piemonte	Col Colombardo	Col de Colombardo N-side	1660	Nadig, 1987
Goidanich	1953	I	4	Piemonte (Val dell'Orco)	Locana	val dell'Orco Teleccio	2400	
Goidanich	1953	I	4	Piemonte (Val dell'Orco)	Locana	val dell'Orco Teleccio	2400	
Carron & Sardet	2000	I	3	Piemonte (Val Soana)	Valprato Soana	Piamprato	1800- 1900	
Nadig	1985	I	2	Piemonte (Val Soana)	Valprato Soana	Piamprato (SW-side)	1750- 1900	Nadig, 1987
Goidanich	1953	I	4	Piemonte (Val Soana)		S. Bessa, S. Besso	2200	
Goidanich	1953	I	4	Piemonte (Val Soana, Val di Forzo)	Ronco canavese	Forzo	2200	

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Carron & Sardet	2000	I	3	Piemonte (Canavese)	Santa Elisabetta	Santa Elisabetta	1400- 1500	
Nadig	1985	I	2	Piemonte (Canavese)	Santa Elisabetta	Santa Elisabetta	1400- 1500	Nadig, 1987
Nadig	1991	I	2	Piemonte (Canavese)		M. Soglio S-side to the top	1800- 2000	
Nadig	1990	I	2	Val d'Aoste (Val Champorcher)	Champorcher	Dondenaz	2100- 2200	
Carron & Praz	1999	I	3	Val d'Aoste (Val Champorcher)	Chardonney	Lanis	2000- 2300	
Carron & Sardet	1999	I		Val d'Aoste (Val de Cogne)	Cogne-Lillaz	Loye	(2100- 2300)	
Carron & Manco	1999	I		Val d'Aoste (Val de Cogne)	Cogne-Lillaz	Loye	2216	
Goidanich	1955	I	4	Val d'aoste (Val Savaranche)	Orville	Orville	2200	

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