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New distributional data on *Oxysternon pteroderum* Nevinson, 1892 (Scarabaeidae, Scarabaeinae,Phanaeini) and its possible implications in conservation

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Abstract

New distributional data are reported on the rare phanaeine dung beetle, *Oxysternon pteroderum* Nevinson, 1892, based on five specimens recently collected between 1985 and 2010. Before the present study, *Oxysternun pteroderum* had been reported solely from the super-moist Atlantic coastal forests of southeastern Brazil. We now believe that the distribution of *O. pteroderum* follows the riparian areas of large rivers connected to the super-moist forest ecosystem.

Keywords

Atlantic Forest, Cerrado, Coleoptera, dung beetles

Resumo

Novos dados de distribuição da espécie *Oxysternon pteroderum* Nevinson, 1892 baseado em cinco espécimes recentemente coletados entre 1985 e 2010. Antes do presente estudo, *Oxysternun pteroderum* tinha sido reportado apenas para Mata Atlântica de áreas costeiras do sudeste do Brasil. Agora, acreditamos que a distribuição de *O. pteroderum* segue áreas de florestas ripárias de grandes rios que são conectadas com este ecossistema.

Palavras-chave
Mata Atlântica, Cerrado, Coleoptera, rola-bosta

Introduction

Oxysternon pteroderum Nevinson, 1892 was described based on specimens from Montevideo (Uruguay), Rio de Janeiro and Espírito Santo (Brazil) (Nevinson 1892). Since then, it has been considered a rare and endemic species from the Brazilian Atlantic forest (Arnaud 2002; Edmonds and Zídek 2004). This species is isolated taxonomically and geographically from the other members of the genus and is not easily confused with any congener. The form of the male pronotum and absence in both sexes of tubercles and other protuberances on the head are unique in the genus. Arnaud, 2002, placed *O. pteroderum* in a subgenus of its own - *Pteroxysternon* Arnaud, 2002. However, regardless of being in the same subgenus or not, those species included by Edmonds in *Mioxysternon* Edmonds, 1972 appear to be more closely related between them than to species in the nominotypical subgenus.

Until now, this species was known only from super-moist Atlantic coastal forests of southeastern Brazil, having been collected in the states of Espírito Santo, Rio de Janeiro and Minas Gerais (in this last case on the Espírito Santo border) (Arnaud 2002; Edmonds and Zídek 2004). As the Atlantic coastal forest is a greatly threatened habitat and the last known record for this species was from 1955, there was good reason to consider *O. pteroderum* as a species seriously endangered (Edmonds and Zídek 2004). The purpose of this paper is to present new data on recently (post-1955) collected specimens known to us. We are aware of five specimens from different locations in three different states, collected between 1985 and 2010. We comment on these below.

1. The oldest specimen known to us that was collected after 1955 is a green male collected by students of the São Francisco Xavier School in Ipatinga, Minas Gerais, in November 1985. The collection method is unknown. Ipatinga is located on the margin of the Rio Doce, the most important river in this region. The basin of this river is located in southeastern Brazil and has a drainage area of 83,400 km², of which 86 % belongs to the state of Minas Gerais and 14 % to the State of Espírito Santo. The source of this river is located in the mountainous regions of Minas Gerais in the ranges of Mantiqueira and Espinhaço, and its waters travel around 853 km to reach the Atlantic Ocean near the city of Regência, in Espírito Santo. Thus, the gallery forests that follow the rivers in this basin have an important role connecting Atlantic forest in the coastal lowlands with other areas of Atlantic forest at higher altitudes inland. This specimen is housed in the Everardo and Paschoal Grossi private collection in Nova Friburgo, Brazil (EPGC).

2. A green female, deposited at the Canadian Museum of Nature, Ottawa, Canada, was collected using a flight intercept trap (FIT) in an area of lowland primary Atlantic forest in Linhares, Espírito Santo state (BRAZIL, Espírito Santo, Linhares, Fazenda do Macuco, 27-I-2000, 19°03'50"S, 39°58'43"W, 10m, F. Génier & S. Ide legs). Lin-

hares is at the mouth of the Rio Doce mentioned above, and lowland evergreen forest is continuous between this and the site previously mentioned.

3. A second specimen from the Grossi collection is a bluish-green male specimen, collected manually in a tunnel about three centimeters underneath cow dung, on a rural road near the city of Encruzilhada, State of Bahia (BRAZIL, Bahia, Encruzilhada, 12-XII-2007, 15°28'28"S, 40°50'17"W, Grossi, Rafael & Parizotto legs). This road was bordered on one side (about 5 m from the road) with secondary Atlantic forest (Ombrophilous forest), that was very dry and low in height. The opposite side of the road was covered with introduced pasture. This region, in the south of the Bahia, consists of a triple border between the major biomes of Atlantic forest, Cerrado (Brazilian savanna) and Caatinga, which presents a high number of endemic species. The Atlantic forest of this region is also called "Mata Seca" because of its physiognomy and the plant species found there. This is one of the poorest regions in Brazil where forests are being removed for carbon production in the steel factories of Minas Gerais State.

4. One blue male was collected using pitfall traps baited with human feces in a Cerrado (Brazilian savannah) area (BRAZIL: Minas Gerais, Januária, Área de Proteção Ambiental (APA) de Pandeiros, XI-2008, 15°30.487'S, 44°45.614'W, 544 m, J.G.M. Souza leg.) in November, 2008, and is deposited at the Entomology Section of the Zoology collection of Universidade Federal de Mato Grosso, Cuiabá, Brazil. This is the first record of this species in a Brazilian savannah area, increasing greatly our knowledge of the distribution of this species, which was previously only recorded in Atlantic coastal forests (Edmonds and Zídek 2004). However, the place where this individual was collected is about 30 km from the edge of San Francisco River. Both the source and the mouth of this river are located in Atlantic forest regions.

5. Another male with a bluish-green pronotum and completely blue elytra was collected with pitfall traps baited with human feces in a fragment of secondary Atlantic forest in Minas Gerais (BRAZIL: Minas Gerais, Santa Bárbara, Estação de Preservação e Desenvolvimento Ambiental de Peti (EPDA-Peti forest), 01/15-X-2010, 19°53'01.58"S, 43°22'07.41"W, 685 m, F. França & C. Alves leg.) in October, 2010. This location is in the mountains of the Espinhaço Range. Although the typical vegetation of this region is also Atlantic forest, this is an important record because the elevation where the specimen was collected casts doubt on previously assumed geographic restrictions to low altitude Atlantic forest. The Espinhaço Range comprises a group of mountains between the limits 20°35'S and 11°11'S, ranging from the Ouro Branco Mountains, south of the city of Ouro Preto in Minas Gerais to Bahia, where it receives the name of "Chapada Diamantina" (Giulietti et al. 1997). Formed by old intermittent uplifting, from the Paleozoic, this is an important geographical barrier that limits the Atlantic Forest to the eastern mountain range and the Cerrado to western portion.

Edmonds and Zídek (2004) reported four localities for this species in the Atlantic forest near the southeastern Brazilian coast (Espírito Santo: Timbuhy, Santa Leopoldina; Minas Gerais: Rio José Pedro; Rio de Janeiro: Rio de Janeiro), in addition to the location of the type-series (Uruguay: Montevideo). With the new records included in

this work, we extend the distribution of *Oxysternon pteroderum* to five locations, one being the first record for the state of Bahia (Figure 1). The locations are shown on the map of Figure 1, in which we highlight the following aspects: 1 – points located in the municipalities of Timbuhy (ES), Santa Leopoldina (ES), Linhares (ES) and Rio de Janeiro (RJ) are located in Atlantic forest of low elevations, confirming the previously highlighted relationship of this species with these ecosystems; 2 – the points in the municipalities of Ipatinga (MG), Santa Bárbara (MG), Rio José Pedro (MG), Pandeiros (MG) and Encruzilhada (BA) are at locations away from the Atlantic coast, with some found in Cerrado, or in mountainous regions in southeastern Brazil. However, these points have in common the proximity of major river courses or basins that are connected with the Atlantic forest, such as the Rio Doce (Ipatinga, Santa Bárbara and Rio José Pedro), the basin of the Rio Pardo (Encruzilhada) and the São Francisco River (Pandeiros) (Figure 1). In general, it is common to record dung beetles species typical of Atlantic Forest and Amazonian rainforest along riparian areas that have connections to these ecosystems (Vaz-de-Mello and Silva, personal communication). In addition, the other species included by Edmonds and Zídek (2004) in *Mioxysternon* also present disjunct distribution areas that are connected by large rivers. The distribution limits of these species appear to be relatively wide within a given biogeographic subregion.

We believe the distribution of *O. pteroderum* follows the riparian areas of large rivers that are connected with this ecosystem. Therefore, we regard the savanna record to be consistent with the assumption that this is a typical species of the Atlantic forest. However, the supposed occurrence of this species in Uruguay (Montevideo), in an area considerably to the south of other known locations, can be a case of incorrect locality record, as already pointed out in the original description of this species (Nevinson 1892).

A large number of pitfalls and/or intercept flight traps were used for sampling specimens in all cases in which *O. pteroderum* was recorded in this work. However, in all studies, only one individual was recorded. François Génier and Sérgio Ide collected one individual at intercept flight traps and none in several pitfalls baited with human feces installed in the same habitat, at the same time. Grossi and collaborators collected one individual underneath cow dung and none in pitfalls baited with human feces. On the other hand, Souza, França and collaborators collected one individual in pitfalls baited with human feces. The information presented above is not enough to define the food habit of *O. pteroderum*. Thus, the low abundance observed in collections may be an artefact due to an unknown feeding behavior. The baits traditionally used for collections might not be attractive for this species. However, the hypothesis that *O. pteroderum* can be a rare species should not be discarded.

This species has not been officially evaluated according to IUCN criteria. Edmonds and Zídek (2004) suggested that *O. pteroderum* might be endangered due to its highly threatened habitat. The possibility of *O. pteroderum* inhabiting inland regions of Atlantic Forest through the gallery forests of great rivers decreases its vulnerability because inland regions suffer relatively lower impacts than the coastal areas of this ecosystem. However, we evaluated informally this species using the IUCN criteria and found that it could receive a threatened status mainly due to high fragmentation and

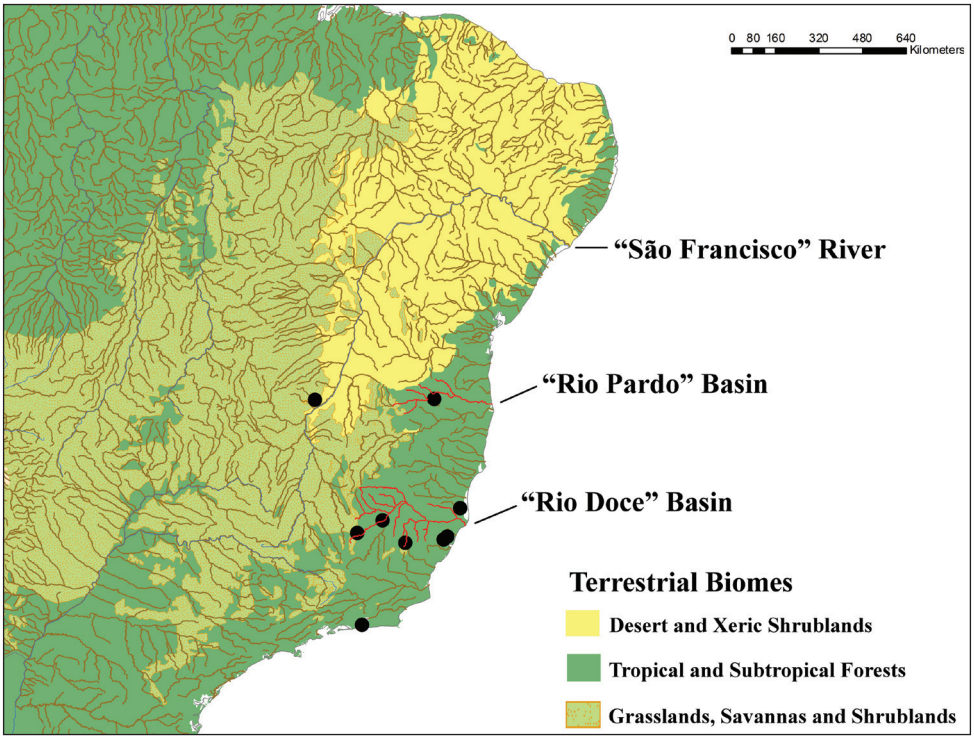

Figure 1. Known geographical distribution of *Oxysternon pteroderum*.

destruction of the Atlantic Forest and due to the low number of individuals collected during more than 100 years (we calculated there are less than 35 specimens in collections, including these new records). However, we believe there are still insufficient data to confidently qualify its level of threat due to the poor knowledge of its biology.

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The Ochodaeidae of Argentina (Coleoptera, Scarabaeoidea)

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Abstract

The Ochodaeidae (Coleoptera: Scarabaeoidea) of Argentina are revised. Previously, two species of Ochodaeinae were known from the country, both in the genus *Parochodaeus* Nikolajev: *P. campsognathus* (Arrow) and *P. cornutus* (Ohaus). An additional 7 species of *Parochodaeus* from Argentina are described here as new. In addition, *Gauchodaeus patagonicus,* new genus and new species in the subfamily Chaetocanthinae, is described. This is the first record of the subfamily Chaetocanthinae in South America. Redescriptions, diagnoses, and maps are provided for each species. We also provide a key to genera and a key to species of *Parochodaeus* of Argentina. With this work, the number of ochodaeid species known from Argentina is increased from 2 to 10.

Keywords

Systematics, Ochodaeidae, *Parochodaeus*, Chaetocanthinae, Argentina, new species, new genus

Introduction

The small family Ochodaeidae includes around 100 species of scarabaeoid beetles that are found nearly worldwide. The family is most diverse in arid, sandy habitats. They are sometimes referred to as the 'sand-loving scarab beetles' (Carlson 2001), although

some species are found in forests. They can be distinguished from most other scarabaeoids by the presence of a pectinate or crenulate mesotibial spur and the absence of a true ocular canthus dividing the eye (Scholtz et al. 1988). Care should be taken in evaluating the presence of a canthus, because in many species of ochodaeids the first antennomere is greatly enlarged with a posterior lobe that covers a portion of the eye and appears as a 'false canthus'.

Scholtz et al. (1988) examined the systematics of the family and divided it into two subfamilies with a total of five tribes. The subfamily Ochodaeinae, with two tribes, is absent only from Australia. It is particularly well represented in Africa, Madagascar, and southwestern North America. In South America only the genus *Parochodaeus* Nikolajev is known (Paulsen 2007, Paulsen in press). Species of *Parochodaeus* are distributed in the New World from the Great Plains of the United States to central Argentina. Among the Ochodaeinae, species of *Parochodaeus* can be easily distinguished by their elytral locking mechanism consisting of acute elytral apices and bituberculate propygidium (Nikolajev 1995; Paulsen 2007). Currently 17 species are known (Paulsen 2007; Paulsen 2011).

The second subfamily, Chaetocanthinae, is predominantly distributed in southern Africa, with three genera and seven species in total in that region. Also included in the subfamily is the monotypic genus *Pseudochodaeus* Carlson and Ritcher from western North America. Previously, no species were known to occur in South America. We independently discovered specimens from Neuquén province belonging to the subfamily Chaetocanthinae. This Argentinean species, which is undescribed, is most similar to species of the African genus *Synochodaeus* Kolbe, but there are numerous generic-level morphological differences between the Argentinean and African taxa. For that reason, a new genus and species for the Argentinean species is described below.

Larvae are unknown for the Ochodaeinae. Little is known about adults except that many species in xeric habitats are nocturnal and are attracted to light (Carlson 2001). Some rarely-seen species are diurnal and may be netted in flight or collected in pitfall traps. Flight intercept traps are the most successful technique for collecting diurnal species in forested habitats.

Materials and methods

Taxonomic material

Specimens examined for this study are deposited in the following institutions and private collections.

AMNH American Museum of Natural History, New York, NY, USA.
BMNH The Natural History Museum, London, UK.
CMNC Canadian Museum of Nature, Ottawa, Canada.

CMNH Carnegie Museum of Natural History, Pittsburgh, PA, USA.
CNCI Canadian National Collection of Insects, Ottawa, Canada.
DEBU University of Guelph Insect Collection, Guelph, Canada.
FMNH Field Museum of Natural History, Chicago, IL, USA.
FSCA Florida State Collection of Arthropods, Gainesville, FL, USA.
IAZA Instituto Argentino de Investigaciones de Zonas Áridas, Mendoza, Argentina.
IFML Fundación e Instituto Miguel Lillo, Tucumán, Argentina.
ISNB Institute Royal des Sciences Naturelles de Belgique, Brussels,Belgium.
LEMQ Lyman Entomological Museum, McGill University, Quebec, Canada.
MACN Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina.
MJPC M.J. Paulsen Collection, Lincoln, NE, USA.
MLP Museo de la Plata, La Plata, Argentina.
UCCC Museo de Zoología de la Universidad de Concepción, Concepción, Chile.
UNSM University of Nebraska State Museum, Lincoln, NE, USA.
USNM United States National Museum (Smithsonian) Collection,Washington, DC, USA.
SARC South African National Collection, Pretoria, South Africa.
TMNH Transvaal Museum of Natural History, Pretoria, South Africa.
ZMHB Museum für Naturkunde (Humboldt Universität), Berlin, Germany.

Morphological characters

Important characters for distinguishing species in the genus *Parochodaeus* are listed in Paulsen (2011) and include the armature of the head, teeth of the legs and metatrochanter, dorsal vestiture and punctation, stridulatory peg, size of the first metatarsomere, and form of the mentum. In species of *Parochodaeus* from Argentina the head armature, when present, consists of either horns, tubercles, or elevated carinae. The leg armature may consist of an acute tooth at the apex of the metafemora or metatibia, or the leg may be unarmed with only a broad, rounded lobe. In one species, the metatrochanter is also toothed. In one group of *Parochodaeus* species ('*P. pectoralis*-complex' *sensu* Carlson 1975) the first tarsomere of the metatarsus is greatly enlarged and often curved. The dorsal vestiture can vary from short bristles to a longer, "shaggy" appearance, but all Argentine species display only short to moderate length setae. Each setose puncture may have an anterior tubercle, and the surface between punctures can be tuberculate or smooth, with the tubercles presenting a tiled appearance. The presence or absence of a stridulatory peg on the abdomen is often diagnostic, and to some extent the shape of the peg can be also when present, but not with the Argentine species. The width of the clypeus is more or less uniform, but the length is often species- and sex-specific. Therefore the form of the clypeus can be strongly transverse, which is described as being short (length about 1/4 or 1/5

width), or long (length about 1/2 width). The form of the mentum is important for identification and may be strongly protuberant vertically, distinctly concave, tumid, or flat. The male genitalia are weakly sclerotized and nondescript, with informative characters restricted to the sclerotized teeth and bristles of the internal sac. Unfortunately, the internal sacs are difficult to dissect if the specimens were collected directly into alcohol or were not recently collected. Because other, more tractable characters are present to distinguish species the internal sacs were not dissected for this work. Males and females do not differ appreciably in size and are not described separately, but sexually dimorphic characters, when present, are noted in the descriptions. Color is not useful in identification of the New World Ochodaeidae because most species vary from light testaceous to dark castaneous in color.

Characters for distinguishing chaetocanthines (as defined in Scholtz et al. 1988) include: 1) metatibial spurs crenulate or pectinate; 2) metatibia compressed, not cylindrical; 3) eyes not bulging; 4) galea of the maxilla rounded. These characters are problematic with respect to the new taxon, which, although clearly allied with *Synochodaeus,* does not conform to half of these criteria. In particular, the metatibial spurs of the new genus are not crenulate or pectinate in the specimens examined. Because the specimens are worn, it may be possible that the crenulations are merely eroded and were originally present, but the crenulations of the mesotibial spurs are present and have not been abraded. Also, the eyes are much larger in the new genus and are as protuberant as in many ochodaeines. The compressed metatibia is not a synapomorphy for chaetocanthines because numerous species of Ochodaeinae also display this character. The rounded galea is present, perhaps representing the strongest remaining synapomorphy for Chaetocanthinae. The new genus is placed into the tribe Synochodaeini Scholtz based on its similarity to *Synochodaeus* species in the following characters: rounded labial palps, elongate form, tridentate protibiae, anterior clypeal margin straight, antenna with ten antennomeres, first antennomere of club not strongly hemispherical, metatrochanter not acutely produced beyond posterior margin of metafemur, and sexual dimorphism lacking. However, it differs from that genus in having a much longer clypeus that is not distinctly separated from the frons by a sulcate depression and not reflexed anteriorly. In addition, the larger metatibial spur is not crenulate, the scutellum is pointed (not rounded) apically, the labrum densely punctate/setose (not mostly glabrous), and the penultimate labial palpomeres are irregularly shaped, not cylindrical.

Taxonomic treatment

Key to the genera of Ochodaeidae of Argentina

1 Propygidium with two tubercles that interlock with acute elytral apices..... ..... ***Parochodaeus*** **Nikolajev**

1' Propygidium unarmed; elytral apices rounded ... ***Gauchodaeus*** **Paulsen, gen. n.**

Parochodaeus **Nikolajev 1995: 77**
http://species-id.net/wiki/Parochodaeus

Type Species. *Parochodaeus pectoralis* (LeConte, 1868), by original designation.

Diagnosis. This genus contains species with an elytral locking mechanism consisting of a bituberculate margin on the propygidium and dentate elytral apices.

Description. Ochodaeidae: Ochodaeinae. Form convex, ovate. ***Length:*** 2.6–9.1 mm. ***Width:*** 1.5–4.9 mm. ***Surface/Color:*** Dorsal surface of head, pronotum, and elytra setose; setae varying from short bristles to longer setae; setae erect or subdepressed. Color testaceous to dark castaneous, variable within species. ***Head:*** Clypeus varying from semicircular to subtrapezoidal, often sexually dimorphic in length (longer in females). Frontoclypeal suture indistinct but generally discernible. Frons simple or variably armed with tubercles, horns, or carinae. Mentum variable between species. Mandibles moderately large, externally rounded to angulate, visible beyond labrum in dorsal view. Labrum strongly projecting between mandibles, setose. Antenna with 10 antennomeres; 3- antennomere club nearly round, pubescent. ***Pronotum:*** Surface densely punctate, punctures fine to moderate, each with or without a distinct setigerous tubercle anteriorly; setae moderately long. ***Elytra:*** Striae (except sutural) not impressed, uniserially punctate; punctures moderate to large, moderately deep, round, lacking setae. Intervals tuberculate; tubercles fine to moderate, forming irregular rows, setigerous; setae variable in length. ***Legs*****:** Protibia with 3 external teeth increasing in size distally; occasionally with apical internal tooth or "thumb" produced beyond tarsal insertion. Metafemur usually simple with slightly produced rounded lobe, occasionally armed with 1 large tooth or several small, irregular teeth on dorsal or ventral posterior margin before apex. Metatibia form variable from slender and subcylindrical to broad and flattened. ***Abdomen*****:** Stridulatory peg, if present, near anterolateral angle of propygidium (necessary to unlock elytron and depress abdomen to view). Propygidial margin with 2 tubercles on posterior margin.

Composition. The genus *Parochodaeus* currently consists of 17 species known from the central Great Plains of the United States south to Río Negro Province in Argentina (Paulsen 2007; Paulsen 2011). An additional seven species from Argentina are described in this paper, bringing the total number of species in the genus to 24.

Remarks. The presence or absence of a stridulatory peg on the abdomen and the form of the mentum are extremely useful in determining species. The head armature of frontal horns, tubercles, and carinae are allometric, and, as such, extremely small specimens will still have the appropriate structure, albeit extremely reduced. In such cases, for example with exceptionally small *P. campsognathus* (Arrow), the other characters given should be used to confirm identification.

Key to the *Parochodaeus* species of Argentina

1 Vertex of head with 2 prominent tubercles in both sexes (Fig. 1)..... ..... ***P. pudu*** **Paulsen & Ocampo, sp. n.**

Figures 1–3. Characters of the head of *Parochodaeus* species **1** Head of *P. pudu* with 2 frontal tubercles, dorsal view **2** Head and pronotum of *P. procelipes,* lateral view showing clypeal horn and pronotum that is strongly declivous anteriorly **3** Head of *P. campsognathus* with large, angulate carina on vertex of head, dorsal view

1' Vertex of head with 1 horn (Fig. 2) or tubercle, elevated carina (Fig. 3), or unarmed (anterior margin of head may have 2 clypeal tubercles) **2**

2 Frontoclypeal area with distinct central horn, tubercle, or elevated carina in both sexes **3**

2' Frontoclypeal area unarmed in both sexes (*P. jujuyus* with 2 indistinct tumosities on vertex, but these never appearing as discrete tubercles) 7

3 Frontoclypeal armature in the form of an elevated, often anteriorly pointing angular carina (Fig. 3)..... ***P. campsognathus* (Arrow)**

3' Frontoclypeal armature consisting of a single horn or horn-like tubercle..... 4

4 Apex of metafemur toothed posteriorly (Fig. 4). Pronotal disc distinctly punctate, surface between punctures smooth ..... ***P. dentipes* Paulsen & Ocampo, sp. n.**

4' Apex of metafemur not toothed. Pronotal punctures obscured by roughened surface **5**

Figures 4–7. Characters of the left hindleg of *Parochodaeus* species, ventral view **4** *P. dentipes* with arrow indicating acute tooth near apex of metafemur; metatibia broad **5** *P. jujuyus,* showing greatly enlarged first metatarsomere **6** *P. procelipes,* narrow metatibia **7** *P. stupendus,* with large metatrochanteral tooth, large ventral tooth at the metafemoral apex (second, dorsal tooth obscured), and strongly curved metatibia.

