

DESCRIPTION OF A NEW SPECIES OF SATRAPES SCHMIDT, 1885 WITH PROPOSED PHYLOGENY OF THE PALEARCTIC GENERA OF HETAERIINAE (COLEOPTERA: HISTERIDAE)

T. Yélamos

ABSTRACT

Description of a new species of Satrapes Schmidt, 1885 with proposed phylogeny of the Palearctic genera of Hetaeriinae (Coleoptera: Histeridae). Satrapes maghrebinus n. sp. is described from Morocco. Keys to species of the genus Satrapes Schmidt, 1885 and to Palearctic genera of Hetaeriinae are also provided. The synonymy of Satrapes peyerimhoffi Bedel, 1899 (S. sartorii peyerimhoffi Bedel, 1899: Müller, 1937) with the nominal subspecies of S. sartorii (Redtenbacher, 1858) is proposed. The cladistic analysis of the related genera of Hetaeriinae is discussed.

Key words: Coleoptera, Histeridae, *Satrapes maghrebinus* n. sp., keys to species and genera, phylogeny, Palearctic region.

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Tomàs Yélamos, Museu de Zoologia de Barcelona, Apartat 593, 08080 Barcelona.

RESUM

Es descriu *Satrapes maghrebinus* n. sp. de Marroc, acompanyant-se de les claus d'espècies del gènere *Satrapes* i dels gèneres paleàrtics d'Hetaeriinae. Es proposa la sinonímia de *Satrapes peyerimhoffi* Bedel, 1899 (*S. sartorii peyerimhoffi* Bedel, 1899: Müller, 1937) respecte a la subspècie nominal de *S. sartorii* (Redtenbacher, 1858). Es realitza l'anàlisi cladística dels gèneres d'Hetaeriinae relacionats.

INTRODUCTION

The Hetaeriinae Marseul, 1857 include a great number of myrmecophilous genera, mainly distributed in America, with the Palearctic genera *Satrapes*

Schmidt, 1885, *Hetaerius* Erichson, 1834, *Eretmotus* Lacordaire, 1854 and *Sternocoelis* Lewis, 1888 (HELAVA *et al.*, 1985; KRYZHANOVSLIJ & REICHARDT, 1976; YÉLAMOS, 1992; YÉLAMOS, 1995). Their phylogeny is discussed.

The genus *Satrapes* is well characterised by its elongate and subcylindrical shape, short, very wide tibiae, and triangular labrum. They live in ants nests of several genera (*Acantholepis*, *Aphaenogaster*, *Formica*, *Tetramorium*). Up to now, four species were known, living in Central and Southern Europe, Near and Middle East, and Central Asia. At present it is not possible to study their phylogeny, because some species are little-known. All the type series are now studied.

Abbreviations

MCSN: collection of Museo Civico di Storia Naturale, Trieste, Italy.

NHML: collection of the Natural History Museum, London, United Kingdom.

NHMW: collection of the Naturhistorisches Museum, Wien, Austria.

TM: Termesztudományi Múzeum, Budapest, Hungary.

TY: Tomàs Yélamos, private collection, Barcelona, Catalonia, Spain.

***Satrapes maghrebinus* n. sp.** Fig. 1, 2, 3 and 4

Diagnosis

It is closely related to *S. talyschensis* (Reitter, 1883) but it may be easily distinguished from it by the combination of characters that can be observed in the key to species.