5 Metatibia slender, less than 1/5 as wide as long (e.g., Fig. 6). Mentum with distinct median longitudinal furrow over entire length..... ..... ***P. proceripes* Paulsen & Ocampo, sp. n.**

5' Metatibia broad, about 1/3 as wide as long (e.g., Fig. 4). Mentum mostly flat, at most only slightly furrowed anteriorly. **6**

6 Frontoclypeal horn or tubercle with apex simple. Mentum entirely flat. Stridulatory peg present. ..... ***P. phoxus* Paulsen & Ocampo, sp. n.**

6' Frontoclypeal horn or tubercle with U-shaped carina at apex. Mentum sulcate anteriorly. Stridulatory peg absent ..... ***P. perplexus* Paulsen & Ocampo, sp. n.**

7 First metatarsomere greatly expanded (Fig. 5) .... ***P. jujuyus* Paulsen & Ocampo, sp. n.**

7' First metatarsomere not greatly expanded (Fig. 6)..... **8**

8 Lateral margin of pronotum evenly rounded. Metatrochanter and apex of metafemur lacking acute teeth. Metatibia straight ..... ***P. cornutus* (Ohaus)**

8' Lateral margin of pronotum strongly angulate. Metatrochanter toothed, apex of metafemur with two teeth (Fig. 7). Metatibia curved..... ..... ***P. stupendus* Paulsen & Ocampo, sp. n.**

***Parochodaeus campsognathus* (Arrow, 1904)**
http://species-id.net/wiki/Parochodaeus_campsognathus
Figs 3, 8; Map 1

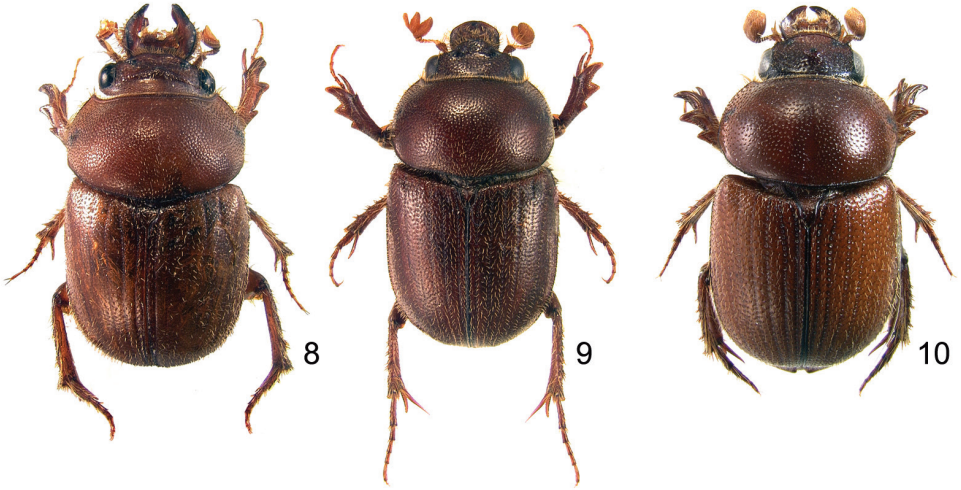
Ochodaeus campsognathus Arrow 1904: 744, original combination.

Type material. Lectotype male (BMNH), pinned. Lectotype here designated to fix the concept to a single specimen from the original series. Original labels: a) "Argentina / Chaco / Wagner. / 1903-180."; b) ♀ (sic); c) "*Ochodaeus / campsognathus,* / Type / Arrow"; d) red-bordered circular "TYPE"; e) blue-bordered circular "SYN- / TYPE"; f) "[O. campsognathus / Arrow BM / Syntype 1]" / DET. / D. C. CARLSON 19__"; g) "*Parochodaeus / campsognathus* / (Arrow, 1904) / det. M.J. Paulsen 2009". Two paralectotypes (male and female) labeled with *a, e, g* as above specimen, and *f* except syntype numbers 2 and 3.

Type locality. Argentina: Chaco.

Diagnosis. The species is easily distinguished by its V-shaped frontal carina (Figs 3, 8), but in the smallest specimens the carinae can be almost obsolete. If necessary, the large, rectangular mentum with a complete, deep longitudinal furrow will confirm identification.

Description. ***Length:*** 4.6–9.1 mm. ***Width:*** 2.5–4.9 mm. ***Head:*** Surface roughened as pronotum, sparsely punctate. Frons with broad V-shaped carina medially (Fig. 3), pointing anteriorly. Clypeus trapezoidal, short in males (length equal to 1/4 width), longer in females (length equal to approximately 1/3 width); anterior margin thickened, elevated but indistinctly indicated. Labrum deeply emarginate. Mandibles angulate externally, larger males with external angulation strongly produced upward.



Figures 8–10. Dorsal habitus of *Parochodaeus* species, males **8** *P. campsognathus* **9** *P. cornutus* **10** *P. dentipes*, sp. n.

Mentum large, rectangular, with distinct longitudinal furrow for entire length. ***Pronotum:*** Form convex to strongly convex in larger individuals. Surface with densely tiled tubercles, tubercles moderate; surface between tubercles punctate; punctures fine. ***Elytra:*** Setae of interstrial tubercles moderately long, erect. ***Legs:*** Protibia with apical spur weakly curved; internal apical tooth lacking. Metatrochanter simple. Metafemur with posterior margin simple. Metatibia straight, narrow (>4× longer than wide) expanding gradually to apex. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg present.

Distribution (Map 1). 153 specimens examined.

ARGENTINA: BUENOS AIRES: Lobos Estancia El Ombú (1), Puán (1), Tandil (1); CHACO: Resistencia (100 km NW) (1); CÓRDOBA: Anisacate (2), Río Cuarto (45 km N) (4), no locality (17); CORRIENTES: San Roque (1); ENTRE RÍOS: Santa Elena (2); FORMOSA: Ingeniero Juárez (1), Gran Guardia (1), Pilcomayo (1), No data (2); LA PAMPA: General Acha (1); MENDOZA: El Retamo (1), Moliches (7), Reserva de la Biósfera Ñacuñán (2), no locality (2); SAN LUIS: Arizona (7); SALTA: Joaquín V. González (1), Rivadavia (1); SANTA FÉ: Estancia la Noria (17), Lanteri (3), Villa Ana (7); SANTIAGO DEL ESTERO: El Pinto (1), Fernández (4), La Banda (1), Ojo de Agua (1), Río Salado (28); TUCUMÁN: Encrucijada (3), no locality (1). No data (4).

BOLIVIA: SANTA CRUZ: Cordillera Parapetí (1).

BRAZIL: MATO GROSSO: Cuiabá (2); RIO GRANDE DO SUL: Rio Grande do Chapada (1). No data (2).

PARAGUAY: BOQUERÓN: 145 km from Puerto Casado (3); Guairá: Independencia (1).

Temporal distribution. January (16), February (16), March (10), April (3), October (1), November (6), December (25). No data (70).

Remarks. Based on the collections examined, this is the most commonly collected species of ochodaeid in South America, and it is also the largest.

The original description of Arrow (1904) mentioned six syntypes, although there are ten specimens with the appropriate Wagner labels in the Natural History Museum in London. There are two pairs, (2♂, 2♀), treated as syntypes by Carlson, who labeled them numbers 1–4. One male with a BMNH type label (Syntype #1 *sensu* Carlson) had the genitalia dissected by Carlson, and this specimen is chosen as the lectotype. The fourth specimen (Carlson's Syntype #4) labeled "Argentina / Rio las Garzas / E. Wagner. / 1907-384" is a female accessioned three years after Arrow's publication. Because this date is after the publication date, it is not clear that Arrow studied the specimen and its syntype status is questionable.

***Parochodaeus cornutus* (Ohaus, 1910)**
http://species-id.net/wiki/Parochodaeus_cornutus
Fig. 9; Map 1

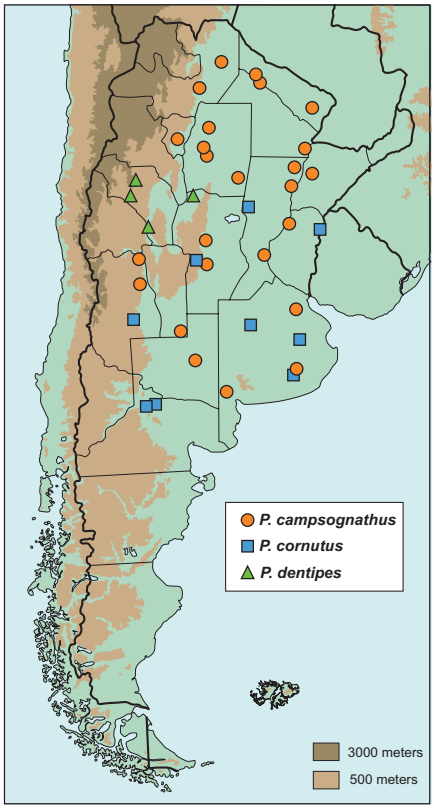
Ochodaeus cornutus Ohaus 1910: 174, original combination.

Type material. Lectotype male (MACN), pinned. Lectotype here designated to fix the concept to a single specimen from the original series. Original labels: a) black-bordered "Rep. Argentina / Prov. Buenos Aires / 190_ / C. Bruch"; b) ♂; c) "Cotypus" on pale green paper; d) red-bordered "*Ochodaeus* / *cornutus* / Ohaus" handwritten by Bruch; e) "*Ochodaeus* / *cornutus* Ohs. / ♂ / Det. F. Ohaus 1909", with "MACN-En 1019" on reverse; f) red paper "*Ochodaeus* / *cornutus* ♂ / Ohaus, 1910 / LECTOTYPE / Det. Paulsen & Ocampo". Paralectotype (MACN), labels a-e as lectotype except with ♀ when appropriate, and "MACN-En 1020"; f) yellow paper "*Ochodaeus* / *cornutus* ♀ / Ohaus, 1910 / PARALECTOTYPE / Det. Paulsen & Ocampo".

Type locality. Argentina: Buenos Aires and Santa Fé.

Diagnosis. Males of *P. cornutus* (Fig. 9) are quickly distinguishable due to the two tubercles on the anterior clypeal margin. Females lack tubercles, but the simply tumid mentum combined with unarmed metatibiae will confirm identification when not associated with males.

Description. ***Length:*** 5.7–8.0 mm. ***Width:*** 2.8–4.0 mm. ***Head:*** Surface variably roughened, tuberculate or not, sparsely punctate. Frons with 2 low tumosities. Clypeus semicircular, long (length equal to 1/2 width), anterior margin of males with an erect, horn-like tubercle on each end, margin between tubercles often indistinct; females lacking tubercles. Labrum emarginate. Mandibles rounded externally. Mentum tumid, lacking longitudinal furrow. ***Pronotum:*** Form convex, strongly so in males (declivous anteriorly). Surface tuberculate, tubercles moderate to large; surface between tubercles punctate; punctures moderate. ***Elytra:*** Setae of interstrial tubercles short, erect. ***Legs:*** Protibia with apical spur nearly straight; internal apical tooth lacking. Metatrochanter simple. Metafemur with posterior margin simple. Metatibia straight,



Map 1. Argentinean distribution of *P. campsognathus* (circles), *P. cornutus* (squares), and *P. dentipes* (triangles)

narrow (>4× longer than wide) expanding gradually to apex. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg absent.

Distribution (Map 1). 30 specimens examined.

ARGENTINA: BUENOS AIRES: El Jabalí (1), Rosas (3), Tandil/Lonacepín (1), No data (2); CÓRDOBA: Alpa Corral Estancia Eloísa (1); ENTRE RÍOS: Concordia (6); MENDOZA: General Alvear (1); NEUQUÉN: No locality (2); SANTA FÉ: Arrufo (2); RÍO NEGRO: Catriel (4), Coronel Gómez (1).

BRAZIL: RIO GRANDE DO SUL: Pelotas (1).

PARAGUAY: CORDILLERA: San Bernardino (3); VILLARICA: Guairá (2).

Temporal distribution. January (10), February (2), June (2), July (4), October (1), November (2). No data (5).

Remarks. Ohaus (1910) examined adults of both sexes from the Bruch and Richter collections, from Buenos Aires and Santa Fé respectively. Two Bruch specimens in the MACN collection are labeled as syntypes, and we designate the male as the lectotype. No specimens from ZMHB, the depository of many Ohaus types, are potential syntypes. Thus, the Richter syntypes have not been located.

***Parochodaeus dentipes* Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:61A3371B-6765-48B7-916B-9DDAEB26895E
http://species-id.net/wiki/Parochodaeus_dentipes
Figs 4, 10; Map 1

Type material. Holotype male (MLP), pinned. Original labels: a) "Piedra Pintada / La Rioja 23-II-39 / Birabén-Scott leg." b) red paper "*Parochodaeus* / *dentipes* / Paulsen & Ocampo / HOLOTYPE". One paratype (MLP) labeled as holotype. Three paratypes (LEMQ) labeled: a) "ARGENTINA, La Rioja / Guandacol, 1000m / 1-3.XII.1983, L.E. Peña / at light"; b) black-bordered "Lyman Entomological / Museum / Ste-Anne-Bellevue / Canada". One paratype (CMNC) labeled: a) "ARGT / La Rioja / Mascasín / I- 1959". One paratype (CMNC) labeled "Argentina / Cordoba / Do. Cruz del Eje / Guanaco Muerto / Coll. Martínez" and "Ene. 977". All paratypes with "*Parochodaeus* / *dentipes* / Paulsen & Ocampo / PARATYPE" on yellow paper.

Type locality. Argentina: La Rioja: Piedra Pintada.

Diagnosis. This is one of only two species in Argentina with a large tooth at the apex of the metafemur (Fig. 4), and the tooth is present in both sexes. The species can be distinguished by the presence of that tooth and a frontal horn on the head (Fig. 10).

Description, holotype male. ***Length:*** 7.7 mm. ***Width:*** 4.0 mm. ***Head:*** Surface tuberculate, punctate; punctures moderate. Frons with central tubercle. Clypeus broadly rounded, narrow, short (length equal to 1/5 width); anterior margin thickened, produced anteriorly in both sexes. Labrum deeply emarginate. Mandibles weakly angulate externally. Mentum tumid, notched anteriorly. ***Pronotum:*** Form convex. Surface shiny, weakly tuberculate anteriorly, tubercles obsolete on disc; surface between tubercles punctate; punctures moderate. ***Elytra:*** Setae of interstrial tubercles moderately long, decumbent. ***Legs:*** Protibia with apical spur weakly curved; internal apical tooth present; tooth short, acute. Metatrochanter simple. Metafemur with tooth on posterior margin before apex. Metatibia curved (in ventral view external margin rounded, internal margin sinuate), broad (at apex approximately as wide as mesofemur), expanding abruptly in basal third. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg absent.

Description, paratypes (n=6). ***Length:*** 6.5–7.6 mm. ***Width:*** 3.3–3.9 mm. Differs from holotype in the following external characters: ***Head:*** Females with clypeus longer, length equal to 1/4 width.

Etymology. The specific epithet 'dentipes' is from Latin *dentis* "tooth" and *pes* "foot, leg", for the toothed metafemur, and is used a masculine adjective in the nominative singular.

Distribution (Map 1). 7 specimens examined.

ARGENTINA: CÓRDOBA: Cruz del Eje (1); LA RIOJA: Guandacol (2), Mascasín (1), Piedra Pintada (2).

Temporal distribution. January (2), February (2), December (2).

Remarks. Only seven specimens of this species are known. The specimens from Guandacol were collected at light.

Parochodaeus jujuyus **Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:1156FB0B-89D1-4D3E-9E0F-8FFD9D10D659
http://species-id.net/wiki/Parochodaeus_jujuyus
Figs 5, 11; Map 2

Type material. Holotype male (CMNC), pinned. Original labels: a) "ARG: Jujuy Prov. / Calilegua Nat. Park / 18-28. XII. 87, S&J Peck / El Cortaderal, km 6, 800m / forest malaise-FIT"; b) on red paper "*Parochodaeus* / *jujuyus* / ♂ / Paulsen & Ocampo / HOLOTYPE". Allotype female (CMNC) labeled: a) "ARGENTINA / SALTA / Dº Anta / El Rey / Bordón- leg. / Coll. Martínez / Feb. 984"; b) "*Parochodaeus* / *jujuyus* / ♀ / Paulsen & Ocampo / ALLOTYPE" on red label. Two paratype males (DEBU) labeled: a) ARGENTINA: Salta / 30km E Campo Quijano / FIT; 18-28.ii.1992 / S. A. Marshall"; b) "*Parochodaeus* / *jujuyus* / Paulsen & Ocampo / ♂ / PARATYPE" on yellow label.

Type locality. Argentina: Jujuy: Calilegua National Park.

Diagnosis. *Parochodaeus jujuyus* (Fig. 11) is the only Argentine species of the *P. pectoralis* group. Members of this species group have greatly enlarged first metatarsomeres (Fig. 5) and often have the mentum produced ventrally.

Description, holotype male. ***Length:*** 7.0 mm. ***Width:*** 3.5 mm. ***Head:*** Surface weakly tuberculate, shiny, punctate; punctures moderate, setose. Frons unarmed but with 2 indistinct tumosities. Clypeus broadly rounded, narrow, short (length equal to 1/4 width), margin thickened, produced anteriorly, as long as remainder of clypeus. Labrum emarginate. Mandibles rounded externally. Mentum deeply furrowed, produced downward laterally. ***Pronotum:*** Form convex. Surface with weakly tuberculate, setose punctures mixed with glabrous punctures; punctures moderate in size. ***Elytra:*** Setae of interstrial tubercles moderately long, erect, somewhat abraded. ***Legs:*** Protibia with apical spur weakly curved; internal apical tooth absent. Metatrochanter simple. Metafemur with posterior margin simple. Metatibia slender, (~5× longer than wide) gradually widening to apex. Metatarsomere 1 subrectangular (not cylindrical), greatly enlarged (longer than greatest width of metatibiae), weakly curved. ***Abdomen:*** Stridulatory peg present.

Description, allotype female. ***Length:*** 6.0 mm. ***Width:*** 3.0 mm. Differs from male holotype in the following external characters: ***Head:*** Clypeus longer (length equal to 1/2 width); anterior margin not produced anteriorly. ***Elytra:*** Setae more abraded.

Description, paratypes (n=2). ***Length:*** 5.8–6.6 mm. ***Width:*** 3.1–3.3 mm. Not differing significantly from the holotype except with dorsal vestiture less abraded.

Etymology. The specific epithet 'jujuyus' is an unconventional but euphonious Latinized form of the province name Jujuy, gender masculine.

Distribution (Map 2)**.** 4 specimens examined.

ARGENTINA: JUJUY: Parque Nacional Calilegua El Cortaderal (1); SALTA: Campo Quijano (30 Km E) (2), Parque Nacional El Rey (1).

Temporal distribution. February (3), December (1).

Remarks. This species is known from only four specimens and is from the far north of Argentina. The habitat in the region is montane forest. Label data indicates

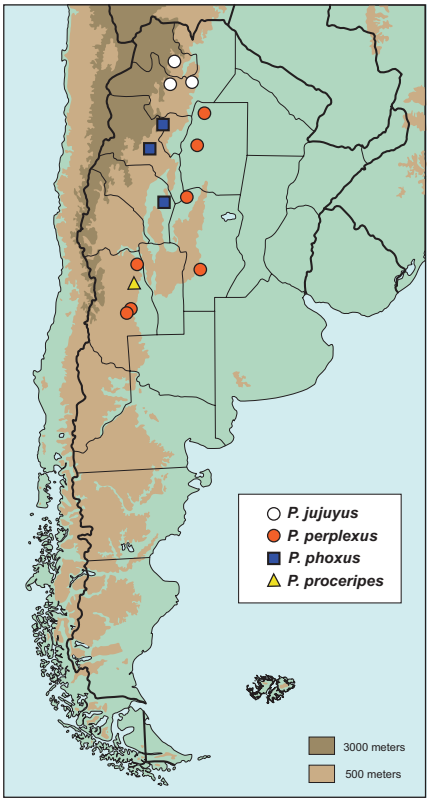
Figures 11–13. Dorsal habitus of *Parochodaeus* species, males **11** *P. jujuyus*, sp. n. **12** *P. perplexus*, sp. n. **13** *P. phoxus*, sp. n.

that the paratypes were collected in flight-intercept traps, which is the most common method of collection for forest ochodaeids.

***Parochodaeus perplexus* Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:0A6E2DAC-595E-4BA2-96E2-70DA1F59E12D
http://species-id.net/wiki/Parochodaeus_perplexus
Fig. 12; Map 2

Type material. Holotype male (MLP), pinned. Original labels: a) "Sgo del ESTERO / RIO SALADO / Wagner Col." b) "*Parochodaeus* / *perplexus* / Paulsen & Ocampo / HOLOTYPE" on red paper. One paratype (CNCI) labeled: a) "ARGT. Stgo. / del Estero"; b) "Fernández / II 1957"; c) "*Parochodaeus* / *campsognathus* / (Arrow) / Vaz-de-Mello det 2003". One paratype at (ZMHB) labeled: "Bolivien / Chaco de Bolivia / K. Pflanz S.G.". One paratype (ZMHB) labeled: a) "Rio Cuarto / Argentina / Breuer"; b) "80." One paratype (MJPC) labeled: a) "ARGT. Santi. del / Estero, Fernández, / II 1957"; b) "*Parochodaeus* / *campsognathus* / (Arrow) / Vaz-de-Mello det 2003". One paratype (IAZA) labeled: "Mendoza, Lavalle / 20 km W de Arroyito / 12-XII-1979 / Col. A. Roig / SERGIO ROIG". One paratype (IAZA) labeled: "San Rafael / Los Toldos, 51 km / SW de Soitué / 31-I-1979 / Sergio Roig." One paratype (CMNC) labeled: "ARGENTINA / CÓRDOBA / D° Cruz del Eje / Guanaco Muerto / Coll. Martínez / Feb. 980". Two paratypes (IAZA) labeled: "San Rafael / Huarpes / 2-II-79 / Sergio Roig". All paratypes labeled: "*Parochodaeus* / *perplexus* / Paulsen & Ocampo / PARATYPE" on yellow paper.

Type locality. Argentina: Santiago del Estero: Río Salado.



Map 2. Argentinean distribution of *P. jujuyus* (white circles), *P. perplexus* (orange circles), *P. cornutus* (blue squares), and *P. dentipes* (yellow triangle).

Diagnosis. The species is similar to *P. dentipes* in that both species have a frontal 'horn' and broad metatibiae. *Parochodaeus perplexus* (Fig. 12) can be separated by its lack of a large tooth at the apex of the metafemur and by the flatter mentum.

Description, holotype male. ***Length:*** 6.9 mm. ***Width:*** 3.8 mm. ***Head:*** Surface tuberculate, punctate; punctures small. Frons with central horn-like tubercle; tubercle with apex U-shaped. Clypeus subtrapezoidal, narrow, short (length equal to 1/4 width); anterior margin not thickened, truncate. Labrum broadly emarginate. Mandibles angulate externally. Mentum flat, weakly concave anteriorly surrounding longitudinal furrow in anterior half. ***Pronotum:*** Form convex. Surface with densely tiled tubercles; tubercles small, setose; surface between tubercles punctate; punctures fine. ***Elytra:*** Setae of interstrial tubercles short, erect. ***Legs:*** Protibia with apical spur weakly curved; internal apical tooth absent. Metatrochanter simple. Metafemur with posterior margin simple. Metatibia weakly curved (in ventral view external margin rounded, internal margin sinuate), broad (at apex approximately as wide as mesofemur), expanding abruptly in basal third. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg absent.

Description, paratypes. ***Length:*** 5.0–7.9 mm. ***Width:*** 2.9–4.2 mm. Differing from the holotype in the following external characters: ***Head:*** Female paratypes with clypeus longer, length equal to 1/3 width.

Etymology. The specific epithet '*perplexus*' is Latin meaning "muddled, interwoven", because this species displays a mix of characters present in other species. The name also aptly represents how perplexed we were to find yet another new species from central Argentina. It is used a masculine adjective in the nominative singular.

Distribution (Map 2)**.** 10 specimens examined.

ARGENTINA: CÓRDOBA: Guanaco Muerto (1), Río Cuarto (1); MENDOZA: Lavalle (20 Km W Arroyito) (1), Los Toldos, 51 Km SW Soitué (1), San Rafael (2); SANTIAGO DEL ESTERO: Fernández (2), Río Salado (1).

BOLIVIA: "Chaco de Bolívia" (1).

Temporal distribution. January (1), February (5), December (1), No data (3).

Remarks. Ten specimens of this species are known. None of the labels have any information on how they were collected, but given the open habitat of the collecting localities they were probably taken at light.

Parochodaeus phoxus **Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:13AB2413-5166-41E5-9DC4-51F3F948FC91
http://species-id.net/wiki/Parochodaeus_phoxus
Fig. 13; Map 2

Type material. Holotype male (FSCA), pinned. Original labels: a) "ARGENTINA: LA RIOJA / Castro Barros; Santa Vera / Cruz; b) -28.67 -66.96; 1600m / 15-II-2005; L. Stange"; b) red paper "*Parochodaeus* / *phoxus* / ♂ / Paulsen & Ocampo / HOLOTYPE". Three paratypes (FSCA, MJPC) labeled as holotype. Four paratypes (UNSM, IAZA) labeled: "ARGENTINA: Catamarca: / Londres. 15 km / SW Belen / 5 Dec. 1973 - 24 Jan. 1974 / Frank A. Enders". One paratype (USNM) labeled: a) "ARGENTINA: Tucumán / Amaichá del Valle, 1995 m. / S 26º 35' 22" W 65º 55' 13" / XII-7-2003 F.C. Ocampo"; b) black-bordered "UNSM SCARAB DNA / VOUCHER SPECIMEN / [FO 63 4/04]". All paratypes labeled: "*Parochodaeus* / *phoxus* / Paulsen & Ocampo / PARATYPE" on yellow paper.

Type locality. Argentina: La Rioja: Castro Barros, Santa Vera Cruz.

Diagnosis. *Parochodaeus phoxus* (Fig. 13) is similar to *P. proceripes* in that it also has a large frontal horn (Figs 2). In *P. phoxus,* the flatter mentum lacking a longitudinal furrow and broad metatibiae will immediately separate it from *P. proceripes*, which has a distinctly furrowed mentum and slender metatibiae.

Description, holotype male. ***Length:*** 7.6 mm. ***Width:*** 4.0 mm. ***Head:*** Surface tuberculate, punctate; punctures small. Frons with horn. Clypeus subtrapezoidal, narrow, short (length equal to 1/4 width); anterior margin not thickened, truncate. Labrum broadly emarginate. Mandibles obtusely angulate at basal third. Mentum almost flat, weakly concave, declivous anteriorly, lacking longitudinal furrow. ***Pronotum:***

Form strongly convex, declivous anteriorly. Surface densely tiled with tubercles; tubercles small, setose; surface between tubercles punctate; punctures fine. ***Elytra:*** Setae of interstrial tubercles moderately long, erect. ***Legs:*** Protibia with apical spur weakly curved; internal apical tooth absent. Metatrochanter simple. Metafemur with posterior margin simple. Metatibia straight, moderately broad (at apex not as wide as mesofemur), gradually expanding to apex. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg present.

Description, paratypes (n=8). ***Length:*** 6.4–8.0 mm. ***Width:*** 3.5–4.1 mm. Differing from the holotype in the following external characters: ***Head:*** Female paratypes with clypeus longer, length equal to 1/3 width.

Etymology. The specific epithet '*phoxus*' is Latinized form of the Greek '*phoxos',* or "pointed, peaked", referring to the frontal horn. It is used a masculine adjective in the nominative singular.

Distribution (Map 2)**.** 9 specimens examined.

ARGENTINA: CATAMARCA: Londres (4); LA RIOJA: Santa Vera Cruz (4); TUCUMÁN: Amaichá del Valle (1).

Temporal distribution. February (4), December (5).

Remarks. Only nine specimens of this species are known. Nothing is known about the life history of these beetles. The Tucumán specimen was collected at mercury vapor light.

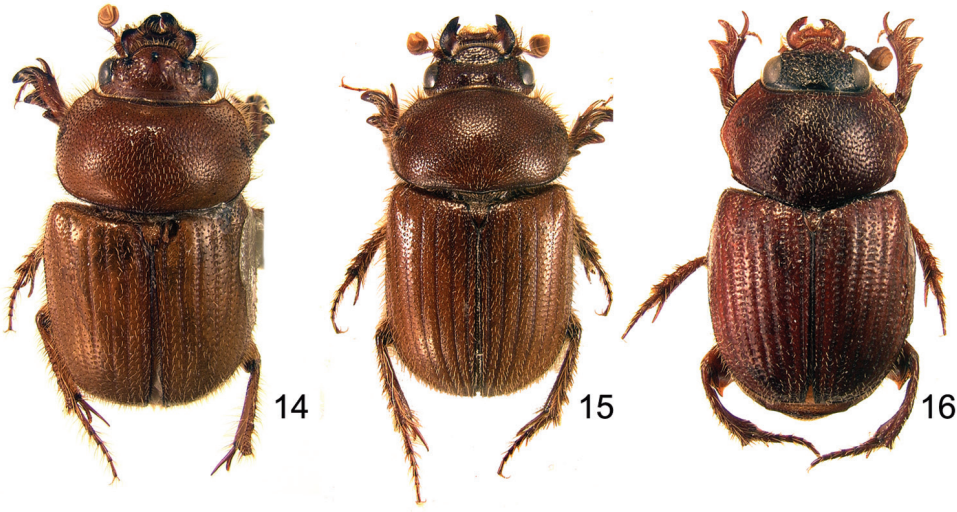
Parochodaeus proceripes **Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:36E307A5-43C6-4F0A-B54F-77959A7C8BF1
http://species-id.net/wiki/Parochodaeus_proceripes
Figs 2, 6, 14; Map 2

Type material. Holotype male (IAZA), pinned. Original labels: a) "RA Mza Santa Rosa / Ñacuñán tramp luz UV / 12-X-02 G. Flores"; b) red paper "*Parochodaeus* / *proceripes* / ♂ / Paulsen & Ocampo / HOLOTYPE".

Type locality. Argentina: Mendoza: Santa Rosa.

Diagnosis. *Parochodaeus proceripes* (Fig. 14) is similar to *P. phoxus* in that it also has a large frontoclypeal horn, but the horn of this species is larger, more anterior, and is almost entirely located on the clypeus. The slender metatibiae are unique among horned species in Argentina.

Description, holotype male. ***Length:*** 8.1 mm. ***Width:*** 4.2 mm. ***Head:*** Surface shiny, weakly tuberculate, punctate; punctures small, sparse. Vertex with frontoclypeal horn (Fig. 2). Clypeus subtrapezoidal, long (length equal to 1/2 width); anterior margin not thickened, broadly rounded. Labrum broadly emarginate. Mandibles strongly angulate externally. Mentum with distinct longitudinal furrow for entire length. ***Pronotum:*** Form strongly convex, declivous anteriorly. Surface densely tiled with tubercles; tubercles moderate in size, setose; surface between tubercles punctate; punctures fine. ***Elytra:*** Setae of interstrial tubercles short, erect. ***Legs:*** Protibia with apical spur curved externally; internal apical tooth absent. Metatrochanter simple. Metafemur



Figures 14–16. Dorsal habitus of *Parochodaeus* species, males **14** *P. procelipes* sp. n. **15** *P. pudu*, sp. n. **16** *P. stupendus*, sp. n.

with posterior margin simple. Metatibia straight, slender (width approximately 1/5 length; Fig. 6), gradually expanding to apex. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg present.

Etymology. The specific epithet '*proceripes*' is derived from the Latin *procerus* "long, slender" and *pes* "foot, leg", referring to the slender metatibiae, which are unusual in species with a frontoclypeal horn. The name is used a masculine adjective in the nominative singular.

Distribution (Map 2). 1 specimen examined.

ARGENTINA: MENDOZA: Santa Rosa- Reserva de la Biósfera Ñacuñán (1).

Temporal distribution. October (1).

Remarks. Only the holotype is known, which is male. The specimen was collected at a light trap.

***Parochodaeus pudu* Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:C6B6C3D6-858A-47A9-A26E-CC040F5BAA80
http://species-id.net/wiki/Parochodaeus_pudu
Figs 1, 15; Map 3

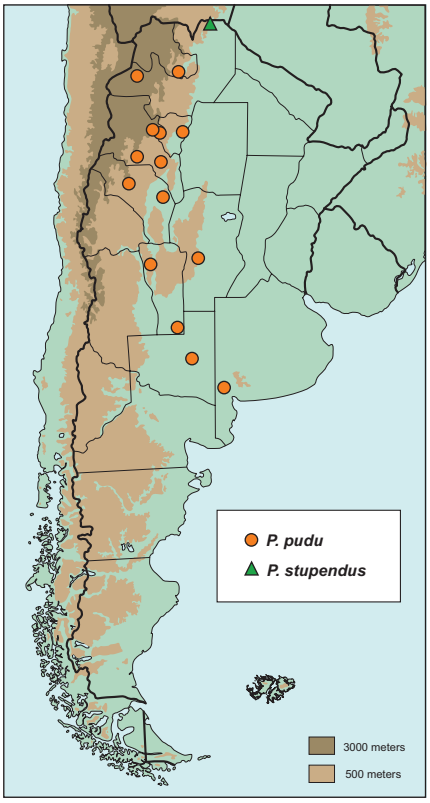
Type material. Holotype male (IAZA), pinned. Original labels: a) "ARGENTINA: La Pampa / General Acha. / 15-III-2008. at light / Col. D. Carpintero" ; b) red paper "*Parochodaeus* / *pudu* / ♂ / Paulsen & Ocampo / HOLOTYPE". Allotype female (IAZA) with a) as holotype; b) "*Parochodaeus* / *pudu* / ♀ / Paulsen & Ocampo / ALLOTYPE" (red label). Twenty-one paratypes (IAZA, MJPC, UNSM) labeled a) as holotype. Four paratypes (CMNC) labeled: a) "ARGENTINA / Córdoba"; "Ao. TEGUA / 5,

9-Abril-1967"; b) Coll: L.E. Peña / y G. Barriga"; c) "H. & A. Howden / Collection / *ex*. A. Martínez coll.". One paratype (FSCA) labeled: "ARGENTINA: LA RIOJA / Castro Barros: Santa Vera / Cruz; -28.67 -66.96; 1600m / 30-II-2004; L. Stange". One paratype (MJPC) labeled: "ARGENTINA: LA RIOJA / Castro Barros: Santa Vera / Cruz; -28.67 -66.96; 1600m / 15-II-2005; L. Stange". Three paratypes (CMNC) labeled: a) "ARGENTINA / Jujuy / CIUDAD / Patología / Prosen - legit / Coll. Martínez / May 948"; b) "H. & A. Howden / Collection / *ex*. A. Martínez coll." One paratype (CMNC) labeled: a) "ARGENTINA / Jujuy / S.S. de Jujuy / Prosen – legit / Coll. Martínez"; b) "H. & A. Howden / Collection / *ex*. A. Martínez coll." One paratype (CMNC) labeled: a) "ARGENTINA / SALTA / D° G. San Martín / Pocitos / Coll. Martínez"; b) "H. & A. Howden / Collection / *ex*. A. Martínez coll." One paratype (IFML) labeled: a) "ARGENTINA / TUCUMÁN / 11 km. cerca / de Las Cejas"; b) "Trampa malaise". Two paratypes (CMNC) a) labeled: "ARGENTINA / Buenos Aires / D° de Puán / Felipe Solá / Coll. Martínez / Ene. 949"; b) "H. & A. Howden / Collection / *ex*. A. Martínez coll." One paratype (CMNC) labeled: a) "ARGENTINA / Buenos Aires / D° de Puán / Felipe Solá / Coll. Martínez / Ene. 949"; b) "*Ochodaeus* / *campsognathus* / Arr. G. J. Arrow. det."; c) "H. & A. Howden / Collection / *ex*. A. Martínez coll." Four paratypes (FMNH) labeled: "Argent. Fama - / balastro: 10. / 3.22. Weiser"; FIELD MUS / (F. Psota Coll.)". Three paratypes (CMNC) labeled: a) "ARGENTINA / Prov. Córdoba / Abril-1967"; "Coll. L.E. Peña / y G. Barriga"; b) "H. & A. Howden / Collection / *ex*. A. Martínez coll." One paratype (UCCC) labeled: a) "Argentina / Los Ángeles / Catamarca / II-46 / Bosq."; b) "5751". One paratype (IAZA) labeled: "ARGENTINA: San Luis / San Gerónimo (500 m NW) / 33°45'52"S, 66°31'31"W. / 546m. 6/IV/10. / F.C. Ocampo, S. Roig". Three paratypes (MLP) labeled: "Caspinchango / Catam. 10-III-921". One paratype (MLP) labeled: "La Rioja / Huanchín / 1925". All paratypes labeled: "*Parochodaeus* / *pudu* / Paulsen & Ocampo / PARATYPE" on yellow paper.

Type locality. Argentina: La Pampa: General Acha.

Diagnosis. *Parochodaeus pudu* (Fig. 15) is the only species of *Parochodaeus* with two small horns on the vertex of the head (Fig. 1). Because of this, the species is immediately recognizable. In *P. bituberculatus* (Erichson) of Peru the frontal structures are not horn-like, being instead two short, transverse carinae.

Description, holotype male. ***Length:*** 7.2 mm. ***Width:*** 3.8 mm. ***Head:*** Surface shiny, roughened near eyes, punctate; punctures small. Frons with two horn-like tubercles on vertex. Clypeus long (length equal to 1/2 width), depressed basally, almost foveate; anterior margin semicircular, not thickened, often indistinct. Labrum subtruncate. Mandibles externally rounded. Mentum tumid, eroded anteriorly, lacking longitudinal furrow. ***Pronotum:*** Form strongly convex, not declivous anteriorly. Surface densely tiled with tubercles; tubercles small, setose; surface between tubercles punctate; punctures small. ***Elytra:*** Setae of interstrial tubercles short, erect. ***Legs:*** Protibia with apical spur curved; internal apical tooth absent. Metatrochanter simple. Metafemur with posterior margin simple. Metatibia straight, slender (width approximately 1/5 length), gradually expanding to apex. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg absent.



Map 3. Argentinean distribution of *P. pudu* (orange circles), and *P. stupendus* (green triangle).

Description, allotype female. ***Length:*** 6.7 mm. ***Width:*** 3.4 mm. Differs from male holotype in the following external characters: ***Pronotum:*** Form not as strongly convex.

Description, paratypes (n=50). ***Length:*** 5.1–-8.8 mm. ***Width:*** 2.5–4.5 mm. Not differing significantly from the holotype and allotype in external characters.

Etymology. The frontal horns are reminiscent of those found on pudú, the small South American deer, *Pudu puda* (Molina). The name '*pudu*' is used as a masculine noun in the nominative singular.

Distribution (Map 3)**.** 52 specimens examined.

ARGENTINA: BUENOS AIRES: Felipe Solá (3); CATAMARCA: Caspichango (6), Famabalasto (1); Los Ángeles (1); CÓRDOBA: No locality (3); JUJUY: San Salvador de Jujuy (1), "Ciudad Patología" (3); LA PAMPA: General Acha (23); LA RIOJA: Huanchín (1), Santa Vera Cruz (2), Tegua (4); SALTA: Pocitos (1); SAN LUIS: Arizona- 18 Km S (1), San Gerónimo (1); TUCUMÁN: Las Cejas (1).

Temporal distribution. January (1), February (6), March (26), April (8), May (4). No data (1).

Remarks. This species is relatively well represented in collections. It is surprising that such a distinctive species remained undescribed for so long. With the two small horns on the head it is immediately recognizable and cannot be confused with any

other species in the genus. The life history of the species is mostly unknown. Label data indicate that many specimens were collected at light traps, which at the very least infers a nocturnal habit for the species.

Parochodaeus stupendus **Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:523C896D-1CFC-4281-824D-F2C2BAF3DD7D
http://species-id.net/wiki/Parochodaeus_stupendus
Figs 7, 16; Map 3

Type material. Holotype male (CMNC), pinned. Original labels: a) "ARGENTINA / SALTA / D° San Martín / Hito 1 / Coll. Martínez / Dic 971"; b) red label "*Parochodaeus* / *stupendus* / Paulsen & Ocampo / HOLOTYPE".

Type locality. Argentina: Salta: San Martín, Hito 1.

Diagnosis. *Parochodaeus stupendus* (Fig. 17) is the only species of *Parochodaeus* to exhibit a doubly-toothed posterior margin on the metafemur. The tooth on the ventral surface is fairly common in ochodaeids, but the second tooth on the dorsal surface is unique. The toothed metatrochanter and strongly curved metatibiae (Fig. 7) are not found in any other species in Argentina, or elsewhere. The strongly produced 'thumb' (internal apical tooth) is also species specific. The female is unknown.

Description, Holotype. ***Length:*** 7.5 mm. ***Width:*** 4.1 mm. ***Head:*** Surface tuberculate, tubercles moderately large, setose. Frons unarmed but indistinctly tumid medially. Clypeus evenly rounded, long (length equal to 1/2 width), margin thickened, produced anteriorly, declivous. Labrum emarginate. Mandibles rounded externally. Mentum tumid, not deeply furrowed. Antennal club strongly globose (Fig. T12). ***Pronotum:*** Form convex. Surface with moderately large, setose tubercles mixed with glabrous punctures; punctures moderate in size, sparse. ***Elytra:*** Setae of interstrial tubercles moderately long, erect, somewhat abraded. ***Legs:*** Protibia with apical spur strongly curved externally; internal apical tooth distinctly produced, subequal to basal protibial tooth in size. Metatrochanter with acute tooth. Metafemur with posterior margin acutely toothed on both dorsal and ventral surfaces. Metatibia strongly curved, slender, abruptly widening in distal third. Metatarsomere 1 not greatly enlarged. ***Abdomen:*** Stridulatory peg absent.

Etymology. The specific epithet '*stupendus*' is Latin meaning "causing astonishment or wonder". With several autapomorphies not seen in other species of the genus, *P. stupendus* is arguably the most wondrous ochodaeid in the New World. The name is used a masculine adjective in the nominative singular.

Distribution (Map 3). The species is known from a locality near the Bolivian border. 1 specimen examined.

ARGENTINA: SALTA: San Martín, Hito 1 (1).

Temporal distribution. December (1).

Remarks. This species is known only from the holotype. Like *P. jujuyus,* it is from the far north of Argentina. It is probable that *P. stupendus* will be discovered in Bolivia

as well, especially because the name of the locality "Hito 1" is in reference to the "hito" or boundary post that indicates the border between Argentina and Bolivia.

***Gauchodaeus* Paulsen, gen. n.**
urn:lsid:zoobank.org:act:E0452D7A-435F-4AF6-A7A8-4CC28D1F4B80
http://species-id.net/wiki/Gauchodaeus

Type species. *Gauchodaeus patagonicus* Paulsen & Ocampo, here designated.

Diagnosis. The only known species in *Gauchodaeus* is an elongate ochodaeid with no elytral closing mechanism, and therefore can be quickly distinguished from the more globular *Parochodaeus* species with dentate elytral apices and a bituberculate propygidium. The genus is most similar to the genus *Synochodaeus* of southern Africa but is distinguished by the characters discussed above.

Description. Ochodaeidae: Chaetocanthinae: Synochodaeini. Form convex, elongate. Sexual dimorphism lacking. Color testaceous to light reddish brown. ***Length:*** 5.7–5.9 mm. ***Width:*** 2.5–2.7 mm. ***Head:*** Surface densely tuberculate/punctate, setose. Mentum strongly tumid, not longitudinally impressed. Labrum densely punctate/setose. Distal 2 labial palpomeres spherical or irregularly shaped (not cylindrical). Clypeus long (length = ½ width), straight anteriorly, not reflexed. Frontoclypeal suture lacking distinct transverse sulcus. Mandibles relatively small, externally rounded, visible beyond labrum in dorsal view. Antenna with 10 antennomeres; 3-antennomere club oval, pubescent; first club antennomere neither strongly hemispherical nor enfolding distal antennomeres. Eyes large, somewhat bulging. ***Pronotum:*** Surface densely punctate, punctures moderate in size, with distinct anterior tubercle, setigerous; setae moderately long, testaceous. Margins beaded. ***Scutellum:*** Form weakly hastate with apex acute. ***Elytra:*** Striae (except sutural) not impressed, obsolete. Surface irregularly punctate; punctures moderate, each with small tubercle anteriorly, setigerous; setae dense, moderately long, testaceous. ***Legs*:** Protibia tridentate. Legs simple, unarmed. Mesotibial spur pectinate. Metatibia with large external carina in distal 1/3 long (extending > ½ width of tibia) but interrupted at middle. Metatibial spurs simple (possibly worn). Metatrochanter not acutely produced. ***Abdomen*:** Stridulatory peg absent. Propygidium short (length <1/5 width), without elytral locking mechanism.

Etymology. The name is formed from *gaucho,* a local word commonly used to describe residents of the pampas or Patagonian grasslands, in combination with the root *Ochodaeus.* It is masculine in gender.

Composition. Only one species is known, herein described.

Remarks. Nothing is known about the life history of these beetles, other than that they live in a rather inhospitable, arid part of Neuquén Province.

***Gauchodaeus patagonicus* Paulsen & Ocampo, sp. n.**
urn:lsid:zoobank.org:act:9904D088-2FE8-44A8-8691-0CE62AA2E36D
http://species-id.net/wiki/Gauchodaeus_patagonicus
Fig. 17; Map 4

Type material. Holotype male (IAZA), pinned. Original labels: a) "Piedra del Águila / (131) 525 m. / Neuquén – Argentina"; b) "7-II-92 / Leg. Mario Gentili"; c) on red paper "*Gauchodaeus* / *patagonicus* ♂ / Paulsen & Ocampo / HOLOTYPE". Two paratypes (IAZA, MJPC) labeled as holotype. One paratype (CMNC) labeled: a) "Ea. Llamuco / (1100 M.S.N.M.) / Neuquén – Arg."; b) "18-III-74 / LG. M. Gentili"; c) black-bordered "H. & A. Howden / Collection / ex. A. Martínez coll.". One paratype (IAZA) labeled: "14-I-80 / Leg. M. Gentili"; "Bajada Marucho / (870 m.s.n.m.) / NEUQUÉN - ARG." All paratypes labeled: "*Gauchodaeus* / *patagonicus* / Paulsen & Ocampo / PARATYPE" on yellow paper.

Type locality. Argentina: Neuquén: Piedra del Águila.

Diagnosis. The elongate body of this species (Fig. 17) is unlike that any other South American ochodaeids, which are in a different subfamily. The pectinate mesoti-

Map 4. Distribution of *Gauchodaeus patagonicus* (circles)

Figure 17. Dorsal habitus of *Gauchodaeus patagonicus* gen. n., sp. n.

bial spur, lack of propygidial tubercles, and simply rounded elytral apices will separate it from *Parochodaeus* or any other scarabaeoids.

Description, holotype male. ***Length:*** 5.2 mm. ***Width:*** 2.5 mm. ***Color:*** Reddish brown, shiny. ***Head:*** Surface tuberculate, punctate, with short setae increasing in length near eyes. Clypeus subtrapezoidal, long (length equal to 1/2 width). Mentum tumid. ***Pronotum:*** Surface punctate, tuberculate, tubercles small, setose. ***Elytra:*** Surface setose; setae moderately long, recumbent. ***Legs:*** Metafemur with posterior margin entire (not toothed in distal half). ***Abdomen:*** Stridulatory peg absent.

Description, paratypes (n=4). ***Length:*** 5.7- 5.9 mm. ***Width:*** 2.5-2.7 mm. Specimens examined did not differ significantly from the holotype. The CMNC specimen lacks an abdomen.

Etymology. The species is named for the region of Patagonia, where it is found. The name is used a masculine adjective in the nominative singular.

Distribution (Map 4)**. ARGENTINA:** NEUQUÉN: Bajada Marucho (1); Estancia Llamuco (1); Piedra del Águila (3).

Temporal fistribution. January (1), February (3), March (1).

Remarks. This species is found in Neuquén province. All known specimens were collected by Mario Gentili in a desolate and arid habitat. The method of collection is not indicated on the labels, but it is probable that the species is nocturnally active and attracted to light.

Acknowledgments

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RESEARCH ARTICLE

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First record of the cicada genus *Semia* Matsumura (Hemiptera, Cicadidae) from Vietnam, with the description of one new species and a key to species

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Abstract

The first record of the genus *Semia* Matsumura (Cicadidae: Cicadinae, Cicadini) from Vietnam is presented. One new species, *Semia spinosa* **sp. n.**, is described from southern Vietnam. Photos of the adult, illustrations of the male genitalia, a distribution map and biological data are provided. A key to the species of *Semia* based on the male adults is also given.

Keywords

New record genus, *Semia spinosa,* morphology, Cicadina, Auchenorrhyncha

Introduction

The cicada fauna of Vietnam has received little attention since the descriptions of Distant (1913a, b, 1917a, b). According to previous reports, 133 cicada species are known from Vietnam, representing 45 genera in all three subfamilies, Cicadinae, Cicadettinae and Tet-

tigadinae (Lee (2008), Pham and Yang (2009, 2010) and Pham et al. (2010)). So far only two species of *Semia* have been described, *S. watanabei* (Matsumura, 1907), the type species, from Taiwan and *S. klapperichi* Jacobi, 1944, from Fukien Province, China. Here we describe a third species, *Semia spinosa* sp. n., from Dong Nai Province, southern Vietnam.

Semia is similar to *Leptosemia* Matsumura, 1917, *Terpnosia* Distant, 1892 and *Euterpnosia* Matsumura, 1917, but has a dentate lateral margin to the pronotum (Fig. 2A), transverse male opercula that are nearly contiguous with each other (Fig. 2B) and lacks a tooth-like projection laterally on the male 4th abdominal segment (Lee and Hayashi 2003).

Materials and methods

Four males of the new species *Semia spinosa* sp. n., were collected from the Phu Ly, Ma Da-Vinh Cuu Nature reserve (NR), Vinh Cuu district, Dong Nai Province in southern Vietnam. The holotype and two paratypes are deposited in the Institute of Ecology and Biological Resources, Hanoi, Vietnam (IEBR), and one paratype in the Natural History Museum, London (BMNH).

Nomenclature for family, subfamily and tribal classification follows that of Moulds (2005) and Lee (2008). Morphological terminology follows that of Moulds (2005). The male genitalia of the holotype were examined and photographed using a dissecting microscope (Leica MZ7 5). A distribution map (Fig. 1) produced by the software *CFF* 2.0 (Barbier and Rasmont 2000), and photos of habitus are provided (Fig. 2).

Taxonomy

Family Cicadidae Latrielle
Subfamily Cicadinae
Tribe Cicadini
Subtribe Cicadina

Genus *Semia* Matsumura, 1917
http://species-id.net/wiki/Semia

Semia Matsumura, 1917: 195. Type species: *Leptopsaltria watanabei* Matsumura, 1907 (Formosa).

Diagnosis. Head nearly as wide as or slightly narrower than base of mesonotum; inner area of pronotum generally concolorous to outer dilatation; male abdomen cylindrical, much longer than distance from head to cruciform elevation and slightly widest across 4th abdominal segment and wider than base of mesonotum; male tymbal cover very small and semicircular, mostly exposing tymbal in dorsal view; male 8th abdominal

tergum mostly covered with white powder; ovipositor not protruding beyond abdominal segment 9; male operculum scale-like, roundish, and not extending beyond 2nd abdominal sternum; wings hyaline; 6th apical cell of forewing about as long as or longer than twice of 5th apical cell in median length. Based on Lee and Hayashi (2003).

Distribution. China, Taiwan, Vietnam (Fig. 5).

Remarks. This genus is similar to *Leptosemia*, *Terpnosia* and *Euterpnosia* (see Introduction).

***Semia spinosa* sp. n.**
urn:lsid:zoobank.org:act:B8A6B87E-9A4A-484C-90DE-4C4F7CFB2D8D
http://species-id.net/wiki/Semia_spinosa
Figs 2, 3A–B, 6C

Etymology. The species name refers to morphological feature such as spinosa for the uncus spines

Material examined. Holotype ♂: VIETNAM [VC.Ho.0650, Phu Ly, Ma Da-Vinh Cuu NR, Dong Nai Province, 4.viii.2008, light trap, 11°24'42.4"N, 107°06'19.5"E, 100–150m, leg Hoang Vu Tru] (IEBR).

Paratypes (3 ♂♂): 2 ♂♂: VIETNAM [VC.Ho.0626, 0631, Phu Ly, Ma Da-Vinh Cuu NR, Dong Nai Province, 31.vii.2008, 100–150m, leg Hoang Vu Tru] (IEBR);

Figure 1. Type locality of *Semia spinosa* sp. n.; (see text for further details).

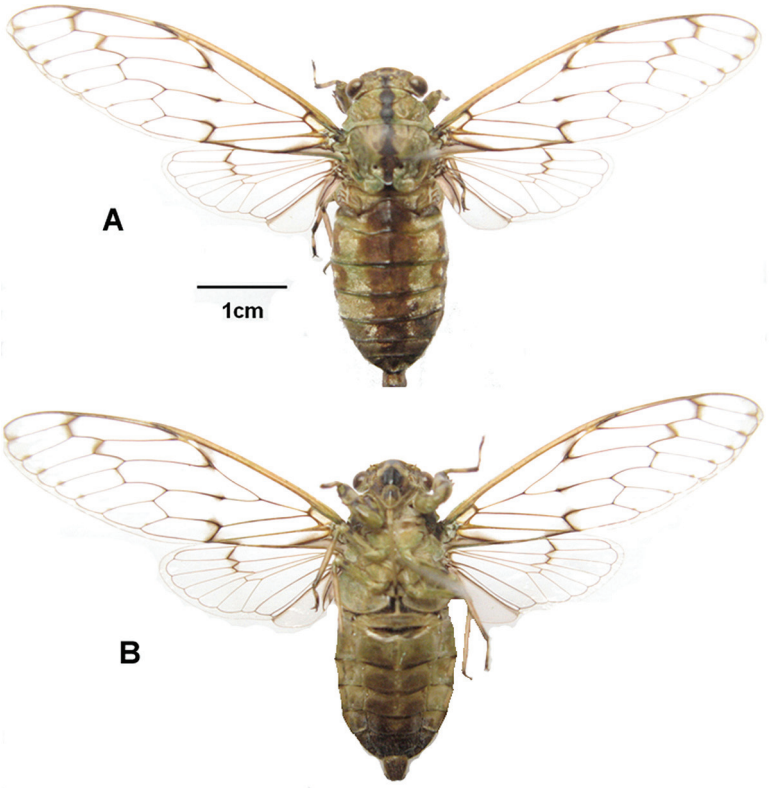

Figure 2. *Semia spinosa* sp. n. (male): **A** dorsal view **B** ventral view.