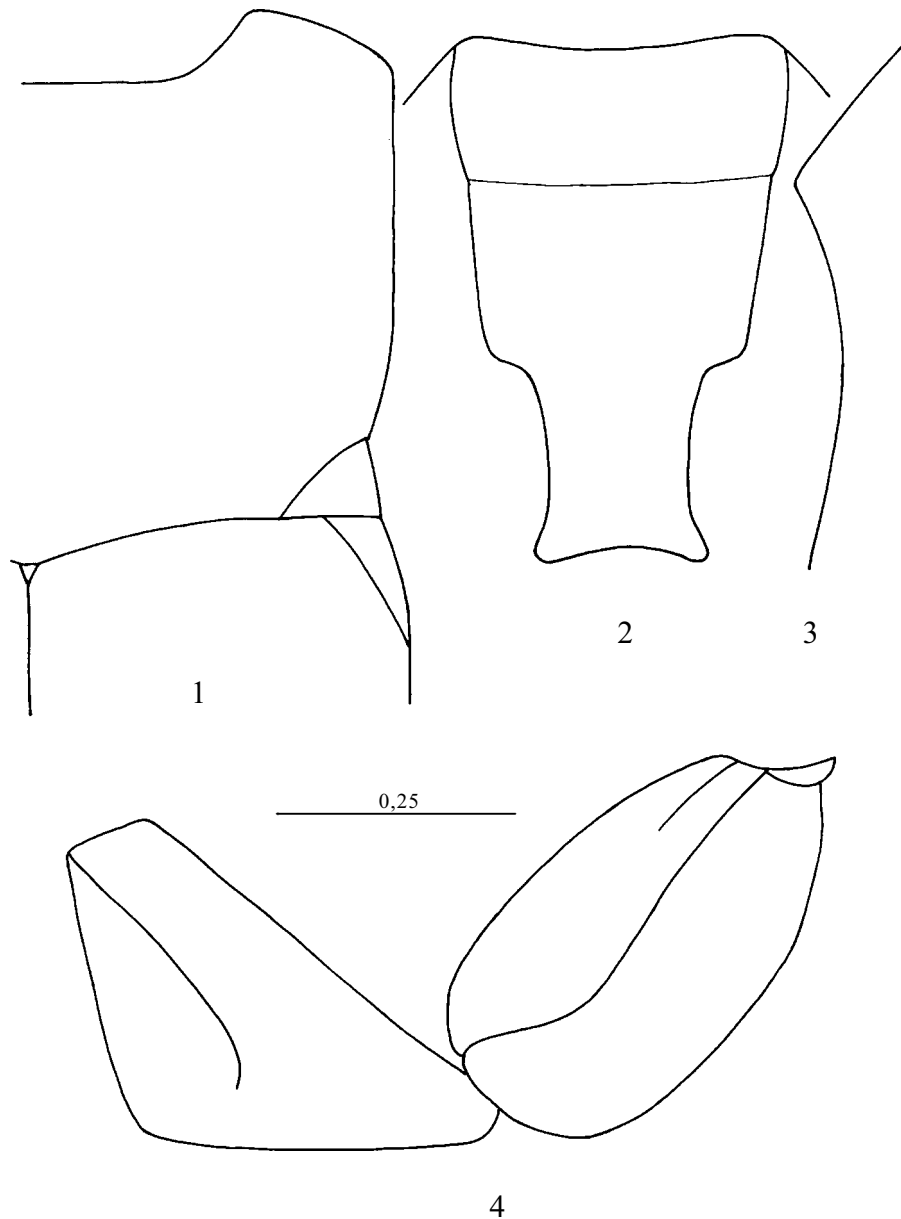
Description

Colour light brown, slightly shiny; body elongate-oval, weakly convex; upper surface covered with short and broad setae with large, dense setigerous punctures, bearing short, dense microsetae.

Mandibles large, densely punctured; labrum strongly produced in front, deeply depressed; frons and epistoma with lateral margins carinate; epistoma narrow and short, smooth; frons densely punctured; antennal scape strongly enlarged; antennal club without distinct suturae, strongly depressed; eyes normal.

Pronotum with anterior angles not elevated, oblique and truncate; sides subparallel, with a deep depression on basal angles, also having depressed anterior angles of elytra (fig. 1); sides slightly separated from disc, without striae; marginal stria obsolete; surface densely punctured. Elytra slightly more expanded than pronotum; marginal stria strongly cariniform, bisinuose; outer subhumeral stria cariniform, parallel to the marginal stria, joined together on apical third; five dorsal striae only as impressions, shortened from the first to the fifth striae, fourth and fifth striae only short, shallow basal impressions; without sutural stria; epipleural striae complete and sinuose; surface covered with dense puncturation.

Propygidium somewhat longer than pygidium, convex; propygidium and pygidium very densely punctured.



Figures 1-4. *Satrapes maghrebinus* n. sp.: Pronotum and elytra, right part (1); prosternum, ventral view (2); prosternum, lateral view (3); right metafemur and metatibia, inner side (4). Scale in mm.