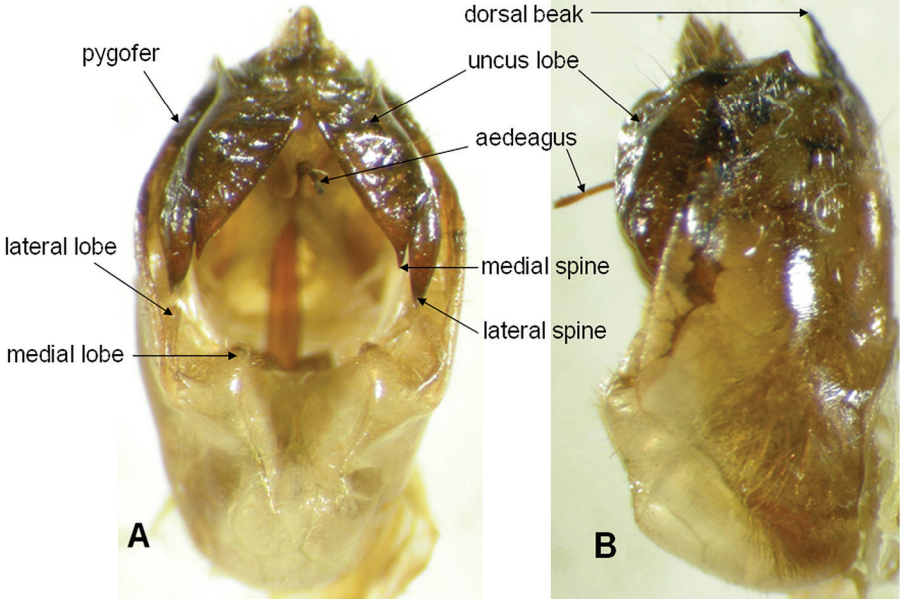

Figure 3. Male genital capsule of *Semia spinosa* sp. n.: **A** ventral view **B** lateral view.

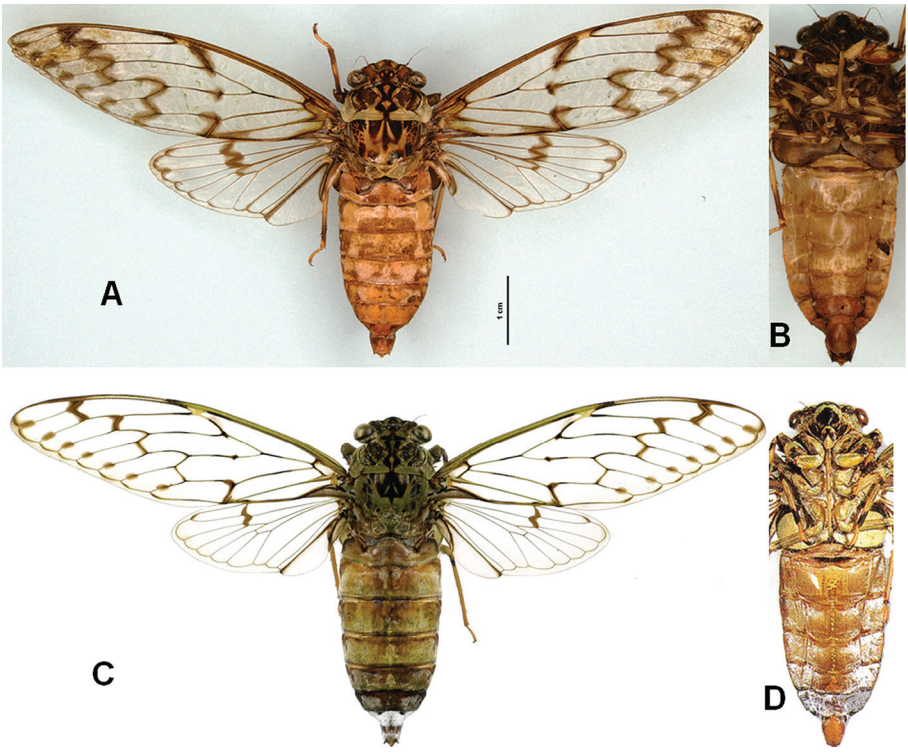

Figure 4. *Semia* species in dorsal view and ventral view (male): **A**, **B** *S. klapperichi* (photograph by Dirk Ahrens) **C, D** *S. wantanabei* (after Chen 2007).

1 ♂: [VC.Ho.0765, Phu Ly, Ma Da-Vinh Cuu NR, Dong Nai Province, 2.viii.2008, light trap and netting, 100-150m, leg Ta Huy Thinh] (BMNH).

Description. *Head* (Figs 2A, 2B, 7, 8): head pale yellowish-brown with following markings: broad median longitudinal band on frons and supra-antennal plate, dark brown; postclypeus dorsally with two oblique oval dark brown patches, in facial view upper half with transverse brown bands, lower half blackish brown; lower half of anteclypeus blackish brown, area between eye and antenna on gena, lorum and apex of rostrum, dark brown. Head including eyes as wide as mesonotum at base; rostrum reaching posterior coxae.

Thorax (Figs 2A, 2B): pale yellowish-green, longitudinal broad band on pronotum narrowed centrally, longitudinal broad band on mesonotum, spot between submedian and lateral sigillae, scutal depression, two spots on lateral margin of mesonotum, central area of cruciform elevation, second anepisternum, anepimeron and katepisternum, dark brown. Pronotal collar with a small dentate projection.

Wings (Fig. 2A): fore and hind wings hyaline, with veins brown or fuscous, and costal margin tawny; fore wings slightly tinged and spotted with infuscations on most veins.

Legs (2B): pale yellow with markings as follows: fore leg with femur, tibia, metatarsus and pretarsus blackish brown, primary spine of femur dark brown, secondary spine

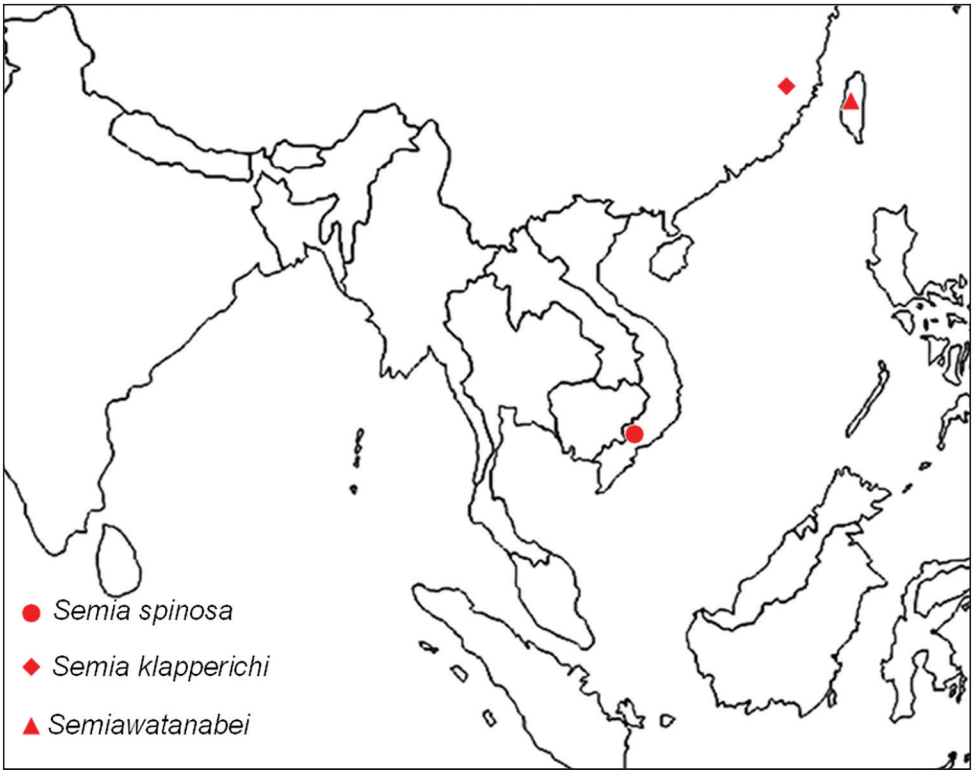

Figure 5. Distribution of the *Semina* species in the world.

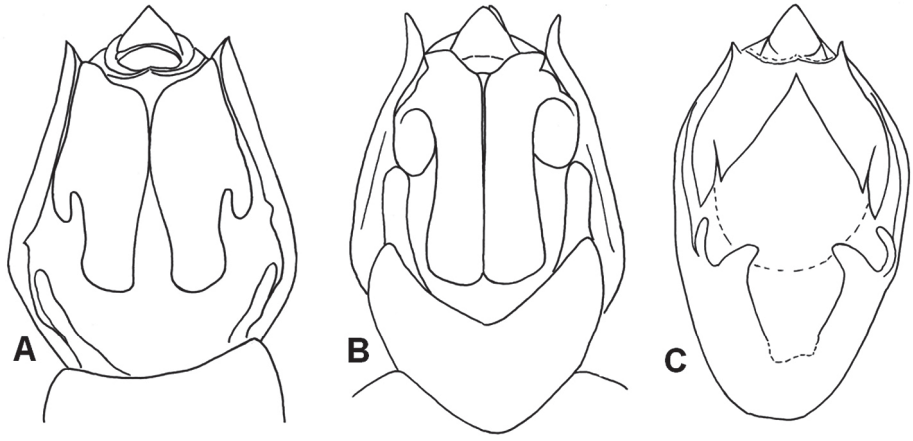

Figure 6. Male genital capsule of *Semia* species (ventral view): **A** *Semia klapperichi* **B** *S. watanabei* (after Lee and Hayashi 2003) **C** *Semia spinosa* sp. n.

dark brown; mid leg with coxa and femur pale yellow, tibia pale brown, apex of femur black, apex and base of tibia black, metatarsus and pretarsus dark brown, mesotarsus pale yellow; hind leg, with femur pale yellow, apex of femur dark brown, tibia pale

Figure 7. Postclypeus of *Semia spinosa* sp. n.

brown, base of tibia dark brown, tibial spur, tibial comb, and thumb of tibial comb dark brown.

Abdomen (Fig. 2B): pale greenish brown in dorsal view, with a longitudinal broad dark brown streak, tergites 3–7 with their lateral margins edged pale brown (Fig. 2A); pale brown in ventral view, anterior margin of sternites III - VI and sternites VII and VIII dark brown; epipleurites 3–6 lighter than sternites (Fig. 2B).

Operculum (Fig. 2B): pale yellow-green, short, transverse, and not reaching beyond anterior margin of sternite II.

Male genitalia (Figs 3A, B): Pygofer oblong in ventral view, lateral lobe of pygofer narrower than medial lobe, the latter triangular and prominent; dorsal beak acute and blackish brown; uncus brown, darker at apex of uncus lobes, the latter strongly divergent with two apical spines, medial spine shorter and acuter than lateral spine; Anal styles and anal tube dark brown. Aedeagus very slender.

Measurements in mm: (4 ♂♂): body length excluding wings: 27.1–29.0 (28.1); fore wing length: 31.0–32.6 (31.8); head width: 6.7–7.2 (7.0); pronotum width: 6.7–8.1 (7.4).

Figure 8. Dorsal part of the postclypeus of *Semia spinosa* sp. n.

Biology. This species was collected by sweeping during the daytime and by light trapping at night in virgin rainforest at an altitude between 100 to150 meters.

Distribution. Vietnam (Dong Nai Province).

Remarks. *S. spinosa* is distinguishable from *S. watanabei* and *S. klapperichi* by the body size, which is shorter than 30mm (in male) in *S. spinosa* and longer than 35mm (in male) in *S. watanabei* and *S. klapperichi*, and from *S. klapperichi* it differs in the infuscations on the hind wings which lack spots along the ambient veins present in *S. klapperichi* (see Figs 4A, C). The new species also differs in the structure of the uncus which has the lobes strongly divergent with acute apical spines (see Figs 6A–C).

Key to the species of the genus *Semia* (males)

1 Body length <30mm; abodomen with longitudinal broad brown band centrally (Fig. 2A); uncus lobes strongly divergent, each with two apical spines (Fig. 3A) ..... ***S. spinosa* sp. n.**

– Body length >35mm; abodomen without longitudinal broad brown band centrally; uncus lobes not or weakly divergent without two apical spines **2**

2 Body length approximately 38mm; operculum with lateral margin not expanding beyond lateral margin of abdomen; tymbal cover very small, pale brown, with darker margin; tymbal mostly exposed in dorsal view; uncus lobes parallel (Fig. 6B) ..... ***S. watanabei***

– Body length 40–45mm; operculum very wide, lateral margin expanding distinctly beyond lateral margin of abdomen; tymbal cover small slightly raised, brown without dark margin; tymbal slightly exposed in dorsal view; uncus lobes weakly divergent (Fig. 6A) ..... ***S. klapperichi***

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RESEARCH ARTICLE

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A new species of the cicada genus *Cicadatra* Kolenati, 1857 (Hemiptera, Cicadidae) from Pakistan with a key to the known species of Pakistani *Cicadatra*

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Abstract

A new species of cicada, *Cicadatra ziaratica* **sp. n.**, is described from Pakistan. Male genitalia, timbal and opercula are described and illustrated as important diagnostic characters. Biological notes are also provided. A key to the known *Cicadatra* of Pakistan is provided.

Keywords

Cicadatra species, taxonomy, Cicadidae, morphology

Introduction

Species of the genus *Cicadatra* Kolenati, 1857 exhibit variability in several morphological characters. As a result, there is still much to learn about the distribution and composition of *Cicadatra* species across the range of the genus. Studies of *Cicadatra* species in the Middle East and Asia continue to illustrate the lack of knowledge about

the species of this widespread genus. However, there have been some more recent studies which provide detailed analyses of the morphological characters of generally new species from this region (Dlabola 1960, 1970, 1979, 1981, Dlabola and Heller 1962, Linnavouri 1962, Boulard 1977, Melichar 1896, Mirzayans 1995, Mozaffarian and Sanborn 2010, Mozaffarian et al. 2010, Ahmed and Sanborn 2010, Ahmed et al. 2010) including the first checklists of the genus for Iran (Mozaffarian and Sanborn 2010) and Pakistan (Ahmed and Sanborn 2010).

The first checklist of the Pakistani cicada fauna was recently produced by Ahmed and Sanborn (2010). They determined that 29 known species inhabited Pakistan at the time with the first records of seven species and the descriptions of four new species included in the total (Ahmed and Sanborn 2010). They listed seven species of *Cicadatra* for Pakistan, four of which represented new records for the country. Later that same year, Ahmed et al. (2010) described a new species of *Cicadatra* from Pakistan along with sound analysis and DNA sequencing of the species. The current work represents another new species that was collected during recent fieldwork. A more complete knowledge of the Pakistani cicada fauna will only be obtained with continued field research and studies of existing collections.

The present species is described from Pakistan as new to science, and is known only from the Ziarat District, Balochistan Province. Notes on the biology of this new species are also provided along with a key to differentiate the species from the known Pakistani *Cicadatra*.

Materials and methods

Specimens were captured during June 2010 and June 2011 in Balochistan Province, Pakistan. Terminology follows Moulds (2005). Measurements were made with Vernier calipers or a Wild Heerbrugg 12034 binocular microscope. Specimens are deposited in the collections of the Natural History Museum, University of Karachi, Pakistan (NHMK) and Zubair Ahmed Collection, Pakistan (ZACP).

Results and discussion

***Cicadatra ziaratica* Ahmed, Sanborn & Akhter, sp. n.**
urn:lsid:zoobank.org:act:04C75272-8CDE-4677-A6EE-798512C83B53
http://species-id.net/wiki/Cicadatra_ziaratica
Figs 1–8

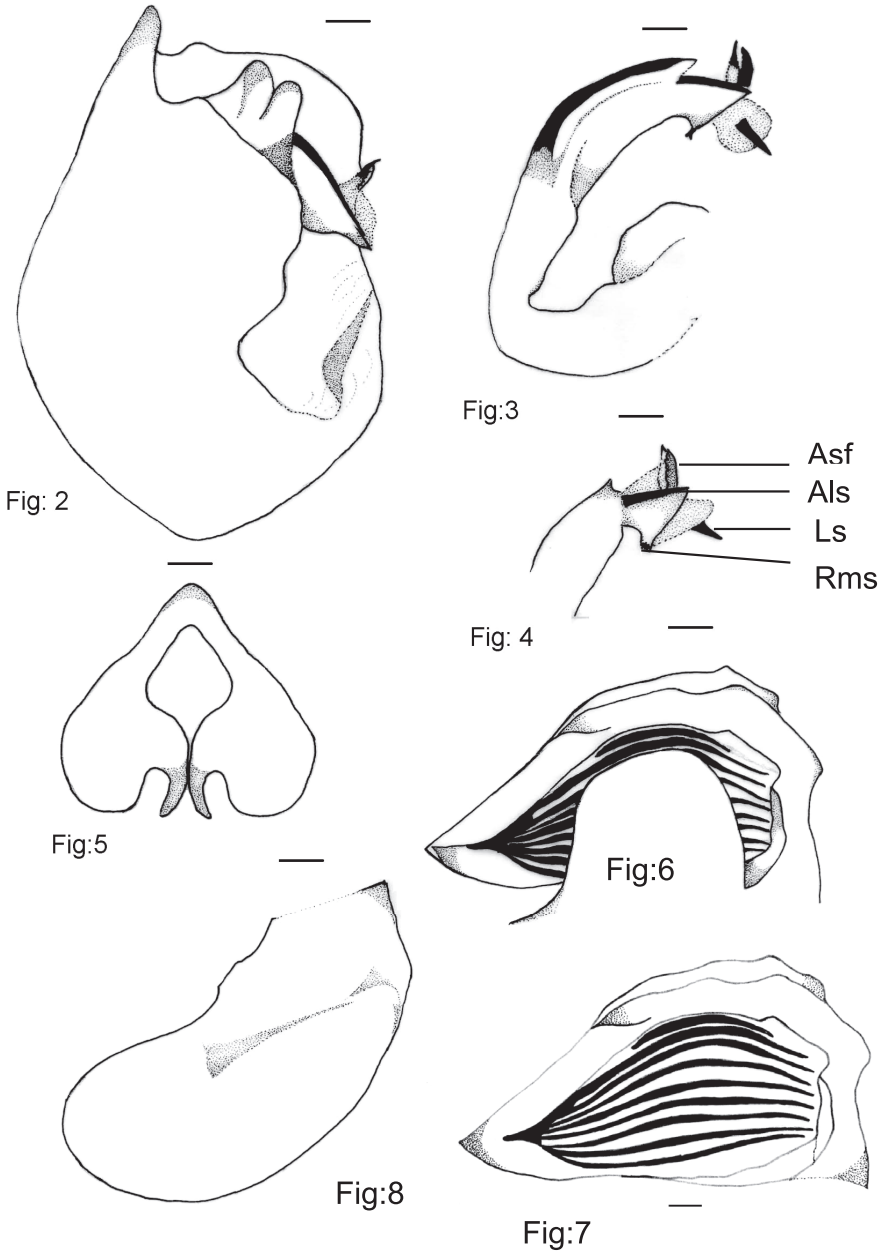
Type locality. Pakistan, Balochistan Province, Khotal Chehri, District Ziarat.

Type specimens. Holotype male, pinned. Original label: "Pakistan, Balochistan Province, Khotal Chehri, District Ziarat, 7.vi.2010, Collector, Zubair Ahmed", "HOLOTYPE / Cicadatra ziaratica / Ahmed, Sanborn & Akhter" [handwritten label]

Figure 1. Holotype Male, *Cicadatra ziaratica* sp. n.

(NHMK); one male paratype, "Pakistan, Balochistan Province, Khotal Chehri, District Ziarat, 7.vi.2010, Collector, Zubair Ahmed", "PARATYPE / Cicadatra ziaratica / Ahmed, Sanborn & Akhter" [handwritten label]; three male paratypes, "Pakistan, Balochistan Province, Khotal Chehri, District Ziarat, N, 3.vi.2011, Collector, Zubair Ahmed "PARATYPE / Cicadatra ziaratica / Ahmed, Sanborn & Akhter" [handwritten label] (ZACP).

Diagnosis. The new species appears to be most allied morphologically to *C. lorestanica* Mozaffarian and Sanborn 2010 from Iran and *C. karachiensis* Ahmed et al. 2010 from Pakistan. The new species can be distinguished by the upper lobe of the pygofer being ill-defined in *C. ziaratica* whereas it is a finger-like extension in *C. lorestanica*. The aedeagus of *C. lorestanica* has a curved, bifold, sclerized, hook-like process and two lateral spiny appendages while the aedeagus of *C. ziaratica* has a long, subapical spine, a dorsal spine along sclerized teeth-like process, a lateral spine and a ventral semicircular toothed process. In *C. karachiensis* the upper lobe of the pygofer is rounded, the aedeagus has a long upturned flap with 11 aedeagal spines and the hind wing has five apical cells instead of the six found in *C. ziaratica*. The species are similar in possessing a mesonotum with two lines but the degree of curvature is slightly variable. Fore wings with radial and radiomedial crossveins at bases of the 2nd and 3rd



Figures 2–8. *Cicadatra ziaratica* sp. n., 2 Male pygofer lateral view 3–4 Aedeagus 5 Claspers 6 Timbal cover 7 Timbal 8 Operculum. Scale lines = 0.6 mm. **Asf** Aedeagus with serrated flap **Als** Aedeagus long spine **Ls** Lateral spine **Rss** Row of middle spines

apical cells infuscated in *C. ziaratica* but lacking infuscation in *C. lorestanica* and *C. karachiensis*. The timbal cover of *C. karachiensis* is reduced and ventral to the majority of the timbal while the timbal cover in *C. ziaratica* and *C. lorestanica* covers more than

half the timbal and is centrally located over the timbal. Finally, the timbal has 9 ribs in *C. ziaratica* and *C. karachiensis* but 11 ribs in *C. lorestanica*. The remaining species known to inhabit Pakistan can be distinguished using the key. There are insufficient data to perform a molecular phylogenetic analysis of the Pakistani *Cicadatra* species as genes from a limited number of species have been sequenced (Ahmed et al. 2010).

Description. ***Male.*** General color of body black with olive to ochraceous markings and white pile.

Head black with white pile particularly on posterior edge, head including eyes as broad as mesonotum; eyes brown, varying from light to dark in different specimens; ocelli orangish, piceous in some specimens; postclypeus black with a central sulcus and obvious transverse grooves, dense pile lateral of grooves, gena and lorum black with dense white pile; rostrum light ochraceous at base, darker towards apex, strongly passing intermediate coxae; labrum with sparse white pile laterally and on apex; antennae dark brown, apical segment faint yellow, vertex black, supra-antennal plate reaching eyes, black, light band at medially in two paratypes.

Pronotum black, brown in some paratypes, with median black biconcave mark containing a light olive green median fascia, an olive green patch crossing ambient fissure posterolateral to each side of median fascia, black mark continues around disc in ambient fissure and across lateral pronotal collar to the lateral angle; paramedian and lateral fissures variably marked with dark brown to black, pronotal collar black anteriorly and olive green across posterior half of lateral angles and posterior margin, ochraceous in some paratypes, white dense pile present on ambient, paramedian and lateral fissure and scattered pile on disc, pile reduced in some paratypes; mesonotum black or dark brown, with ochraceous J-shaped mark along parapsidal suture, mark triangularly shaped at base in some paratypes; cruciform elevation olive green (brown in some paratypes) medially, darkening to black in anterior arms; metanotum olive green (brown in some paratypes); thoracic sternites black with dense white pile, ochraceous in different specimens; some specimens with dark marking on basisternum 2, epimeron 2, katepisternum 2, and episternum 3.

Fore coxae light olive to ochraceous with black linear marking, middle coxae light ochraceous with broad dark anterolateral surface, hind coxae light ochraceous with darker laterally; fore and middle trochanter olive to ochraceous with a dark brown area at middle with white pile; fore femorae dark brown with white pile and light areas on ventral apex with strongly angled primary spine, erect secondary spine and a small angled apical spine; middle femora dark brown with a yellow area at ventral and apex with dense white pile, hind femora dark brown with yellow area on base and apex; fore tibiae dark brown lighter at apex, middle tibiae dark brown with white pile and yellow at lateral, hind tibiae yellow, half dark brown with five brown tibial spurs and sparse white pile; tibial spurs and combs brown, darker towards their apices; tarsi black; pretarsal claws dark brown.

Fore wings hyaline with faint yellow and brown venation, radial (r) and radiomedial (r-m) crossveins at bases of apical cells 2 and 3 darkly infuscated, infuscation on r-m absent or reduced in some paratypes, basal call twice as long as wide; fore wings

with 8 apical cells, basal membrane light reddish; hind wings with faint yellow venation, light grey infuscation around anal veins 2 and 3 (2A and 3A), hind wings with 6 apical cells.

Male opercula light brown with black spot on lateral base and rather dense white pile, rounded, and slightly overlapped, not meeting medially in paratypes, meracanthus triangular, light ochraceous with black spot at base.

Abdominal tergites black with white pile more or less located near the anterior edge of each tergum, tergites 2–7 with a light area on posterior except median part, timbal cavity exposed; timbal cover incomplete covering about half the timbal, black or dark brown with white pile, timbal with 9 ribs; abdominal sternites brown with dense white pile, epipleurites dark brown with dense white pile.

Male pygofer dark brown with scattered pile, dorsal beak pointed, upper lobe of pygofer rounded, basal lobe of pygofer appears as a bud like projection beneath the upper lobe; uncus very short; claspers tapering to a point, curved slightly laterad, close to each other at base; aedeagus with theca curved, a lateral scleritized, serrate appendages, a long, subapical spine, a ventral scleritized, rounded serrate process, a lateral and a median long spine.

Female. Unknown.

Etymology. The species is named for the district of Balochistan from which the type series was collected.

Measurements (mm). N=5 males, mean (range). Length of body: 16.9 (16.0–18.0); length of fore wing: 20.2 (19.0–22.0); width of fore wing: 6.7 (6.1–7.0); width of head including eyes: 4.6 (4.0–5.0); width of pronotum including paratota: 5.7 (5.5–6.0); width of mesonotum: 5.1 (4.8–5.5).

Biological notes. All specimens were collected during 2010 and 2011 in the vicinity of Ziarat between 3 June–7 June. The cicadas emerged among wild grasses based on the location of the emergence holes. Adult males called from these same grasses as well as from shrubs including *Peganum harmala* L.

Key to the males of *Cicadatra* of Pakistan

1	Body length >24 mm, prontoal collar almost or entirely black	**2**
–	Body length <24 mm, pronotal collar heavily marked with ochracous, olivaceous or tawny	**4**
2	Pronotal disk black	***C. acberi* (Distant, 1888)**
–	Pronotal disk ochraceous	**3**
3	Supra-antennal plate, cruciform elevation, and costal margin tawny	***C. persica* Kirkaldy, 1909**
–	Supra-antennal plate and cruciform elevation black, costal margin castaneous	***C. gingat* China, 1926**
4	Head castaneous	***C. raja* (Distant, 1906)**
–	Head black	**5**

5 Radial and radiomedial crossveins not infuscated **6**
– Radial and/or radiomedial crossveins infuscated..... **7**
6 Pronotum castaneous marked with black, cruciform elevation black, male opercula overlapping medially, small marginal spot on hind wing..... ..... ***C. sankara*** **(Distant, 1904)**
– Pronotum dark ochraceous marked with black, cruciform elevation marked with ochraceous, male opercula almost meeting medially, hind wing hyaline ..... ***C. karachiensis*** **Ahmed, Sanborn and Hill, 2010**
7 Postclypeus black ..... ***C. ziaratica*** **sp. n.**
– Postclypeus tawny marked with castaneous or black **8**
8 Postclypeus with transverse grooves black ..... ***C. walkeri*** **Metcalf, 1963**
– Postclypeus with medial castaneous or black stripe..... .....***C. xanthes*** **(Walker, 1850)**

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Perapion connexum (Schilsky, 1902) (Coleoptera, Apionidae) in Central Europe, a case of plant expansion chase

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Abstract

Perapion connexum (Schilsky) is recorded for the first time from Hungary and Kyrgyzstan, and new distribution data from Ukraine and Russia are provided. Preliminary placements of this weevil in faunal checklists for Poland and Slovakia are here documented with detailed data. Its occurrence in Austria based on older evidence, is discussed. The neophytic and invasive in Central Europe sorrel *Rumex confertus* Willd. is confirmed to be its unique host plant in Poland. Morphology of the newcoming weevil is described and illustrated, and the key to all Central European species of *Perapion* is presented.

Keywords

Weevils, Curculionoidea, *Perapion*, Poland, Hungary, Slovakia, Kyrgyzstan, new records, morphology, taxonomy, key, biology, *Rumex confertus*

Introduction

The title weevil species was originally described from Aulie-Ata (currently Taraz) in SE Kazakhstan and long considered as confined to Asian fauna (Schilsky 1902, Wagner 1930). After the World War II it was found on several distant localities in the European part of Russia, both in the extreme south (vicinity of Krasnodar) and well north of the 50th parallel of north latitude (Bryansk, Ul'yanovsk), as well as in Eastern Ukraine (Luhansk and Kharkiv regions) and in Moldova (Korotyaev 1987, Poiras 1998). Further

published records concerned Miodobory and Podolian Upland in the Western Ukraine (Mazur and Kuśka 1994, Mazur 2002). Most recently it was found in Kiev (Nazarenko 2011). At the same time the species turned out widespread in Western Siberia, in the provinces of Tomsk, Novosibirsk, Kemerovo, and in the Altai (Legalov 1998, 2002; Legalov and Opanasenko 2000, Krivets and Legalov 2002), thus covering practically the whole natural range of its main host plant, *Rumex confertus* Willd. The new sites of *Perapion connexum* presented herein are located more to the west, and partially within the boundaries of Central Europe, where the plant is an invasive neophyte, and the weevil remained completely unknown hitherto. The aims of this paper are to document its current distribution in Western Palaearctic, and to facilitate its recognition from other species of *Perapion* occurring in Central Europe.

Material and methods

The study was based on 118 specimens collected by the authors in 2000-2008, obtained from other collectors or borrowed from several institutional collections.

Measurements were taken using a calibrated stereomicroscopic grid eyepiece. Body length excludes rostrum, but includes head; it was measured in lateral view from the anterior eye margin to the apex of the elytra. Width of head was measured across middle of eyes. Tarsal width was measured at the level of the 3rd segment.

Photos of specimens were taken with a Leica M205C stereomicroscope and attached JVC KYF75 digital camera, and processed using the AutoMontage Pro and Adobe Photoshop CS2 software programmes.

The abbreviations used are as follows: MW, AP, KS – authors' respective acronyms, HG – G. Hegyessy, KMS – Kazinczy Museum, Sátoraljaújhely, nr. – near. Unless elsewhere stated, voucher specimens are in the collector's collections.

Taxonomic treatment

***Perapion connexum* (Schilsky, 1902)**
http://species-id.net/wiki/Perapion_connexum

Apion connexum Schilsky, 1902: 28.
Apion arcuatum Bajtenov, 1977: 15. Syn. by Legalov (1998).

Diagnosis. *P. connexum* is of the same size and at first glance very similar to the common in Europe *P. curtirostre*, from which it differs in a black tone of body integument (evidently grey in *curtirostre*), almost cylindrical and distinctly curved rostrum (thickened in basal half and nearly straight in *curtirostre*, as in Figs 5, 6, 9, 10), narrower subconical head, puncturation of vertex rugose and indefinite, smaller and not elongate scutellum (scutellar shield), slenderer tarsi and in male metatarsi devoid of ventral

spines. It strongly resembles *Aizobius sedi* in the colour of integument, but the latter species has different frons sculpture, with well defined punctures and long median fovea, pronotum distinctly rounded at sides, and a ventrally spined basal segment on all male tarsi. See the key to species of *Perapion* occurring in Central Europe given below.

Morphology. Body length 2.0–2.3 mm.

Integument and vestiture. clearly black with slight "oily" glint (Fig. 1). Body covered with sparse and extremely fine white-semitransparent hair-like scales, on pronotum as long as diameter of the largest punctures, on elytral disc not longer than half interval's width and unordered on intervals, not aggregated in any part of elytra, slightly denser on mesothoracic epimera and anepisterna, along metanepisterna condensed to form a thin white line. Entire body surface with dense microreticulation, scale-like and rough on head and the basal half of rostrum.

Rostrum in dorsal view subcylindrical with obtuse widening at antennal insertion, obscuredly punctured throughout, except distal third completely mat.

Head narrow, subconical, nearly as long as wide, about 1.5× narrower than pronotum (Figs 7, 8); eyes gently convex; frons slightly depressed in middle, with a few indictinct strigae partly obscured by dense microsculpture; puncturation on vertex lacking or indefinite, rarely with few punctures much smaller than on pronotal disc; head ventrally between eyes evenly scale-like microsculptured, without irregular asperities.

Antennae short and thin, with large club nearly as long as six distal funicular segments combined, 2.10–2.25× as long as wide, having fused segments with their circular rims incomplete (Fig. 2); pedicel 1.4–1.6× longer than wide, twice as long as next segment, segments 2, 3 minute and weakly elongate, segments 4, 5 isodiametric, 6 sligthtly, and 7 markedly transverse.

Pronotum small, slightly shorter than wide, with weakly rounded sides, at base 1.1–1.2× as wide as at apex, coarsely punctured, the punctures usually of 3–4 combined ommatidia size, with flat, heavily and somewhat roughly microreticulate interspaces; prescutellar fovea not wider than single puncture, as long as 3–4 neighbouring punctures combined.

Scutellar shield small, isodiametric (Fig. 7).

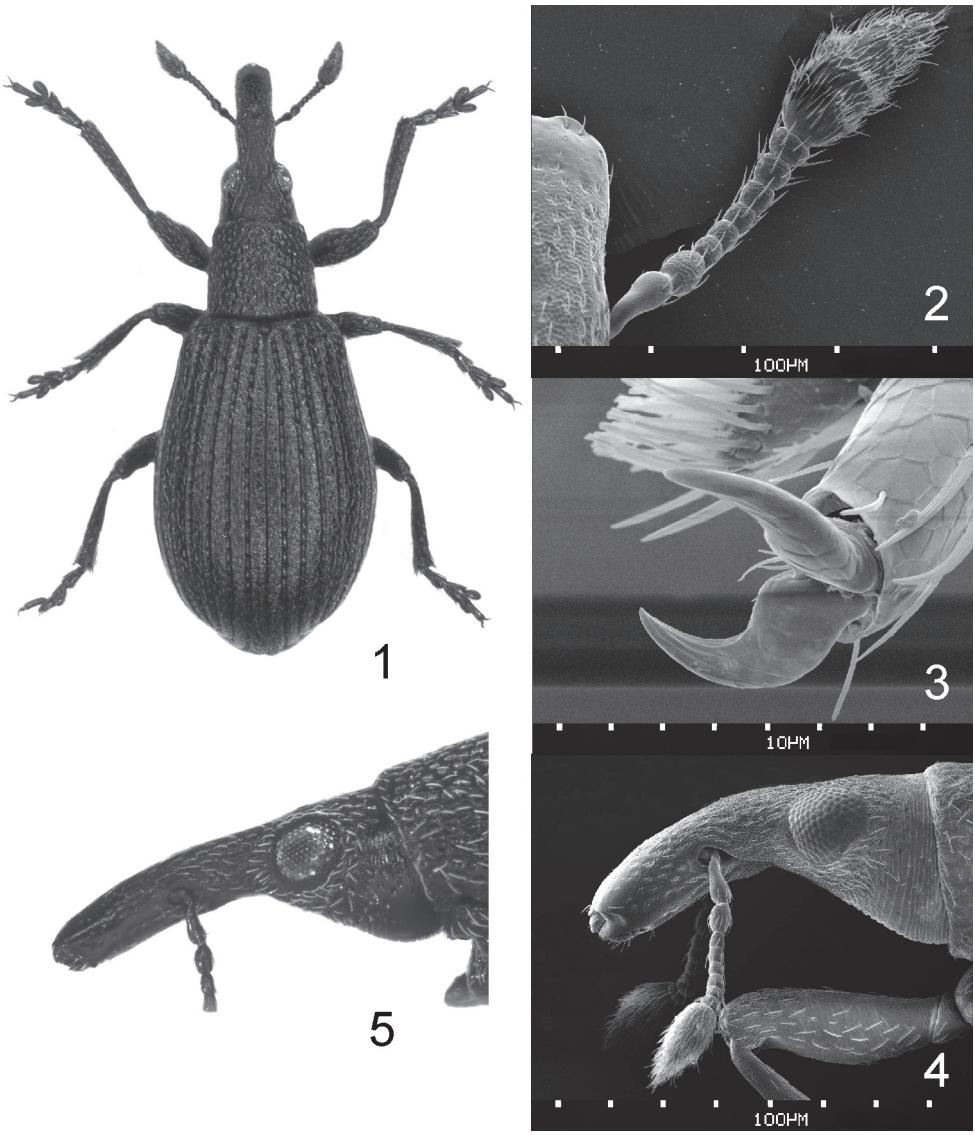
Elytra widest clearly behind mid-length, 1.6–1.7× longer than wide, 3.4–3.8× as long as pronotum, with deeply impressed catenulate-punctate striae, on elytral disc half as wide as intervals; intervals flat, barely punctate; specialised setae single on 7th and 9th interval.

Wing without radial window.

Ventrites. Metaventrite and abdominal ventrites I, II microreticulate and evently punctate, shiny, the punctures much smaller than on pronotal disc, well over a diameter apart from each other; abdominal ventrites III–V with strong, scale-like microsculpture.

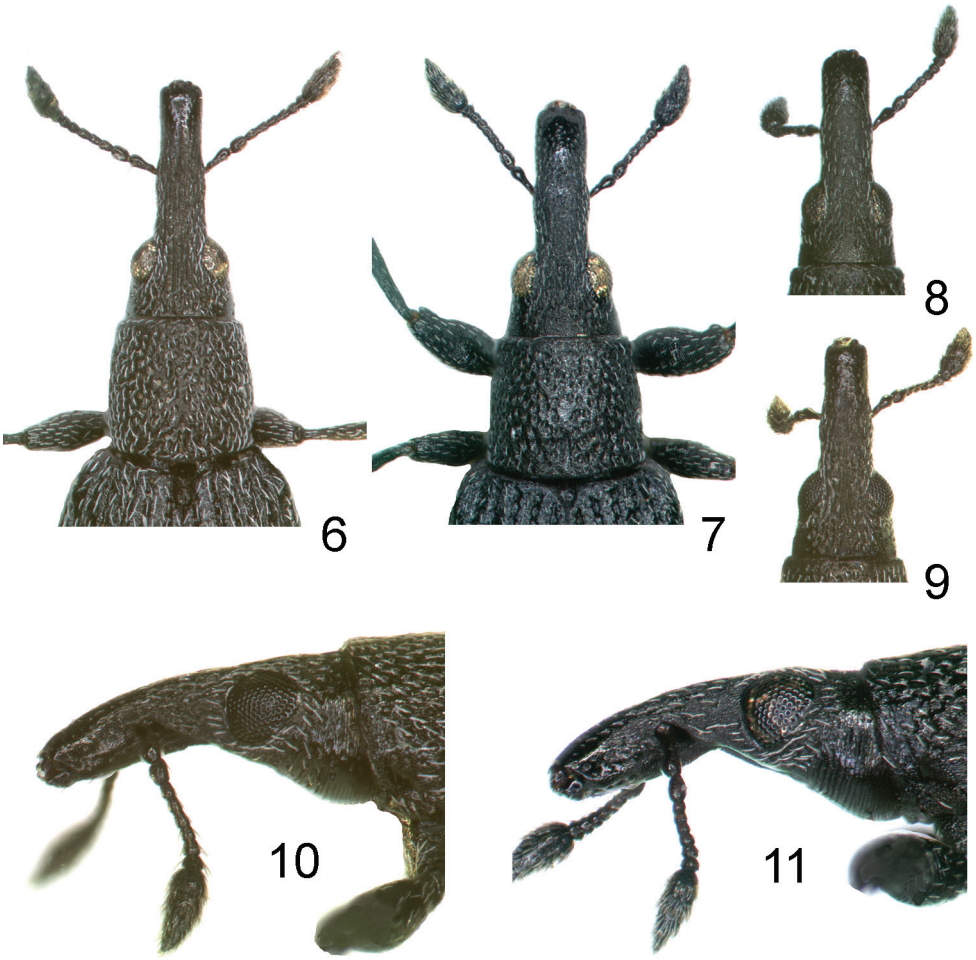
Legs slender; profemur 0.80–0.85× as thick as rostrum; protibia widening from base to apex, with obsolescent apical tuft of setae; tarsi slender, protarsus 3.15–3.40× as long as wide; claws untoothed, thickened basally (Fig. 3).

Male. Rostrum slightly shorter than pronotum, 2.20–2.35× longer than wide, in profile almost straight and somewhat wedge-like, distinctly narrowing apicad in distal



Figures 1–5. 1–4 *Perapion connexum* (Schilsky), female **1** total view **2** antenna **3** tarsal claws **4** head with rostrum, lateral view **5** *P. curtirostre* (Gyllenhal), female head with rostrum, lateral view. **2–4** SEM photos.

half (Fig. 11). Antennal insertion at basal 0.38–0.42 of rostrum. Abdominal ventrite V very broadly rounded apically. Metatarsus unarmed. Pygidium half exposed, with very broad complete transverse sulcus. Terminalia only slightly different from those of *P. curtirostre*, mainly in more elongate tegminal plate and aedeagus. Sternite VIII broad, with very short and indistinct lobes. Sternite IX with slightly asymmetrical fork half as long as apodeme. Tegmen with phallobase as long as apodeme; tegminal plate fused, short, devoid of macrochaetae, with broadly and very deeply emarginate prostegium.



Figures 6–11. 6, 7 female anterior half of body, dorsal view **6** *Perapion curtirostre* (Gyllenhal) **7** *P. connexum* (Schilsky) **8, 9** male head with rostrum, dorsal view **8** *P. connexum* **9** *P. curtirostre* **10, 11** same in lateral view **10** *P. curtirostre*, **11** *P. connexum*.

Aedeagus short and flattened, with pedon about 4.5× as long as wide, membranous tectum and free apophyses less than 0.2× as long as pedon; endophallus finely and more or less evenly microspinose.

Female. Rostrum 1.00–1.15× as long as pronotum, 2.60–2.75× longer than wide, in profile distinctly curved and equally high along its length (Fig. 4). Antennal insertion at basal 0.35–0.39 of rostrum. Abdominal ventrite V narrowly rounded apically. Tergite VIII broad and strongly transverse, uniformly slerotized. Sternite VIII with large and broad basal arms. Gonocoxites less than 2.5× longer than wide, without median string of sclerotisation; styli slightly elongate, shortly setose apically.

Material examined. Poland (E): Stare Stulno (51.3714°N, 23.6628°E), 1 VIII 2000, 4 exs, 2 VIII 2000, 10 exs, 5 VIII 2000, 10 exs, 7 VI 2001, 1 ex., 31 VII

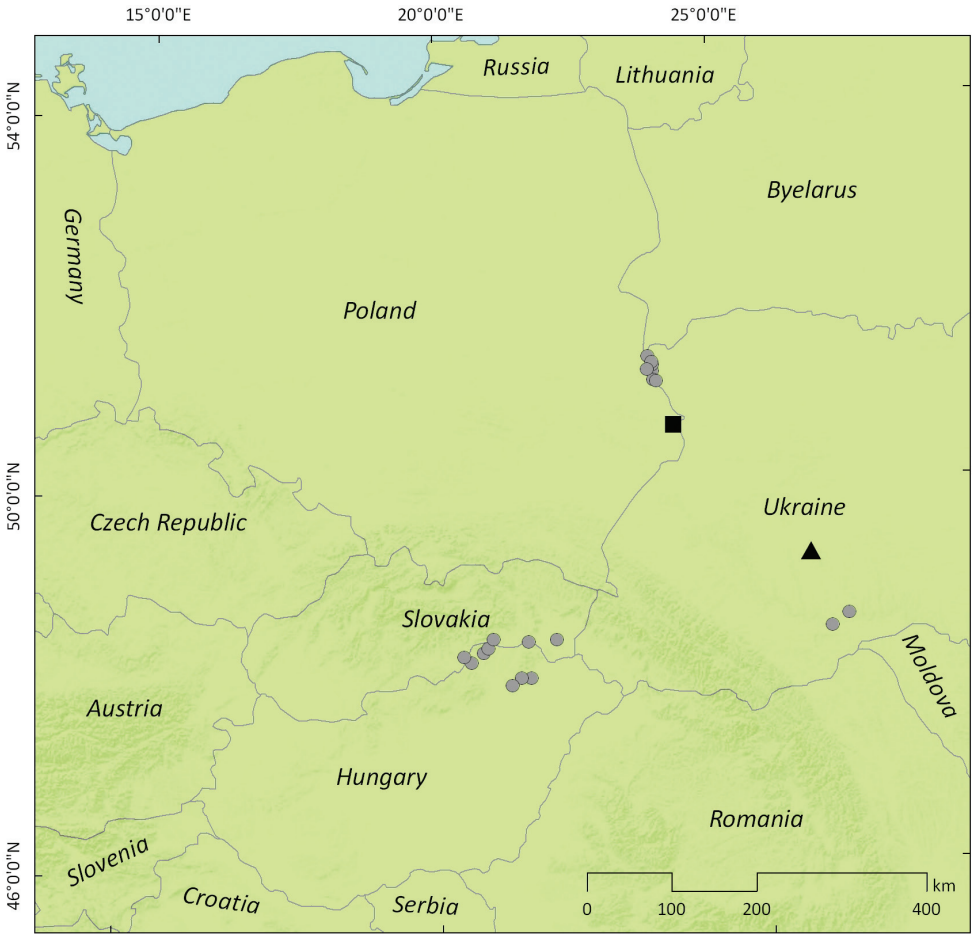


Figure 12. Westernmost recent localities of *Perapion connexum* (Schilsky) in Central Europe mentioned in the text (circles – new records; black square – record by Gosik (2006) in Gródek nr. Hrubieszów, Poland; black triangle – record by Mazur and Kuśka (1994) in Vikno, Ukraine).

2001, 16 exs; Rudka nr. Wola Uhruska (51.2761°N, 23.6694°E), 15 VII 2002, 1 ex.; Wołczyny (51.4392°N, 23.6656°E), 6 VII 2002, 2 exs; Orchówek-Obłonie (51.5291°N, 23.5950°E), 7 VII 2002, 2 exs; Sobibór (51.4680°N, 23.6599°E), 6 VII 2002, 13 exs; Kosyń (51.3903°N, 23.5750°E), 12 VII 2002, 7 exs; Hniszów (51.2646°N, 23.7119°E), 15 VII 2002, 2 exs – all leg. et coll. MW.

Ukraine (W): Podolia: Zvenihorod at Dniester riv., 48.5500°N, 26.2833°E, 25 VI 1996, 2 exs; Kamyanets Podilskiy, 48.6667°N, 26.5667°E, 26 VI 1996, 2 exs – all leg. et coll. MW;

Hungary: Borsod-Abaúj-Zemplén county: Füzér, Hosszú-rét (48.5644°N, 21.4324°E), 21.VII.2005, 3 ex., leg. Hegyessy G & S; Alsószuha, Hideg-kút-völgy (48.3586°N, 20.5144°E), 17 VI 2003, 5 exs, leg. HG – coll. AP (2 ex) and KMS (3 exs); Zalkod, Erkecse (48.1818°N, 21.4541°E), 10.VII.1993, 1 ex, leg. HG – coll.

KMS; Szalonna, Köszvényeskút (48.4612°N, 20.7086°E), 10.V.2007, 1 ex, leg. HG – coll. KMS; Tornaszentandrás: Mile-völgy (48.5066°N, 20.7853°E), 10.V.2007, 1 ex, leg. HG – coll. KMS; Mád, Becsek (48.1826°N, 21.3056°E), 10.IV.2008, 1 ex, leg. HG & AP – coll. AP; Taktaszada: Ökör-mező (48.1122°N, 21.1504°E), 11.VI.2008, 1 ex, leg. HG – coll. KMS.

Slovakia (S, E): Železné env., Tornaľa - Starňa (48.4167°N, 20.4000°E), 26 V 2006, 1 ♂, leg. et coll. T. Kopecký; Zemplínské Kopčany (48.5833°N, 21.8833°E), 14 VI 2000, 1 ♂ 1 ♀, leg. P. Boža – coll. S. Benedikt, 20 V 2002, 7 ♂♂ 7 ♀♀, leg. M. Mantič – coll. M. Mantič & KS; Turňa nad Bodvou (48.6000°N, 20.8667°E), 9 VI 2001, 1 ♂, leg. R. Fornůsek – coll. S. Benedikt.

Russia: Kursk, 1 ex.; Orel [Oryol], 3 exs; Nikitskoe near Voronezh, 1 ex. – all coll. F. Schubert (in Naturhistorisches Museum Wien). W Siberia: Novosibirsk Area, Kochenevo distr., 43 km WNW of Kochenevo, Sektinskoye Lake, 27.05.1998, leg. R. Dudko & A. Legalov, det. A. Legalov, 6 exs – coll. KS (2 ♂♂ 2 ♀♀) and M. Koštál (1 ♂ 1 ♀). Rostov reg.: Krasny Sulin distr.: Donleskhoz env. (47.8627°N, 40.2405°E), 12 VI 2004, 1 ex., leg. D. Kasatkin – coll. MW.

Kyrgyzstan: Chüy province: Ala-Archa valley (42.6000°N, 74.4833°E), ca. 30 km S of Bishkek, above 1300 m alt., 4 VI 2003, 3 exs., leg. R. Królik – coll. MW.

Distribution. Austria?, Hungary*, Kazakhstan, Kyrgyzstan*, Moldova, Poland (E), Russia (Central and South European Territory, Western Siberia), Slovakia (S and E), Ukraine, Uzbekistan (first records herein marked with asterisk).

Biology. Korotyaev (1987) collected this weevil from broad-leaved sorrel species. The senior author (MW) collected it in Ukraine by general sweeping of wet meadows in the Dniester valley, where an unidentified broad-leaved sorrel was abundant. Poiras (1998) identified the host plant as *Rumex confertus* Willd. and, indeed, in Poland the weevil was collected exclusively from this sorrel species. In the Udmurt Republic Dedyukhin (2009) confirms the same host plant, but he collected adults also from the sorrels resembling *Rumex crispus* L. The life cycle of *P. connexum* remains unknown, but the adults were in Poland mostly beaten in summer from mature infruitescences, which may indicate larval feeding on developing seeds or eventually in fruit petioles, rather than in thick main stem or leaf petioles. In Poland teneral beetles were observed since mid-July.

Comments. Korotyaev (1987) reported a specimen from the collection of ZIN labelled "Austria", which was then approximately 800 km distant from the westernmost known locality in Moldova. This outstanding record was ignored by the authors of subsequent Centraleuropean weevil catalogues (Lucht 1987, Böhme 2005, Alonso-Zarazaga 2011), but in the light of our current findings and proximity of current Slovak and Hungarian localities, this opinion should be verified and the occurrence of *P. connexum* in Austria should be considered as likely, though obviously requiring confirmation with new data. Unfortunately, the information on distribution of its host plant in Austria is poor and equivocal. It was missing from the first two editions of Austrian Excursionsflora by Fritsch (1897, 1909), but it was noticed from Austria since at least mid-20th c. (Tutin et al. 1964). Then Jalas and Suominen (1979) did

not justify Austrian records of this sorrel, and they were consequently removed from the revised editions of Flora Europaea. Most recently the occurrence of *R. confertus* in Austria has been confirmed in the departments of Wien, Niederösterreich, Steiermark and Kärnten (Fischer et al. 2008), but the history of its invasion(s) remains unclear.

The occurrence of *P. connexum* in Poland, as based on the abovementioned data, was earlier generally announced by Wanat and Mokrzycki (2005), and further confirmed by Gosik (2006). Analogously, the weevil has been just placed on the list in Slovakia (Benedikt et al. 2010). The range of this weevil in Poland seems still strictly limited to the southern section of the Bug River Valley, which constitutes there the country border between Poland and Ukraine, but one of the listed localities (Kosyń) is situated ca. 18 km "inland" West of the river. Along the Bug River Valley the southernmost site is Gródek near Hrubieszów (Gosik 2006) (lat/long approximately 50.79°N, 23.96°E), while the remaining seven sites are situated between Hniszów and Orchówek, which is the northermost locality of this species in Poland (51.5291°N, 23.5950°E). Searching for the weevil in 2002-2003 in similar sites rich of the host plant but laying North along the Bug valley, i.e. in Parośla nr. Sławatycze (51.8099°N, 23.6206°E), Mielnik (52.3328°N, 23.0225°E) and Kózki nr. Siemiatycze (52.3605°N, 22.8660°E), brought negative results. Nevertheless, in Russia the weevil was found up to 54.5°N in Ul'yanovsk (Korotyaev 1987) and even 57°N in the Udmurt Republic (Dedyukhin 2009) and the northernmost Siberian sites (Legalov 2002), despite of continental climate. Thus the Lower Bug Valley seems to be the most obvious natural area for further spreading of *P. connexum* in Poland and presently limited range of the weevil there may indicate a stage of current invasion.

Rumex confertus is an invasive plant in Europe, and its natural range ends probably close to Southeastern Poland, in Southern Slovakia and Hungary (Rechinger and Schreiber 1957, Tutin et al. 1964, Jalas and Suominen 1979, Dostál 1989, Jehlík et al. 2001). However, although it is known from the Bug River Valley in Poland since 1873 (Eichler and Łapczyński 1892), its autochtonous status in Poland is doubtful. According to Trzcińska-Tacik (1963) and Tacik (1992), who studied distribution of this sorrel species in most detail, its natural range North of the Carpathians rather ends in Western Ukraine. Its spreading to the West of Poland started probably since 1950 (Tokarska-Guzik 2005) and currently it appears a common plant in Poland east of the Vistula river, reaching even the Baltic coast to the North, and it has many diffused localities also in the Western Poland (Trzcińska-Tacik 1963, Zając and Zając 2001, Stosik 2006). It extends its range widely also to the North, being probably introduced to Skandinavia with the Soviet army transports since the very early 20th century in Finland, and about mid 20th century in Norway and Sweden (Snogerup 2000). It is now widespread also in Baltic countries and treated as invasive plant in Lithuania (Gudžinskas 1999). The Southern stream of its invasion to Central Europe seems less active. The plant is still very rare in Czech Rep. with just a few isolated and ephemeral localities (Jehlík et al. 2001) and, as stated above, it has quite similar status in Austria.

Following current distribution of the host plant, further expansion of *P. connexum* in Central Europe from the sites showed in Fig. 12 seems very likely especially through

the territory of Poland, and it could be monitored quite easily by summer sweeping of mature inflorescences of *R. confertus*. The same method should be applied on stabilized localities of *Rumex confertus* in Austria to record its occurrence and expansion.

Key to Central European species of *Perapion*†:

The key includes also *Aizobius sedi* (Germar, 1818), a related and morphologically similar species.

1 Elytra with distinct metallic blue or green shine **2**
– Elytra black, concolorous with rest of body **5**
2 Body longer than 2.5 mm. Scutellar shield elongate, subrectangular. Elytra 1.5–1.7× longer than wide. Male basal segment of metatarsus with a ventral spine **3**
– Body shorter than 2.5 mm. Scutellar shield isodiametric, rather triangular. Elytra nearly always 1.4-1.5× longer than wide. Tarsi without ventral spines **4**
3 Abdominal ventrites 1-2 entire coarsely punctate, punctures nearly as large as those on pronotal disc. Pronotum 1.4-1.7× wider than head across eyes. Rostrum slightly curved, in male at least 2.5× longer than its basal width, in female longer than pronotum and more or less cylindrical ..... ***P. violaceum* (Kirby)**
– Abdominal ventrites 1-2 sparsely and finely punctate, punctures several times smaller than those on pronotal disc. Pronotum at most 1.2–1.4× wider than head across eyes. Rostrum shorter, straight, in male tapering from base to apex and less than 2.5× longer than its basal width, in female as long as or shorter than pronotum, narrowing apicad from antennal insertion ..... ***P. hydrolapathi* (Marsham)**
4 Genae coarsely punctured and finely strigose. Punctures on head dorsum and pronotum mostly slightly elongate ..... ***P. affine* (Kirby)**
– Genae largely impunctate, only transversely strigose. Punctures on head dorsum and pronotal disc round ..... ***P. marchicum* (Herbst)**
5 Frons with evident median sulcus, though not wider nor deeper than neighbouring punctures. Pronotum with markedly rouded sides and very thick walls, its disc distinctly convex. In male all tarsi ventrally spinose. On Crassulaceae (*Sedum* spp.) ..... [***Aizobius sedi* (Germar)**]
– Frons finely punctate or strigose. Pronotum with weakly rounded to nearly straight sides and thinner walls, its disc barely convex. At most male metatarsi with ventral spines. On Polygonaceae (*Rumex* spp., *Polygonum* spp.) **6**
6 Body vestiture distinct, composed of cream-yellowish hair-like scales, on elytra forming a condensed patch on the outermost interval along metathoracic ventrite. Rostrum cylindrical, thinner than profemur. On *Polygonum aviculare* L. ..... ***P. lemoroi* (Ch. Brisout)**

– Body vestiture less distinct, the scales finer, evenly confused on elytra. Rostrum at base as thick as or thicker than profemur.....**7**

7 Head and basal half of rostrum with indistinct puncturation obscured by very dense rough scale-like microreticulation. Rostrum in female distinctly curved, in male somewhat wedge-like due to prominent septum between antennal insertions (Figs 4, 11). Scutellar shield isodiametric, flat (Fig. 7). Body vestiture very fine, beetle appears evidently black. Male tarsi unarmed. On *Rumex confertus* Willd..... ***P. connexum*** **(Schilsky)**

– Head and basal half of rostrum clearly punctured, the punctures dense and on vertex nearly as large as those on pronotal disc. Rostrum straight to slightly arched, in lateral view equally high throughout (Figs 5, 10). Scutellar shield elongate, furrowed (Fig. 6). Body vestiture more distinct, altogether with integument microsculpture giving beetle a greyish colouration. In male basal segment of metatarsus with small ventral spine **8**

8 Body larger, 2.2-3.0 mm long. Rostrum longer, in male ca. 3×, in female ca. 3.5× longer than its width at antennal insertion, in female subequally wide at narrowest points before and behind antennal insertion. On *Rumex acetosa* L. ..... ***P. oblongum*** **(Gyllenhal)**‡

– Body smaller, 1.5-2.6 mm long. Rostrum in male ca. 2.5×, in female ca. 3.0× longer than its width at antennal insertion, in female at narrowest point basad of antennal insertion clearly wider than at narrowest point of apical half of rostrum (Fig. 6). On a wide range of *Rumex* spp., occasionally on *Polygonum bistorta* L..... ***P. curtirostre*** **(Germar)**

† Generic definition after Alonso-Zarazaga (1990)

‡ This species was synonymised with *P. curtirostre* by Legalov (2001), which was commented by Wanat and Mokrzycki (2005), refused by Alonso-Zarazaga (2011), and is not agreed upon by the authors of this paper.

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Terrestrial slugs (Gastropoda, Pulmonata) in the NATURA 2000 areas of Cyprus island

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Abstract

Terrestrial slugs of the Island of Cyprus were recently studied in the framework of a study of the whole terrestrial malacofauna of the island. The present work was carried out in the Natura 2000 conservation areas of the island in 155 sampling sites over three years (2004–2007). Museum collections as well as literature references were included. In total six species are present in the Natura 2000 areas of the island, belonging to three families: Limacidae, Agriolimacidae and Milacidae. One of the species, *Milax riedeli*, is a new record for the island. The distribution of the species across the island and in the surrounding areas is discussed.

Keywords

Agriolimacidae, Limacidae, Milacidae, Distribution, East Mediterranean

Introduction

Cyprus, the largest island in the Eastern Mediterranean, has an area of 9,251 km^2, and there are 33 special areas under nature conservation, that cover 22 % of the total area. The designation of these areas was based mainly on habitat types, geology, knowledge

of plant and vertebrate species, and on published data on invertebrates. This is in accordance with what Dimitrakopoulos et al. (2004) claim *"… it is questionable whether the inclusion of species and habitats in the list of biodiversity components of 'community interest' has been based on a previous detailed evaluation of regional biodiversity patterns, but rather the selection was based on the inclusion of pre-existing national ad hoc schemes".*

Our previous knowledge of the slugs of Cyprus was mainly based on a fairly recent paper by Rähle (1991). In most other relevant papers slugs of Cyprus appear in passing, either because the work deals mainly with the neighbouring areas of the Mediterranean (Schütt 2005, Heller 2009) or they concern a particular slug taxon (Hesse 1926). Six slug species had been recorded from the island, but only three of them within a NATURA 2000 conservation area; namely *Deroceras berytensis, D. chrysorroyatissensis* and *Limax flavus* (Rähle 1984, 1991; Wiktor 2001). These slugs are recorded from six conservation areas, which are among the most popular and most visited parts of the island.

In this work we present new distributional data about the slugs of Cyprus and comments on their taxonomy when necessary. Additionally, we discuss their presence in the conservation areas and the whole island and compare it with occurrence in surrounding countries.

Material and methods

During the years 2004–2007 we collected land snails in all NATURA 2000 areas. Slugs were found at 99 sites within 28 of the 33 areas although we collected land snails at 155 sampling sites (Map 1, Table 1). Sampling sites were intended to cover the whole diversity (habitat and substrate) of each NATURA 2000 area. Snails and slugs were collected only during the wet period (October-April) by A. Demetropoulos (AD), S. Demetropoulos (SD), Chr. Makris (M), Chr. Makris & L. Georgiou (MG), M. Mylonas (MM), K.A. Triantis, and K. Vardinoyannis (V). We also included material from the mollusc collection of the Natural History Museum of Crete (Map 1, Table 1). After sampling, specimens were relaxed and then preserved in 75 % ethanol. Their identification was based on anatomy of the genitalia. The material is kept in the Natural History Museum of Crete and in the Museum of Natural History, Wrocław University.

Table 1. Sampling sites in each NATURA 2000 area, the date of collection, the vegetation type and the dominant plant species, the substrate and the corresponding number on Map 1.

NATURA 2000 area	Sampling site with slugs	Date	Number on map	Dominant Vegetation	Substrate
Agiatis	Agiatis–Agia S (CY411–1)	14/3/2006	25	Pine forest (*Pinus brutia*)	Diabase dykes
	Agiatis–500m from Tarmac CY411–2	14/3/2006	26		
Akrotirio Aspro–Petra tou Romiou	Aspro cape–Petra tou Romiou (eastern valley)	29/1/2005	53	Phrygana (*Sarcopoterium spinosum;* Maquis (*Olea europaea, Ceratonia siliqua*)	Biocalcarenites, sandstones

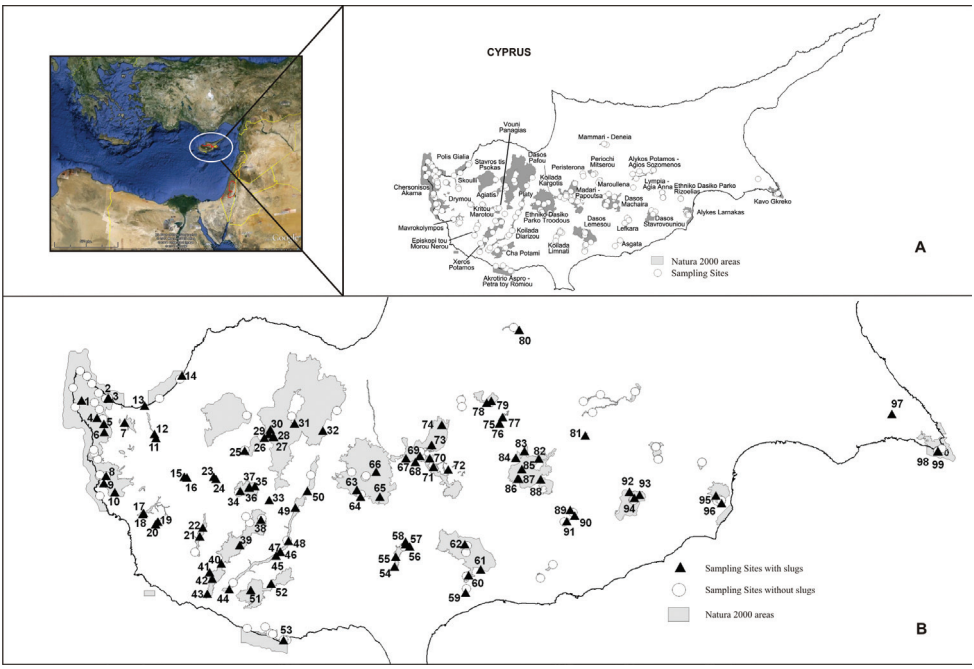
NATURA 2000 area	Sampling site with slugs	Date	Number on map	Dominant Vegetation	Substrate
Alykes Larnakas	Alyki, Tekes (site 1)	15/1/2005	95	Plantations with *Acacia*	Sand, silts
	Larnaka salt marsh new buildings	19/11/2005	96		
Alykos Potamos–Agios Sozomenos	Kotsiatis Dam (CY202–1)	4/3/2006	81	Phrygana (*S. spinosum*)	Pillow lavas, Olivine - Pyroxene
Cha Potami	Cha river, Kato Archimantria	5/3/2005	52	Maquis (*O. europaea* & *C. siliqua*)	Chalks, marls
	Cha river, Orites	5/3/2005	51		
Chersonisos Akama	Agios Kononas springs	24/11/2005	1	Maquis (*Juniperus phoenicea, O. europaea, C. siliqua*); Phrygana (*S. spinosum*); Pine forests (*P. brutia*)	Limestone
	Agios Minas spring CY410–11	15/3/2005	4		
	Akamas (may be Loutra tis Afroditis)	1/10/1989	3		
	Akamas forest CY 410–8	12/3/2005	6		
	Akamas, Loutra tis Afroditis CY 410–10	15/3/2005	2		
	Avakas	19/2/2005	8		
	Mountiko maquis CY410–3	24/1/2005	9		
	Petratis gorge	23/11/2005	7		
	Pittokopos CY410–13	16/3/2005	5		
	Pykni forest CY410–4	15/2/2005	10		
Dasos Lemesou–Periochi Kyparisia	Germasogeia north, at the stream (CY 20)	20/2/2000	59	Pine forest (*P. brutia*); Maquis (*O. europaea*, *C. siliqua*)	Serpentinized harzburgites, Diabase dykes and gabbros
	Lemesos forest, Akrounta river valley	11/2/2006	62		
	Lemesos forest, Foinikaria	2/1/2005	61		
	Lemesos forest, Germasogeia dam, Foinikaria	2/1/2005	60		
Dasos Machaira	Gionia Camp (CY204–2)	17/3/2006	87	Forest (*Q. alnifolia, P. brutia*)	Diabase dykes and pillow lavas
	Gionia Valley north (CY204–3)	17/3/2006	85		
	Kapedes (CY204–1)	17/3/2006	82		
	Kiona ~1380m alt	22/12/2006	86		
	Lazania CY 204–7	27/12/2006	84		
	Machairas, Kyprovasa– Arkatzi tou Klosmatou	22/12/2006	88		
	Philani Pine CY 204–6	27/12/2006	83		
Dasos Pafou	Dasos Pafou Tripyla	7/1/2006	29	Forests with Pines (*P. brutia*) and Cedars (*Cedrus brevifolia*)	Diabase dykes
	Gerakies (CY 206–3)	15/3/2006	32		
	Kedron valley	13/3/2005	28		
	Kedron valley (CY 10)	18/2/2000	27		
	Kremnos tis Pellis CY 206–1	15/3/2006	30		
	Roudia Bridge (site CY7)	17/2/2000	33		
	Sylladin tou Petrou near Tsakistra	15/3/2006	31		

NATURA 2000 area	Sampling site with slugs	Date	Number on map	Dominant Vegetation	Substrate
Dasos Stavrovouniou	Stavrovouni, entrance of monastery	19/12/2006	93	Pine forest (*P. brutia*); Maquis (*O. europaea*, *C. siliqua*)	Diabase dykes and pillow lavas
	Stavrovouni, low	19/12/2006	92		
	Stavrovouni, NE low	19/12/2006	94		
Drymou	Drymou Oak	28/3/2007	16	Riparian	Biocalcarenites, sandstones
	Drymou Valley	28/3/2007	15		
Episkopi tou Morou Nerou	Ezousas Alder (CY405–1)	11/2/2006	22	Maquis (*Q. coccifera*)	Sand, silts, clays
	Ezousas Pseudogarrigue (CY405–2)	11/2/2006	21		
Ethniko Dasiko Parko Troodous	Caledonian falls	22/11/2005	63	Pine forests (*P.nigra, P. brutia*)	Gabbros, harzburgites
	Mesapotamos waterfall	22/11/2005	65		
	Platres to Mesapotamos	22/11/2005	64		
	Troodos mt., Almyrolivado	26/11/2005	66		
Kavo Gkreko	Cavo Gkreko Rocks	9/1/2005	99	Maquis (*J. phoenicea*); Phrygana (*S. spinosum*)	Limestone
	Gkreco cape at Agioi Anargyroi (CY 24)	21/2/2000	98		
	Paralimniou lake	9/1/2005	97		
Koilada Diarizou	Diarizos Arminou	28/1/2006	49	Maquis (*O. europaea*, *C. siliqua*); Phrygana (*S. spinosum*); Pine forests (*P. brutia*)	Chalks, sand, lava breccia
	Diarizos gorge, after Kikisia (CY 8)	17/2/2000	47		
	Diarizos Kidasi	22/1/2006	45		
	Diarizos Nikokleia	28/1/2006	44		
	Diarizos valley, Gefyri	22/1/2005	48		
	Diarizos valley, Petres ton Hasanpoulion	22/1/2005	46		
Koilada Limnati	Limnatis valley, 1 km west of the bridge, 400 m alt.	5/12/2004	58	Maquis (*O. europaea, C. siliqua*)	Chalks, serpentinite
	Limnatis valley, Alassa	19/11/2005	55		
	Limnatis valley, Mantra	18/2/2006	54		
	Palia Korfi, approx. 500 m alt., Limnatis valley	4/12/2004	56		
	Palia Korfi, river below at Limnatis bridge	4/12/2004	57		
Kritou Marotou	Kritou Marotou Cultivations	27/3/2007	24	Riparian and cultivations	Chalks, marls, clays
	Kritou Marotou Oak	27/3/2007	23		
Lefkaron	Lefkara–Agios Minas	25/2/2006	91	Presteppe scrub (*Genista fasselata*; Maquis (*Q. coccifera*)	Chalks, marls and pillow lavas
	Lefkara 600 m alt	19/11/2005	89		
	Lefkara croosroad to Kato Drys	11/3/2006	90		
Madari–Papoutsa	Kyperounda (CY205–1)	25/3/2006	67	Forest (*Q. alnifolia, P. brutia*)	Diabase dykes and pillow lavas
	Lagoudera valley	20/12/2006	70		
	Lagoudera, 6 km north	21/12/2006	73		
	Papoutsa ~1240m alt.	20/12/2006	72		
	Pitsilia district, Kyperounta	15/4/2001	68		
	Polystypos Fountoukies	17/12/2006	71		
	Spilia–Madari, 1250m alt.	17/12/2006	69		
	Xyliati dam, low	21/12/2006	74		

NATURA 2000 area	Sampling site with slugs	Date	Number on map	Dominant Vegetation	Substrate
Mammari–Deneia	Mammari 1st site	21/11/2005	80	Phrygana (*S. spinosum*)	Biocalcarenites, sandstones
Maroullena	Maroulena gorge	17/12/2006	75	Pine forest (*P. brutia*) and Riparian	Pillow lavas
	Maroulena's Dam	23/12/2006	76		
	Maroulena's Pine	23/12/2006	77		
Mavrokolympos	Agios Neophytos Valley CY408–4	13/1/2006	20	Maquis (*O. europaea, C. siliqua*); Phrygana (*S. spinosum*)	Chalks, marls
	Agios Neophytos Garrigue CY408–3	13/1/2006	19		
	Mavrokolymbos Garrigue CY408–1	9/1/2006	18		
	Mavrokolymbos Stream CY408–2	9/1/2006	17		
Periochi Mitserou	Mitsero–Agios Panteleimonas	11/3/2006	79	Phrygana (*S. spinosum*); Pine forest (*P. brutia*)	Chalk & Limestone
	Mitsero Pinewood & valley	11/3/2006	78		
Platy	Platy area, crossroad Kelefos–Kaminaria–Milikouri	19/2/2005	50	Pine forest (*P. brutia*)	Diabase dykes
Polis Gialia	Gialia Acacia CY401–1	8/1/2006	14	Plantations with *Acacia*	Calcarenites, sands, gravel
Skoulli	Chrysochou River CY409–2	15/1/2006	12	Woodland (*Q.infectoria*); Riparian (*Platanus orientalis, Nerium oleander*)	Sand, silts, gravel
	Goudi Oak CY409–1	15/1/2006	11		
	Polis Camp river CY409–3	15/1/2006	13		
Vouni Panagias	Agia Moni south of Panagia	22/12/2004	34	Forests (*Q. infectoria, Pinus brutia*)	Chalks, marls
	Makries Limnes Chasanpoulion–Eryfiou–Profitis Ilias	23/12/2004	36		
	Profitis Ilias	1/2/2005	35		
	Vloudkia	23/12/2004	37		
Xeros Potamos	Asprokremnos Pools CY407–1	2/2/2006	43	Phrygana (*S. spinosum*); Maquis (*O. europaea, C. siliqua*); Pine forests (*P. brutia*)	Chalks, marls
	Finikas CY407–2	2/2/2006	42		
	Nata Pine CY407–5	6/2/2006	39		
	Xeros Army CY407–3	2/2/2006	41		
	Xeros Rock CY407–4a	3/2/2006	38		
	Xirou valley, Nata	5/2/2005	40		
Stavros tis Psokas	Agios Merkourios			Pine forests	Diabase dykes
	Stavros tis Psokas (CY 11)	18/2/2000			
Ethniko Dasiko Parko Rizoelias	No slugs were found in these areas				
Asgata					
Lympion–Agia Anna					
Peristerona					
Koilada Kargotis					

In Table 1 we give the sampling sites in each NATURA 2000 area, the date of collection, the vegetation type, the dominant plant and the substrate.

Initially we assembled all data from the literature, including the doubtful names. These are presented and discussed separately for each species.



Map 1. Natura 2000 areas **A** and sampling sites **B** in each area. Numbers depict sampling sites where slugs were found (their name is given in Table 1)

Results

In total we found six slug species belonging to three families - Agriolimacidae, Limacidae and Milacidae. Below we present analytically for each species the collecting sites in each NATURA 2000 conservation area (bold), data from literature, and if necessary comments on its systematics.

Family Agriolimacidae Wagner, 1935

Deroceras berytensis (Bourguignat, 1852)

This species had been reported from Akrotirio Aspro–Petra tou Romiou; Alykes Larnakas; Chersonisos Akama; Ethniko Dasiko Parko Troodous; Koilada Diarizou; Polis Gialia and Vouni Panagias (Rähle 1984, 1991).

We found it in (Fig. 1a): **Alykes Larnakas:** Larnaka salt marsh new buldings, 19.11.05, M; Alyki Tekes, 15.1.05, MG. **Alykos Potamos – Agios Sozomenos:** Kotsiatis Dam (CY202–1), 4.3.2006, SD. **Cha Potami:** Cha river, Kato Archimandria, 5.03.05, MG. **Chersonisos Akama:** Agios Minas spring CY 410–11, 15.3.05, AD; Agios Kononas springs, 24/11/2005, AD; Akamas (may be Loutra tis Afroditis), 1.10.1989, MM; Petratis gorge, 23.11.05, MM; Pittokopos CY 410–13, 16.03.05,

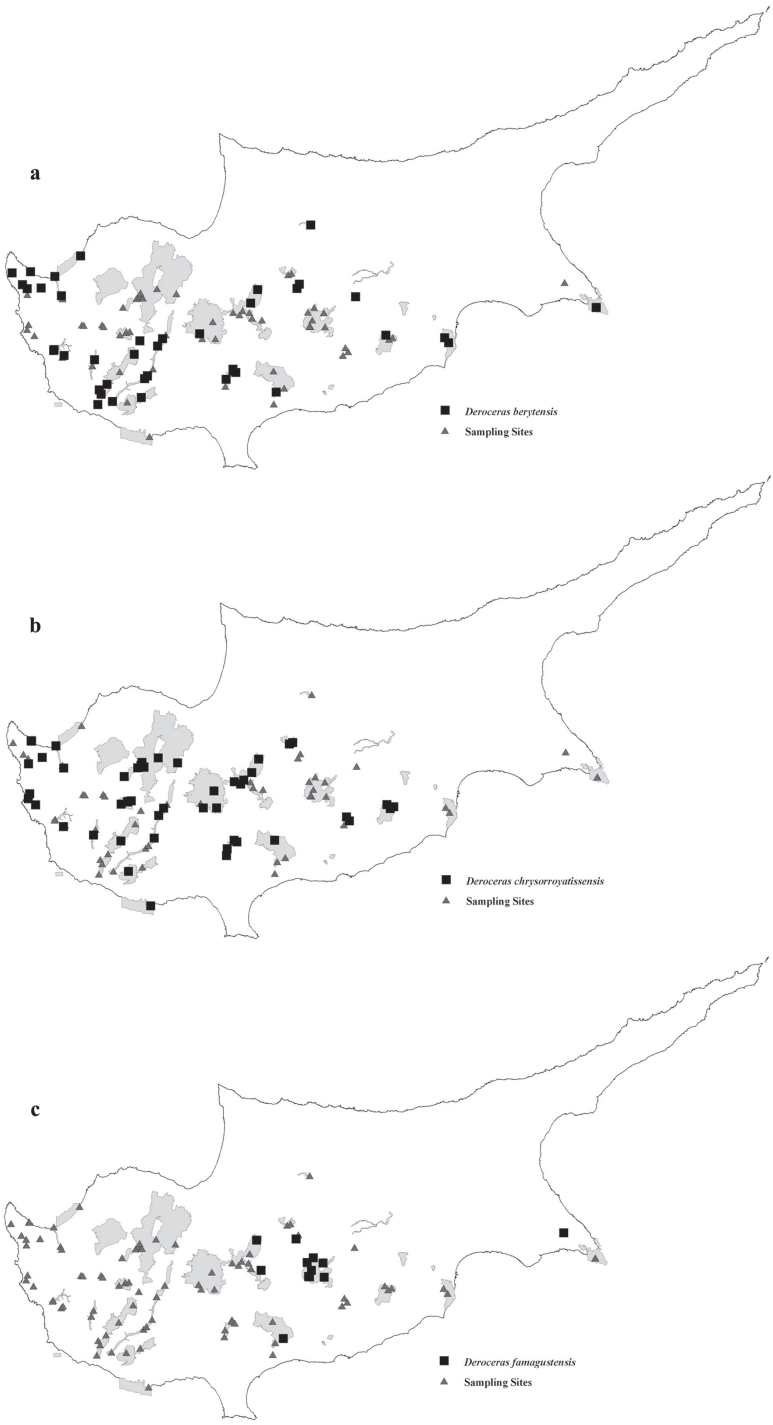


Figure 1. Distribution of **a** *D. berytensis* **b** *D. chrysorroyatissensis* and **c** *D. famagustensis* in the Natura 2000 areas of conservation in Cyprus Island.

SD. **Dasos Lemesou – Periochi Kyparisia:** Lemesos forest, Germasogeia dam, Foinikaria, 2.1.05 MG. **Dasos Pafou:** Roudia bridge (CY7), 17.2.00, MM. **Dasos Stavrovouniou:** Stavrovouni, low, 19.12.06 MM. **Episkopi tou Morou Nerou:** Ezousas Alder (CY405–1), 11.02.06, SD. **Kavo Gkreko:** Cavo Greko Rocks, 9.1.05, MM; Gkreko cape at Agioi Anagyroi (CY24), 21.02.00, MM. **Koilada Diarizou:** Diarizou gorge, after Kikisia (CY 8), 17.02.00, MM; Diarizos Arminou, 28.1.06, MG; Diarisos Kidasi, 22.1.06, AD; Diarizos Nikokleia, 28.1.06, MG; Diarizos valley, Petres ton Hasanpoulion, 22.1.2005, MG. **Koilada Limnati:** Limnatis valley, Alassa, 19.11.05, MG; Palia Korfi, river below at Limnatis bridge, 4.12.04, MM; Palia Korfi, approx. 500 m alt. Limnatis valley, 4.12.04, MM; Limnatis valley, 1 km west of the bridge, 400 m alt., 4/12/2004, MM. **Madari – Papoutsa:** Lagoudera, 6 km north, 21.12.06, V; Xyliati dam, low, 21.12.06, MM. **Mammari – Deneia:** Mammari 1st site, 21.11.2005, V. **Maroullena:** Maroulena's Dam, 23.12.06, SD; Maroulena gorge, 17.12.06, MM, V, SD. **Mavrokolympos:** Mavrokolymbos stream CY408–2, 9.1.06, SD; Mavrokolymbos Garrigue CY408–1, 9.01.06 SD; Agios Neophytos valley (CY 408–4), 13.1.06 SD. **Polis Gialia:** Gialia Acacia CY401–1, 8.01.06, AD & SD. **Skoulli:** Chrysochou River CY 409–2, 15.01.06, SD; Polis Camp river CY409–3, 15.01.06, SD. **Xeros Potamos:** Asprokremnos Pools CY407–1, 2.2.06, AD; Xirou valley Nata, 5.2.05 MG; Finikas CY407–2, 2.02.06, AD & SD; Xeros Army (CY 407–3), 2.2.06, AD & SD; Xeros Rock CY407–4a, 3.02.06, AD & SD

Comments on systematic characters

The colour of alcohol-preserved specimens ranges from cream to dark brown, especially on the back and mantle; the dark pigment is distributed more or less evenly with no distinct spots; when spots are present, they are blurred and their margins fuse (they are never black dots). These external characters are always combined with the following anatomical characters: long caecum, forked penial gland with a distinct common stalk, more or less half as long as the entire gland. The two branches of the penial gland are covered by glandular papillae. The stimulator in the penis is wide, flat, and bowl-shaped.

The species varies very widely (Wiktor 2000); a few very similar slugs, of unclear taxonomic status, are found in the literature. *Agriolimax cyprius* Simroth, 1906 was described from Cyprus as two forms (*A. cyprius* and *A. cyprius coeciger* Simroth, 1906). The description, however, is so laconic that it is impossible to say which slugs Simroth (1906) was dealing with (the types most probably have not been preserved). Rähle (1984) commented on these slugs saying that the slugs from Cyprus differed in a few anatomical details from *D. berytensis* earlier described from Lebanon. The slugs from Cyprus are often smaller; differ somewhat in the appearance of their glandula hermaphroditica, caecum length, penial gland and stimulator. Rähle (1984) suspected that it might be only a form of the variable *D. berytensis.* In our opinion these comments

are justified and agree with our own observations; according to Wiktor (2000), at the current state of knowledge it is reasonable to regard the name *A. cyprium* as a junior synonym of the widely distributed and very variable *D. berytensis,* rather than use names without knowing what they refer to. It cannot be excluded that Simroth (1906) was dealing not only with *D. berytensis* but also for example with *D. famagustensis*.

***Deroceras chrysorroyatissensis* Rähle, 1984**

This species had been reported from Akrotirio Aspro–Petra tou Romiou and Vouni Panagias (Rähle 1991).

We found it in (Fig. 1b): **Agiatis:** Agiatis–Agia S (CY411–1), 14.03.06, MM, V, AD, SD; Agiatis – 500m from Tarmac CY411–2, 14.03.06, MM, V, AD, SD. **Akrotirio Aspro – Petra tou Romiou:** Aspro cape – Petra tou Romiou (eastern valley), 29.01.05, M. **Cha Potami:** Cha river Orites, 5.03.05, MG. **Chersonisos Akama:** Pykni forest CY 410–4, 15.02.05, SD ? juv.; Akamas (may be Loutra tis Afroditis), 1.10.89, MM; Akamas, Loutra tis Afroditis CY410–10, 15.03.05, SD; Avakas, 19.02.05, SD; Mountiko maquis CY410–3, 24.01.05, SD ? juv.; Petratis gorge, 23.11.05, MM; Akamas forest CY 410–8, 12.03.05, SD. **Dasos Lemesou – Periochi Kyparisia:** Lemesos forest, Akrounta river valley, 2.01.06, MG. **Dasos Pafou:** Gerakies CY206–3, 15.03.06, MM, V, AD, SD; Kremnos tis Pellis CY 206–1, 15.3.06. MM, V, AD, SD; Sylladin tou Petrou CY206–2, 15.03.06, MM, V, AD, SD; Kedron valley, 13.03.05, MG; Dasos Pafou–Tripyla, 7.01.06, AD; Kedron valley (CY 10), 18.02.00, V. **Dasos Stavrovouniou:** Stavrovouni, entrance of monastery, 19.12.06, MM, V; Stavrovouni, NE low, 19.12.06, MM, V; Stavrovouni, low, 19.12.06, MM, V. **Episkopi tou Morou Nerou:** Ezousas Pseudogarrigue (CY 405–2), 11.02.06, SD. **Ethniko Dasiko Parko Troodous:** Mesapotamos waterfall, 22.11.05, V; Troodos mt. Almyrolivado, 26.11.05, M; Platres to Mesapotamos, 22.11.05, MM. **Koilada Diarizou:** Diarizos Arminou, 28.01.06, MG; Diarizou valley, Gefyri, 22.1.05, MG. **Koilada Limnati:** Limnatis valley, Alassa, 19.11.05, MG; Palia Korfi, river below at Limnatis bridge, 5.12.04, MG; Palia Korfi, approx. 500m alt. Limnatis valley, 5.12.04, MM; Limnatis valley, Mantra, 18.02.06, M. **Lefkaron:** Lefkara 600m alt., 19.11.05, MM. ? juv.; Lefkara croosroad to Kato Drys, 11.03.06, MM. **Madari – Papoutsa**: Xyliati dam, low, 21.12.06. MM, V; Lagoudera 6 km north, 21.12.06, MM, V; Pitsilia district, Kyperounta, 15.04.01 ? juv.; Kyperounta (CY 205–1), 25.03.06, SD; Spilia – Madari, 1250m alt., 17.12.06, MM, V. **Mavrokolympos:** Agios Neophytos Garrigue CY 408–3, 13.01.06, SD. **Periochi Mitserou:** Mitsero, Pinewood & valley CY203–2, MM, V, AD, SD; Mitsero–Agios Panteleimonas, 11.03.06, MM, V, AD, SD. **Platy:** Platy area crossroad Kelefos–Kaminaria– Milikouri, 19.02.05, MG. **Skoulli:** Polis Camp river CY409–3, 15.01.06, SD; Goudi Oak CY409–1, 15.01.06, AD. **Vouni Panagias**: Makries Limnes Chasanpoulion – Eryfiou – Profitis Ilias, 23.12.04, V; Profitis Ilias, 1.02.05, MG; Vloudkia, 23.12.04, MG; Agia Moni south of Panagia, 22.12.04, MG. **Xeros Potamos:** Nata Pine CY407–5, 6.02.06, SD.

Comments on systematic characters

The slug is easy to recognise even based solely on its external appearance. As emphasised by Rähle (1984), the species is characterised by very little variation of the characters which are regarded as diagnostic: the external colour pattern on the body, the penis shape, with its external and internal accessory structures, and the absence of a rectal caecum. Only the appendix at the posterior end of the penis may vary in shape. This constancy of characters is exceptional within the genus *Deroceras.* In all likelihood it is endemic to Cyprus. Otherwise, a slug with such a characteristic appearance would have been noticed elsewhere.

***Deroceras famagustensis* Rähle, 1991**

It had not been reported from any NATURA 2000 site.

We found it in (Fig. 1c): **Dasos Lemesou – Periochi Kyparisia:** Lemesos forest, Foinikaria, 2.1.2005, MG. **Dasos Machaira:** Gionia Valley north (CY204–3), 17.03.06, SD; Lazania CY 204–7, 27.12.06, SD; Kapedes (CY204–1), 17.03.06, MM; Kiona – 1380 m alt., 22.12.06, MM, V; Machairas Kyprovasa–Arkatzi tou Klosmatou, 22.12.06, MM, V; Gionia Camp CY204–2, 17.03.06, SD; Philani Pine CY204–6, 27.12.06, SD. **Kavo Gkreko:** Paralimniou lake, 9.1.2005, MG. **Madari – Papoutsa:** Papoutsa 1240 m alt., 20.12.06, MM; Xyliati dam, low, 21.12.06, MM, V. **Maroullena:** Maroulena's Pine, 23.12.06, D.

Comments on systematic characters

We found only unspotted specimens, which is in agreement with Rähle (1991), though the mantle often gives an impression of being speckled with a dark pigment. Thus the colour is not uniform. The back, outside the mantle, is covered by a pattern in the form of a dark reticulation following the system of skin grooves; the dark pigment concentrates in these grooves. Most specimens have thin and soft skin. The penis is thin-walled, of varying shape. Inside it, complicated structures adhering to the penis wall form a kind of pocket. When everted, they form a nearly circular shallow bowl or a slightly concave shield. Rähle (1991) mentions the absence of a stimulator, but apparently this structure should be regarded as one of an unusual shape. Its position within the penis, as well as when everted, clearly indicates that this is its role. The caecum is vestigial. This species is endemic to Cyprus.

There are three Natura 2000 areas, namely Drymou, Stavros tis Psokas and Kritou Marotou, where we found only juvenile *Deroceras*.

Family Limacidae Rafinesque, 1815

***Limax flavus* Linnaeus, 1758**

This species had been reported from Akrotirio Aspro – Petra tou Romiou and Ethniko Dasiko Parko Troodous (Rähle 1991).

We found it in (Fig. 2a): **Dasos Lemesou – Periochi Kyparisia:** Germasogeia north, at the stream (CY20), 20.2.00, V. **Dasos Pafou:** Kedron valley, 13.3.05, MG. **Ethniko Dasiko Parko Troodous:** Caledonian Falls, 22.11.05, MM. **Koilada Limnati:** Palia Korfi, river below at Limnatis bridge, 5.12.04, MG; Palia Korfi, approx. 500 m alt, Limnatis valley, 4.12.04, MM. **Madari – Papoutsa:** Xyliati dam, low, 21.12.06, MM.

Family Milacidae Ellis, 1926

***Milax barypus* Bourguignat, 1866**

It had not been reported from any NATURA 2000 site.

We found it in (Fig. 2b): **Kavo Gkreko:** Gkreko cape at Agiol Anargyrol CY24, 21.02.00, MM; Cavo Gkreko, 9.01.2005, M. **Lefkaron:** Lefkara – Agios Minas, 25.02.06, MG ? juv.

This species is endemic to Cyprus.

***Milax riedeli* Wiktor, 1986**

This species had not yet been reported from the island.

We found it in (Fig. 2c): **Madari – Papoutsa:** Polystypos with hazel, 17.12.06, MM, V ? juv.; Lagoudera valley, 20.12.06, MM, V, SD.

The above list represents the current state of knowledge of slug diversity within the NATURA 2000 areas of conservation of Cyprus Island. To provide a more complete picture of the fauna we have to add that Bourguignat (1853) recorded *Limax antiquorum* A.E. Férussac,1819 and *Limax variegatus* **Férussac** [= *Limax variegatus* Draparnaud 1805] from the island, but he said that "they do not look like the true European species (naming *L. cinereus*)". It will be possible to clarify these names after knowing the slugs in the whole island and not only in the areas of conservation. Also Rähle (1991) listed *Deroceras cyprium* but this most probably refers to *D. berytensis*.

Discussion

In the Natura 2000 areas of conservation there are six slug species, one of them, *M. riedeli*, a new record for the whole island. According to the literature there were only

Figure 2. Distribution of **a** *L. flavus* **b** *M. barypus* and **c** *M. riedeli* in the Natura 2000 areas of conservation in Cyprus Island.

three species known from the Natura 2000 areas; thus we have doubled the number of species. *Tandonia sowerbyi* is the only species that has been recorded from the island (Rähle 1991; pers. obs.) but still not in the NATURA 2000 areas. However, we cannot exclude the possibility of finding this species in one of the areas in the future, since in the Mediterranean it can be found in undisturbed as well as disturbed places (Wiktor 2001). The slug fauna in the NATURA 2000 areas of conservation of Cyprus appears at first glance equally rich as the corresponding areas of the island of Crete (seven species on Crete, Vardinoyannis 1994, Wiktor et al. 1994). However, on Crete there are 10 slug species on the whole island, and thus only 70% of the slug fauna is found in the conservation areas, compared to 85.7% on Cyprus. It seems that the slug fauna of Cyprus is well represented in the NATURA 2000 areas, regardless on which basis these areas were proposed.

D. chrysorroyatissensis and *D. berytensis* are the most widespread species, both present in 19 areas; but the latter is distributed all around the island, while *D. chrysorryatissensis* has a more restricted distribution. All the other species are found in 2–5 areas of conservation.

Three species are endemic to the island, namely *D. chrysorryatissensis, D. famagustensis* and *M. barypus*. One species, *M. riedeli,* is distributed on Cyprus and the southeast coast of Turkey (Schütt 2005), while *L. flavus* is found all around the Mediterranean and Europe (Wiktor 2001) and *D.berytensis* all around the eastern Mediterranean (Heller 2009; Wiktor 2000; Schütt 2005).

There are five NATURA 2000 areas where no slugs were found – Ethniko Dasiko Parko Rizoelias, Asgata, Lympion – Agia Anna, Peristerona and Koilada Kargotis. In the first two areas the substrate is mainly gypsum which is most probably the reason for their absence. In the other areas the substrate is limestone, and the vegetation is Mediterranean scrubland (maquis and phrygana). Based on all the characteristics of these areas there is no obvious explanation for the absence of slugs, and we consider it as possible that slugs might be found in the future.

The richest Natura 2000 area is Madari – Papoutsa, in the center of the island, with five of the six species present (Fig. 3). This is followed by Dasos Lemesou – Periochi Kyparisia. There is only one site, Xyliati dam, where all three *Deroceras* species cooccur; additionally, at this site *L. flavus* was also found. In most other localities there is only one slug species present, usually *D. berytensis*. Milacidae are very restricted: each species has been found in only two of the NATURA 2000 areas.

D. chrysorroyatissensis was known from very few localities in the southwest part of the island (Rähle 1991; Wiktor 2001) but with our study it appears that this species has a wider distribution, it is absent from the northern and the easternmost part of Cyprus.

D. famagustensis had been reported only from Cavo Gkreco, the southeastern peninsula of the island, but we found it in the central part of Cyprus. Further studies could enlarge its known distribution still further.

Until recently, *L. flavus* had been known only from sites near human settlements, but we found it also in more natural areas.

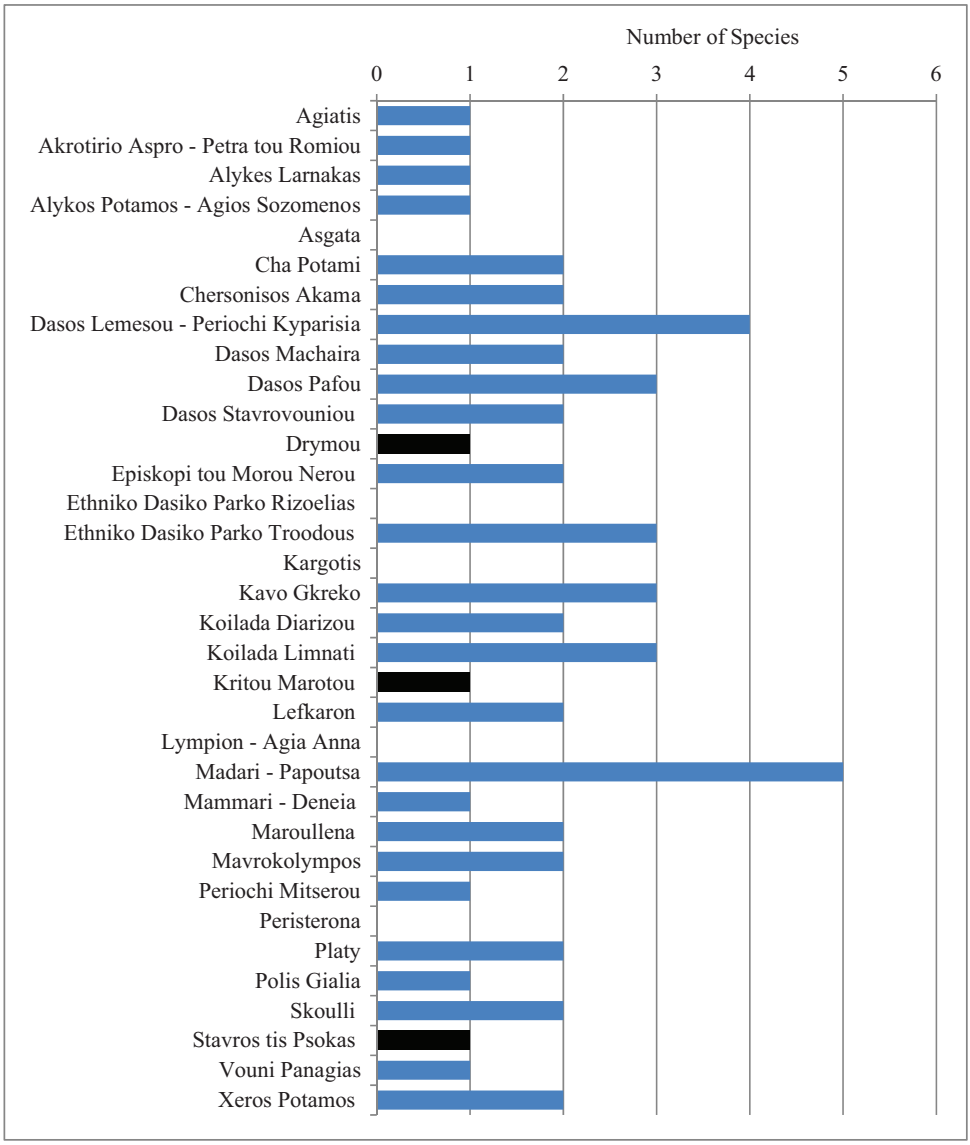


Figure 3. Number of slug species in each Natura 2000 area. Bars in black depict juvenile individuals.

M. barypus was known from three suburban areas in the eastern and northern part of the island but we also found it in central Cyprus.

M. riedeli is recorded for the first time from the island. It is distributed in the central part of the island in the area of Madari–Papoutsa.

The presence of the slug species does not seem to correlate with vegetation, rainfall, altitude or the substrate of the site they were found.

All slugs were active only during the wet period; *L. flavus* in the urban areas is an exception, as it was found active also during the dry season, even in summer (pers. obs.).

In the future we will present more data on this group since we are currently studying the terrestrial malacofauna of the whole island.

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RESEARCH ARTICLE

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New records and a new species of chewing lice (Phthiraptera, Amblycera, Ischnocera) found on Columbidae (Columbiformes) in Pakistan

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Abstract

The chewing lice (Phthiraptera) of Columbidae (Columbiformes) from Pakistan are studied. Six species of chewing lice with new host records are recorded and one new species of the genus *Colpocephalum* is described from *Columba livia* in the Karachi region. All the columbid chewing lice from Pakistan are keyed out and the new species is illustrated and compared with the closest allied species.

Keywords

chewing lice, Columbidae, Pakistan, new records, new species, taxonomy

Introduction

The study of chewing lice in Pakistan has been neglected for many years, especially in the Sindh region of Pakistan. During 1940s to 1950s, Ansari published his work on lice from Pakistan, but his studies were restricted to Lyallpur (now Faisalabad), in

the Punjab Province of Pakistan (Ansari 1947, 1951, 1955a–e, 1956a, b). Most of his work referred to the Punjab region of India (Ansari 1957a, b, 1958, 1959).

Lakshminarayana (1979) published a list of Mallophaga from India and its adjacent countries, listing only those chewing lice species that were reported by Ansari from Lyallpur, Pakistan.

After Ansari (1955b; 1958), no taxonomic studies have been carried out in Karachi, Pakistan. Here we present a key to species of columbid chewing lice of this region and describe a new species of the genus *Colpocephalum*. This new species is compared with the closest allied species of the genus.

Material and methods

The chewing lice used in this study were preserved on microscopic slides using a standard method (Palma 1978) and mounted in Canada-balsam. Line diagrams were made using micro-ocular graticule with a light microscope. Collected species have been deposited in the Natural History Museum, University of Karachi (NHMUK), Pakistan and the Moravian Museum (MZM), Burno, Czech Republic.

Abbreviations:

AL Abdominal Length
DHS Dorsal Head Seta
GL Genital Length
HL Head Length
ML Metathorax Length
MW Metathorax Width
PL Pronotal Length
PML Paramere Length
POW Preocular Width
PW Pronotal Width
TL Total Length
TW Temporal Width

Results

Chewing lice Species of Columbidae in Pakistan

Bonomiella columbae Emerson, 1957 – **New record**
Campanulotes bidentatus Scopoli, 1763 (Lakshminarayana 1979)
Campanulotes compar Burmeister, 1838 – **New record**

Coloceras piageti Johnston & Harrison, 1912 (Ansari 1947, Lakshminarayana 1979)
Colpocephalum afrozeae sp. n.
Colpocephalum turbinatum Denny, 1842 (Ansari 1951)
Columbicola columbae L. 1758 (Ansari 1947)
Columbicola theresae Ansari, 1955 (Lakshminarayana 1979)
Columbicola tschulyschman Eichler, 1942 – **New record**
Hohorstiella lata Piaget, 1880 – **New record**
Hohorstiella modesta Ansari, 1951 (Lakshminarayana 1979)
Hohorstiella streptopeliae Eichler, 1953 – **New record**
Turturicola salimalii Clay & Meinertzhagen,1937 – **New record**

Key to the chewing lice species of Columbidae in Pakistan

1 Maxillary palpi present; meso and metathorax separated..... **Amblycera, 2**
– Maxillary palpi absent; meso and metathorax fused, forming pteronotum .... **Ischnocera, 7**
2 Postpalpal process present.....***Hohorstiella*, 3**
– Postpalpal process absent **5**
3 Head much broader than long; anterior head margin broadly convex; abdomen short and oval; three abdominal sternites (st. III–V) with thick setal brushes ..... ***H. modesta* (Ansari)**
– Head broader than long; anterior head margin relatively more convex; abdomen large and oblong; two abdominal sternites with setal brushes **4**
4 Postpalpal process short; antennal segment II small and rounded; prosternal plate small; abdominal sternite IV–V with thin setal brushes; vulval margin wide with thin short to long setae .....***H. lata* (Piaget)**
– Postpalpal process long; antennal segment II large and globulate; abdominal sternite III–IV with dense setal brushes; vulval margin narrow with thin microsetae to short fine setae.....***H. streptopeliae* Eichler**
5 Head without ocular and occipital carinae; femur III and abdominal sternites without ctenidia..... ***Bonomiella columbae* Emerson**
– Head with ocular and occipital carinae; femur III and abdominal sternites with fine ctenidia .....***Colpocephalum*, 6**
6 Femur III and abdominal sternite III with two fine ctenidia on each; male genital sclerite large, with short and fine latero–posterior points; penis short; female subgenital plate with medially short, stout setae.....***C. afrozeae* sp. n.**
– Femur III and sternite III with three ctenidia on each; male genital sclerite with long and slightly curved latero–posterior points; penis long; female subgenital plate with lateral tufts of setae..... ***C. turbinatum* Denny**
7 Head circumfasciate; temples large or broad, angulated **8**
– Head non–circumfasciate; temples short and rounded.....**10**

8 Antennae dimorphic; scape very enlarged in male ..... ***Coloceras piageti*** **(Johnston and Harrison)**

– Antennae monomorphic ..... ***Campanulotes*****, 9**

9 Female larger in size, not less than 1.58 mm long; ventral median setae on sternites VI and VII absent ..... ***C. bidentatus*** **(Scopoli)**

– Female smaller in size, not more than 1.34 mm long; ventral median setae on sternites VI and VII present ..... ***C. compar*** **(Burmeister)**

10 Median head setae blade-like, on anterior dorsal plate; anterior dorsal plate divided medially; preantennal width narrow ..... ***Columbicola*****, 11**

– Median head setae not blade-like, on anterior dorsal plate; anterior dorsal plate complete; preantennal width broad ..... ***Turturicola salimalii*** **Clay and Meinertzhagen**

11 Head length more than 0.55mm; posterior median head setae spike-like, shorter than anterior median head setae; male genitalia with triangular mesosomal plate, with groves directed towards median; female subgenital plate without lateral row of setae, grove with clear lateral indentations ..... ***C. theresae*** **Ansari**

– Head length less than 0.55mm; posterior median head setae hair like or spike like, equal or longer than anterior median head setae; male genitalia with medially divided mesosomal plate, with anterior grove, bearing pores in or out of the pigmented border; female subgenital plate with lateral row of setae, grove without indentations..... **12**

12 Posterior median head setae hair-like and longer than anterior median head setae; male genitalia with relatively long, straight and posteriorly narrower parameres, mesosomal plate with shallow and narrow anterior grove, two pairs of pores present at mediolateral margins of mesosomal plate; female subgenital plate narrow with smooth posterior grove..... ***C. tschulyschman*** **Eichler**

– Posterior median head setae spike-like, more or less equally long to anterior median head setae; male genitalia with short, stumpy parameres, curved inside outwards, mesosomal plate with large or deep anterior grove, anterior pair of mesosomal pores present at lateral margins within the dark pigmented borders; female subgenital plate relatively wider with wavy posterior grove, long and wide, bearing 4–8 pairs of medium to long setae..... ***C. columbae*** **(L.)**

Suborder Amblycera Kellogg, 1896
Family Menoponidae Mjöberg, 1910

Bonomiella columbae **Emerson**
http://species-id.net/wiki/Bonomiella_columbae

Bonomiella columbae Emerson 1957: 63, 1972: 37, Selim et al. 1968: 79, Hill and Tuff 1978: 308, 316, Price et al. 2003: 93, 303, 308.

Material examined. 2 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 21-V-2004; leg. Naz.

New record from Pakistan.

***Colpocephalum afrozeae* sp. n.**

urn:lsid:zoobank.org:act:CC7DD2BC-D82F-4E06-89E7-8C3EB8A5739F
http://species-id.net/wiki/Colpocephalum_afrozeae
Figs 1–12

Holotype. male, on *Columba livia* (Gmelin); Pakistan: Karachi; 20-VII-2006; leg. Naz, S.

Paratype. 8 males, 12 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 20-VII-2006; leg. Naz, S.

Other material. 6 nymphs, on *Columba livia* (Gmelin), with data as above.

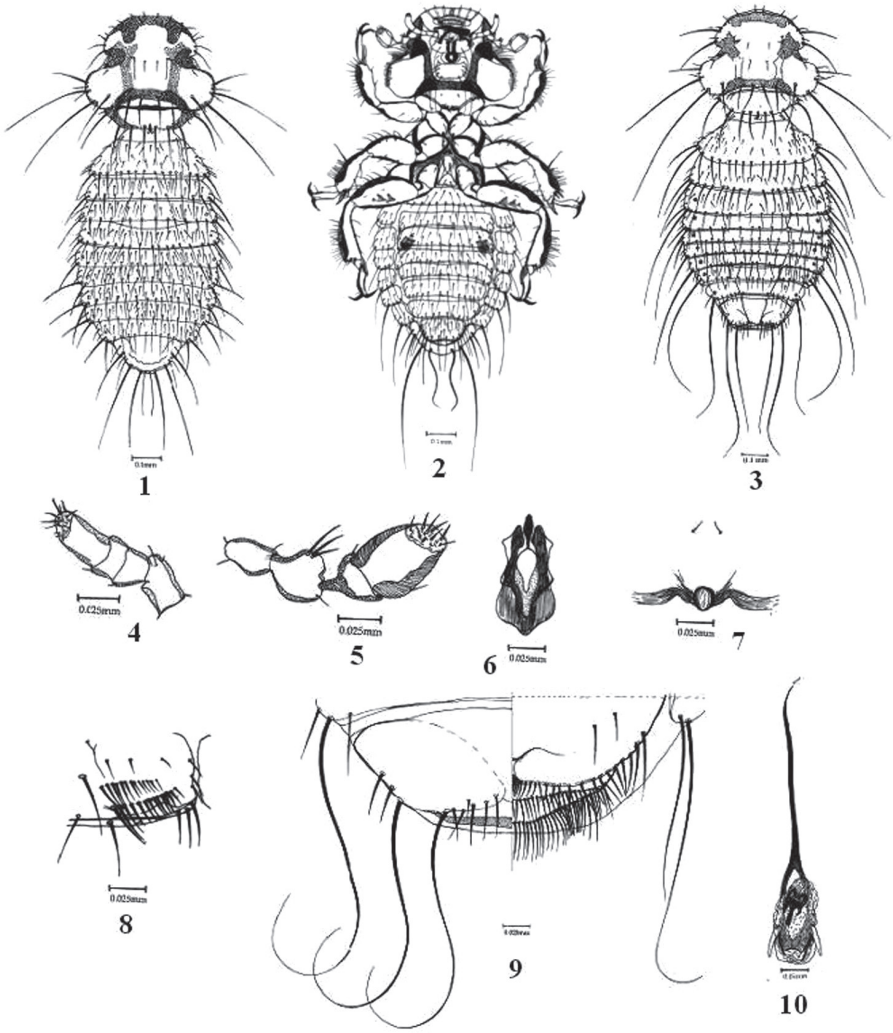
Type host. *Columba livia* (Gmelin) (Columbiformes: Columbidae).

Measurements. TL: male 1.242 (1.24–1.245) (Figs 1–2), female 1.330 (1.285–1.375) (fig. 3); HL: male 0.287 (0.286–0.288), female 0.302 (0.30–0.305); POW: male 0.318 (0.315–0.332), female 0.347 (0.345–0.35); TW: male 0.45 (0.445–0.455), female 0.492 (0.48–0.505); PL: male 0.12 (0.11–0.13), female 0.137 (0.135–0.14); PW: male 0.288 (0.255–0.322), female 0.332 (0.325–0.34); ML: male 0.135 (0.12–0.15), female 0.152 (0.15–0.155); MW: male 0.374 (0.322–0.426), female 0.51 (0.505–0.515); AL: male 0.658 (0.642–0.675), female 0.697 (0.685–0.71), GL: 1.03 (1.01–1.05), GW: 0.155 (0.15–0.16), PML: 0.055 (0.050–0.060).

Head (Figs 1–6)**.** Anterior marginal carina very thick, with large and blunt marginal nodi; DHS 8–10 short fine to stout setae; DHS 15 long; occipital setae 21–22 thick setae of normal length; ventral subtemporal setae present; ocular and occipital nodi very well developed, connected with thick oculo–occipital and occipital carinae; maxillary palpi as in fig. 4; antennae (fig. 5) four segmented, pedicel large with short lateral process, bearing three stout sharp setae, flagellomere II long, oval with broad terminal disc; hypopharynx (fig. 6) very well developed.

Thorax (Figs 1–3, 7)**.** Pronotal carina very thickly sclerotized; pronotal seta 2 minute peg-like setae; lateral to posterior margin of pronotum with four long and at least two short setae; prosternal plate (fig.7) weakly developed, short, with posterior margin convex and lateral margins absent, one pair of small microsetae anterior to the plate present; posterior margin of metanotum straight, with 8–10 normal fine setae, arranged equally without any gape; femur III with two ctenidia.

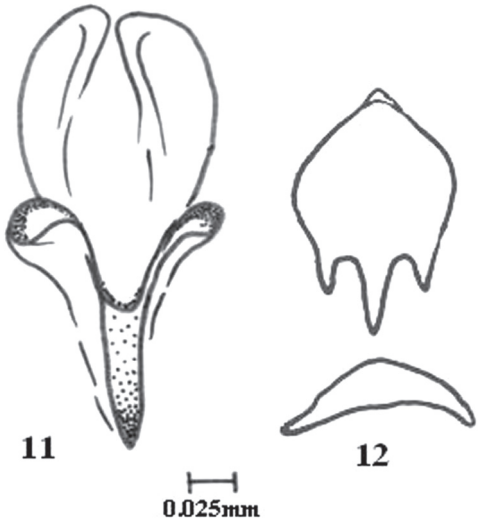
Abdomen (Figs 1–3, 8)**.** Male. Tergal plates complete, marginal setae from tergite I–VIII: 12, 14, 17, 18, 16, 16, 15 and 13 respectively; anterior tergal setae scattered, ranging from 14–28 microsetae; postspiracular seta long on segment II, V–VII, shorter on segments III–IV and VIII; sternal setae in double rows on sternites I–VII: 15, 24, 16 (+ two large ctenidia on segment III; fig. 8), 24, 21, 20 and 16 respectively. Terminalia (Figs 1–2): Terminal segment comprises segments IX and X, posteriorly rounded; large tergal plate usually without anterior setae, latero–posterior margin with



Figures 1–10. *Colpocephalum afrozeae* sp. n. **1** male dorsal view **2** male ventral view **3** female dorsal view **4** maxillary palp **5** antenna; **6** hypopharynx **7** prosternal plate **8** sternite IV with ctenidia **9** female terminalia ventral view **10** male genitalia

two long macrosetae and posterior margin bears four long macrosetae and two short fine setae; sternites VIII forming a short subgenital plate, bearing dense scattered small thin setae; anal margin almost straight.

Female. Tergites I and II complete, wide and long, tergites III–VIII divided, tripartite, narrow and short; tergocentral setae on segment I and II long; tergal marginal setae from I–VIII: 20, 20–22, 16–18, 18–20, 16–19, 17, 18 and 14–16 respectively; postspiracular setae long on II–III, VI–VIII; segment VIII with one pair of long, latero–anterior setae; sternite I developed, sternite II–VIII complete and well sclerotized; sternal setae small short to fine, scattered all over the plates; sternite III with two long



Figures 11–12. *Colpocephalum afrozeae* sp. n. **11** penis details **12** genital sclerite.

ctenidia (fig. 8). Terminalia (fig. 9): Terminal segment widely rounded posteriorly; tergite IX divided, median piece triangular; posterior margin of lateral plates with small fine setae and two pairs of long macrosetae; anus narrow, transverse with tapering ends; anal fringes bear forty three stout microsetae in anterior fringe and forty seven to fifty fine curved setae in posterior fringe; vulval margin medially concave, with small thick, stout curved setae, gradually larger at latero–posterior ends.

Male genitalia (Figs 10–12)**.** Elongated; genital sclerite (fig. 12) short, with long and slightly curved latero-posterior points; genital lateral plates short and thick; basal plate thick and broad; median process long; penis (fig. 11) terminally narrow; parameres straight, tubular.

Remarks. *Colpocephalum afrozeae* were collected from *Columba livia* on which *C. turbinatum* has been reported previously. The two species of the genus *Colpocephalum* of *C. livia* are different from each other. *C. afrozeae* has the anterior margin of head broadly convex; anterior marginal carina thick; oculo-occipital carina thick; prothorax with two short marginal setae; femur III with two ctenidia; female tergite II with long tergocentral setae; postspiracular setae long on tergites II–III and VI–VIII; lateral plates of male genitalia very short; lateroposterior points of genital sclerite large and curved; median process reduced; female genital reticulation invisible; vulva medially concave; anus narrow and transverse.

Colpocephalum afrozeae has also some similarities with *Colpocephalum arfakiani* Price and Beer, but they have morphological differences, which consist of a thin anterior marginal carina; five long pronotal marginal setae; tergite II of female divided; tergite VIII with small triangular median piece; anal opening broad, with light fringe of short setae; male genital sclerite without latero-posterior points and long lateral plates are found in *C. arfakiani* whereas the anterior margin very thick; four pronotal marginal setae long; tergite II of female complete; tergite VIII with large trapezoidal piece; anal opening narrow and transverse, with dense fringe of

short setae in anterior margin and thick, long setae on posterior margin; male genital sclerite with long and curved latero-posterior points and short lateral plates are found in *C. afrozeae*.

Etymology. The present species is named after Mrs Hussan Afroze, mother of the first author.

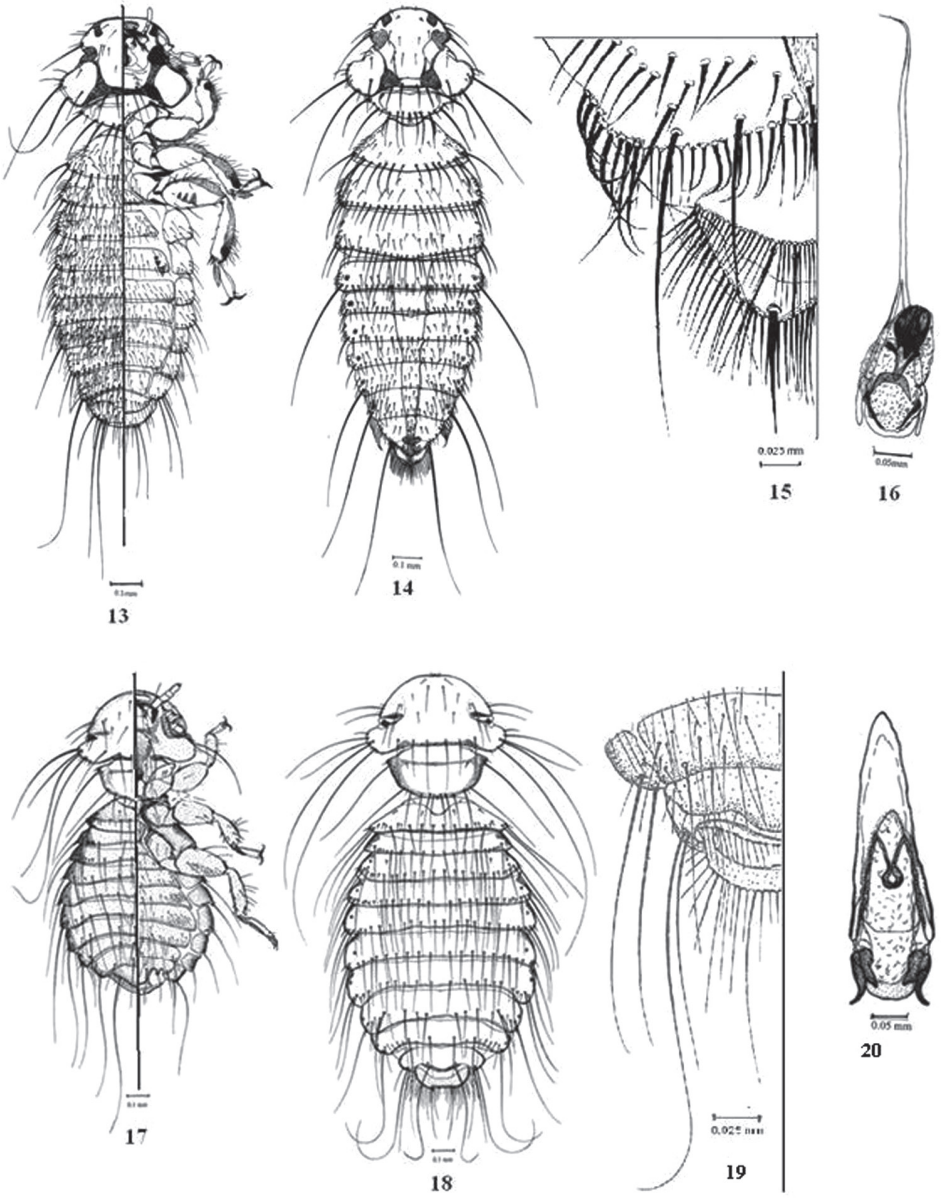
***Colpocephalum turbinatum* Denny**
http://species-id.net/wiki/Colpocephalum_turbinatum
Fig. 13–16

Colpocephalum turbinatum Denny 1842: 198, 209, Harrison 1916: 56, Hopkins and Clay 1952: 84, Price and Beer 1963: 735, 736, 754, Hill and Tuff 1978: 308, 315, Lakshminarayana 1979: 80, Price et al. 2003: 102, 303, 304, 308.
C. abruptofasciatum Mjöberg 1910: 36.
C. ailurum Nitzsch (In Giebel) 1861: 522.
C. bicinctum Nitzsch (In Giebel) 1861: 524.
C. caudatum Giebel 1874: 261, Piaget 1880: 519, 1885: 125.
C. dissimile Piaget 1880: 520, 1885: 119.
C. intermedium Piaget 1880: 521.
C. latifasciatum Piaget 1885: 130.
C. osborni Carriker 1903: 172.
C. oxyurum Nitzsch (In Giebel) 1861: 519.
C. subflavescens Piaget 1880: 571.
C. tricinctum Nitzsch (In Giebel) 1861: 524, Ansari 1951: 154.
C. wernecki Orfila 1959: 477.
Neocolpocephalum gypae Qadri 1935: 229.
N. tricinctum Eichler 1941: 374.
Vulturigogus eugenii Eichler and Zlotorzycka 1963: 207.
V. femellus Eichler and Zlotorzycka 1963: 209.

Material examined. 91 males, 105 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 21-V-2004, 23-IX-2007; leg. Naz.

***Hohorstiella lata* (Piaget)**
http://species-id.net/wiki/Hohorstiella_lata
Fig. 17–20

Menopon latum Piaget 1880: 457.
Menopon giganteum Denny 1842: 225, Harrison 1916: 39.
Hohorstiella lata Eichler 1940: 362, Hopkins and Clay 1952: 173, Hill and Tuff 1978: 308, 310, Price et al. 2003: 111, 303.



Figures 13–20. 13–16. *Colpocephalum turbinatum* Denny **13** male dorso-ventral view **14** female dorsal view **15** female terminalia **16** male genitalia. **17–20.** *Hohorstiella lata* (Piaget) **17** male dorso-ventral view **18** female, dorsal view; **19**, female terminalia **20** male genitalia.

Material examined. 25 males, 39 females, on *Columba livia* (Gmelin), *Streptopelia decaocta* (Frivaldszky); Pakistan: Karachi; 21-V-2004, 04-VIII-2006; leg. Naz. New record from Pakistan.

Hohorstiella streptopeliae **Eichler**
http://species-id.net/wiki/Hohorstiella_streptopeliae
Fig. 21

Hohorstiella streptopeliae Eichler 1953: 169, Price et al. 2003: 111, 307.

Material examined. 4 females, on *Columba livia domestica* (Gmelin) (Fantail Pigeon breed); Pakistan: Karachi; 15-VII-2006; leg. Naz.

New record from Pakistan.

Suborder Ischnocera Kellogg, 1896
Family Philopteridae Burmeister, 1838

Campanulotes compar **(Burmeister)**
http://species-id.net/wiki/Campanulotes_compar
Fig. 22–25

Goniocotes bidentatus Scopoli 1763: 385, Harrison 1916: 80.
G. compar Burmeister 1838: 431.
G. formosanus Sugimoto 1929: 25.

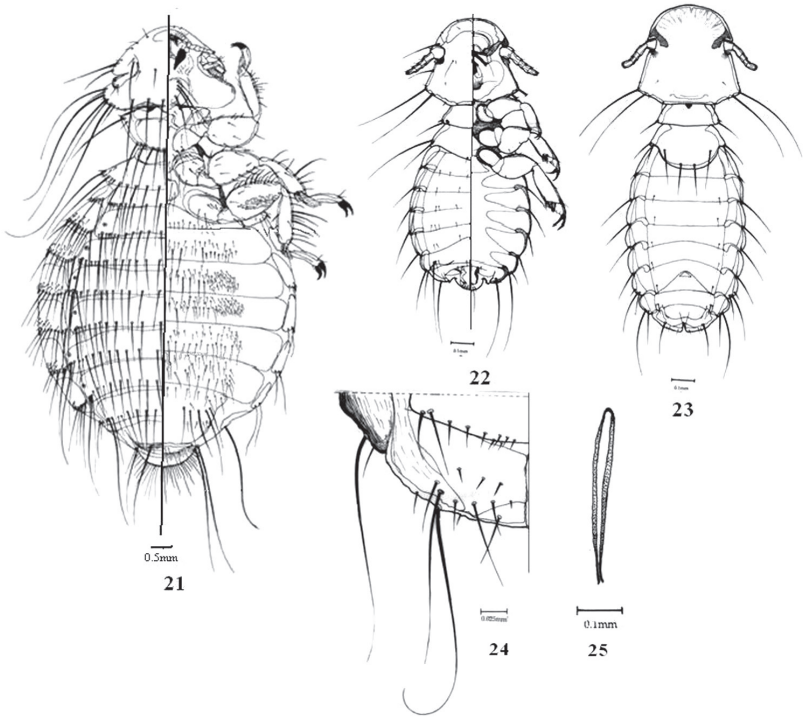
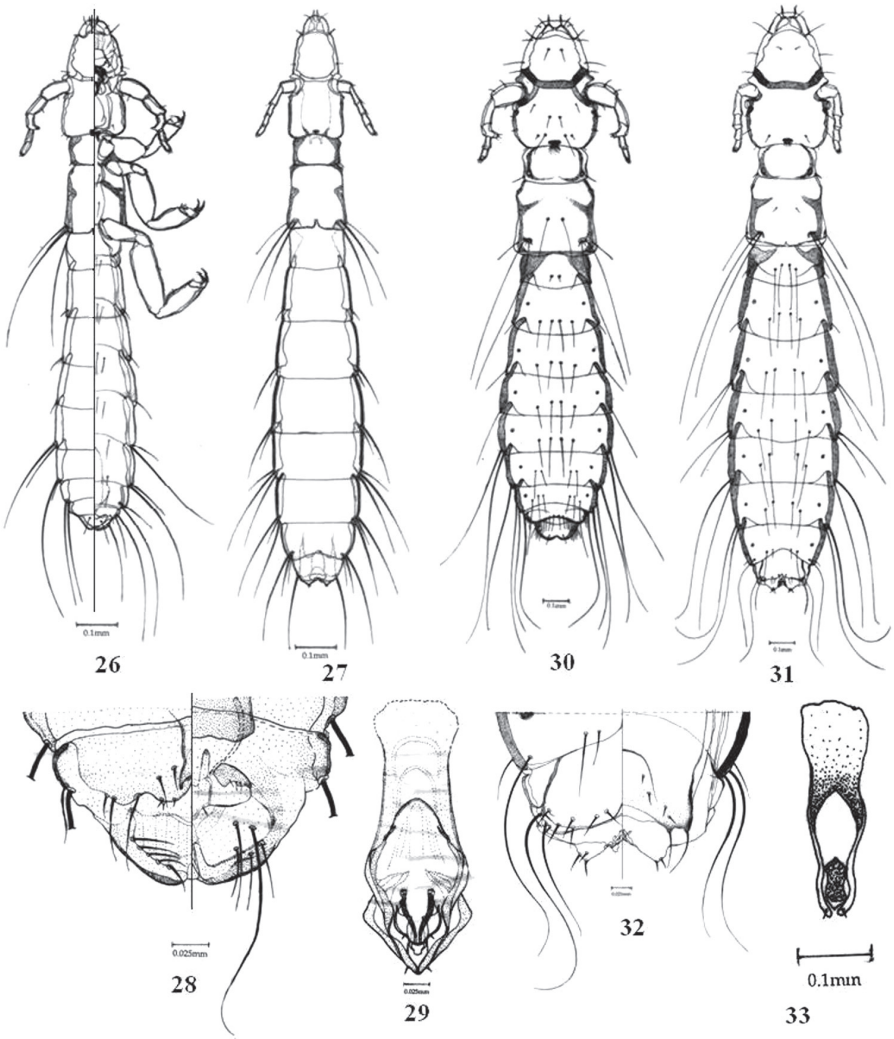


Figure 21–25. 21 *Hohorstiella streptopeliae* Eichler, female, dorso-ventral view. **22–25** *Campanulotes compar* (Burmeister) **22** male dorso-ventral view **23** female dorsal view **24** female terminalia **25** male genitalia.



Figures 26-33. 26–29 *Columbicola columbae* (L.) **26** male dorso-ventral view **27** female dorsal view **28**, male terminalia dorso-ventral view **29** male genitalia. **30–33** *Columbicola tschulyschman* Eichler **30** male dorsal view **31** female dorsal view **32** female terminalia dorso-ventral view **33** male genitalia.

Goniodes compar Nitzsch 1818: 294, Denny 1842: 13, Giebel 1842: 12, Piaget 1842: 234, Neumann 1909: 31, Neveu–Lemaire 1919: 1116.

Campanulotes compar Keler 1939: 157, Hopkins and Clay 1952: 64, Ansari 1955: 48, Selim et al. 1968: 79, Hill and Tuff 1978: 309, 322, Tendeiro 1969: 380, 1978: 117, Lakshminarayana 1979: 70, Price et al. 2003: 160, 303.

Material examined. 51 males, 72 females, on *Columba livia* (Gmelin); Pakistan: Karachi, Hyderabad, Khairpur mir's; 21-V-2004, 04-VIII-2006; leg. Naz.

New record from Pakistan.

***Columbicola columbae* (L.)**
http://species-id.net/wiki/Columbicola_columbae
Fig. 26–29

Pediculus columbae L. 1758: 614.
Lipeurus bacillus Nitzsch 1818: 215.
L. baculus Giebel 1866: 379, Kellogg 1896: 506, Neumann 1909: 30.
L. antennatus Giebel 1874: 213.
Philopterus baculus Nitzsch 1818: 293.
Phagopterus columbae Freire and Duarte 1944: 14.
Nirmus claviformis Olfers 1816: 90.
N. filiformis Olfers 1816: 90.
Esthiopterum columbae Harrison 1916: 132.
Columbicola columbae Ewing 1929: 117, Ansari 1947: 259, Hopkins and Clay 1952: 86, Tendeiro 1960: 530, 533, Selim et al. 1968: 76, Hill and Tuff 1978: 309, 317, Lakshminarayana 1979: 82, Clayton and Price 1999: 675, Price et al. 2003: 166, 303.

Material examined. 48 males, 73 females, on *Columba livia intermedia* (Gmelin), *Columba livia neglecta* Hume; Pakistan: Karachi; 21-V-2004, 23-IX-2007; leg. Naz. New host record from Pakistan.

***Columbicola tschulyschman* Eichler**
http://species-id.net/wiki/Columbicola_tschulyschman
Fig. 30–33

Columbicola tschulyschman Eichler 1942: 28, Tendeiro 1960: 531, 571, Hopkins and Clay 1952: 88, Price et al. 2003: 168, 303.
Columbicola montschadskyi Blagoveshtchensky 1951: 308, Tendeiro 1965: 131.

Material examined. 5 males, 6 females, on *Columba livia neglecta* Hume; Pakistan: Karachi; 16-VIII-2007; leg. Naz.
New record from Pakistan.

***Turturicola salimalii* Clay & Meinertzhagen**
http://species-id.net/wiki/Turturicola_salimalii

Turturicola salimalii Clay and Meinertzhagen 1937: 278, Ansari 1947: 260, Hopkins and Clay 1952: 360, Tendeiro 1965: 26, 48, Lakshminarayana 1979: 174, Price et al. 2003: 246, 307.

Material examined. 2 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 16-VII-2005; leg. Naz.

New host record from Pakistan.

Discussion

This study is the first survey of chewing lice of family Columbidae in Pakistan. Among the nine species found in this region, six species are recorded for the first time. Four of them, *Campanulotes compar*, *Colpocephalum turbinatum*, *Columbicola columbae* and *Hohorstiella lata*, are cosmopolitan (Emerson 1972, Ledger 1980, Mey 2003, Naz and Rizvi 2004, Naz et al. 2010).

Only two species of the genus *Colpocephalum* have been recorded from Columbidae, which are *C. longicaudum* Nitzsch 1866 on *Streptopelia chinensis tigrina* (Temminck) and *C. turbinatum* on *Columba livia* Gmelin (Price and Beer 1963, Price et al. 2003). Kellogg and Paine (1914) have reported *C. longicaudum* from *Columba livia*. Price and Beer (1963) have recorded *C. turbinatum* from various species of Falconiformes. Ansari (1951) reported *C. turbinatum* from *Milvus migrans govinda* Sykes (Accipitridae: Falconiformes) with the synonym *C. tricinctum,* in Lyallpur, Pakistan (Lakshminarayana 1979). Here, this species is reported from *Columba livia* in Karachi, Pakistan. Galloway and Palma (2008) showed that some species of lice can be overlooked for many decades even when they parasitize common hosts.

Columbicola tschulyschman is also a regular pigeon parasite. It is known from three species of *Columba* including *C. livia neglecta,* which is also found in Pakistan (Grimmett et al. 1999, Naz et al. 2010) and is probably still isolated from feral pigeons in Pakistan (Johnston 1996). There is no record of this louse species from feral pigeon (Adams et al. 2005).

The presence of *Hohorstiella streptopeliae* on *Columba livia* represents a case of straggling, because its type host is *Streptopelia turtur arenicola* (Hartlert) (Price et al. 2003). Ansari (1947) recorded *Turturicola salimalii* on three species of *Streptopelia* and on *Columba livia* from different regions of India, but he also collected this species from Passeriformes and Psittaciformes and suggested these hosts as likely stragglers.

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