Prosternal lobe with medial part wide and very deflexed, forming an obtuse angle with keel (fig. 3); prosternal keel with base emarginate (fig. 2), covered with rugose puncturation, slightly convex; inner striae lacking; outer striae cariniform and complete. Mesosternum very short, with excretor orifices broad and very deep; slightly directed toward prosternum on middle; meso-metasternal suture very shallow. Metasternal disc convex, with dense puncturation; longitudinal suture fine; two lateral striae arcuate, not reaching metacoxae, moreover there is a fine, short, arcuate and transverse striae opposite to metacoxae; sides and mesepimeron with dense foveae; metepisternal stria going from mesepimeron up to metacoxae.

First abdominal sternite like metasternum; two post-metacoxal striae on each side, cariniform, oblique and complete.

Legs covered with setae and puncturation; protibiae very expanded and short, oval, with large tarsal grooves; mesotibiae less expanded; metatibiae very expanded on middle, subtriangular (fig. 4); base of tibiae finer proximally, where it fits into the femora; femora very expanded and short, with inner part finer, forming a groove to fit tibiae; tarsi short, setose on ventral side.

Male unknown.

Maximum length (head, propygidium and pygidium excluded): 1.52 mm

Maximum width: 1.05 mm

Type material

Holotype ♀, labeled /Mechra Ben-Abbou (Marroc) 12.04.1992, T. Yélamos Leg./ (TY).

Comments

It is only known from the type locality, Mechra-Benabbou, about 100 km N of Marrakech (Morocco), at altitude 300 m on clay soil with xerophytic vegetation, in nests of the ant *Aphaenogaster* in wet weather.

Etymology

Specific name derived from the geographical area of the Maghreb, the Arabic word for NW Africa.

Key to species of genus *Satrapes*

- 1 Sides of pronotum clearly convex at middle; inner prosternal striae obsolete (fig. 2); surface of body densely setose; meso- and metatibiae with inner margin either straight or slightly sinuose, and outer margin angulate (fig. 4); prosternal lobe strongly deflexed, forming an obtuse angle with the keel..... 2
- Sides of pronotum not convex; inner prosternal striae distinct (fig. 5); surface of body either glabrous or microsetose; meso- and metatibiae with the inner margin rounded, sinuose, and the outer margin regularly rounded; prosternal lobe either recurved or slightly deflexed with the keel 3

- 2 Elytra with basal remnants of inner subhumeral and dorsal striae; epistoma depressed and very narrow, with frontal striae strongly cariniform; upper side of body with dense and deep setigerous foveae; basal angles of pronotum and elytra deeply excavated; prosternal keel densely punctured and densely setose; prosternal lobe strongly deflexed with the keel (fig. 3); mesosternum with excretor orifices very broad and very deep; pronotal sides very convex at middle *S. maghrebinus*
- Elytra without remnants of inner subhumeral and dorsal striae; epistoma depressed, wide, with frontal striae less cariniform; upper side of body with setigerous foveae and punctures, less dense, mainly sparser on pronotum; basal angles of pronotum and elytra less deep; prosternal keel sparsely punctured and sparsely setose; prosternal lobe less deflexed with keel; mesosternum with excretor orifices narrower and less deep; pronotal sides slightly convex *S. talyschensis*
- 3 Outer subhumeral stria joined to the marginal stria; aedeagus with parameres apically separated (fig.) *S. sartorii*
- Outer subhumeral stria not joined to the marginal stria; aedeagus with parameres apically approximate (fig. 7) 4
- 4 Prosternal lobe only slightly curved with the keel; body microsetose
.....*S. reitteri*
- Prosternal lobe distinctly deflexed with the keel; body either glabrous or finely microsetose*S. subglaber*

***Satrapes talyschensis* (Reitter, 1883)**

Eretmotes talyschensis Reitter, 1883: 143.

Satrapes talyschensis (Reitter, 1883): Schmidt, 1885: 300.

Type material

Holotype ♀, with an ant, labeled /Caspi-M.- Gebiet, Rasano, Leder (Reitter)/, /Eretmotus orientalis/, /Holotypus 1883, Eretmotus talyschensis Reitter/, /coll. Reitter/ (TM)

Distribution

The type was recorded from Talysch (Azerbaijan), this species also occurs in Iran, Turkmenistan, Armenia, Turkey and Jordan (KRYZHANOVSKIJ & REICHARDT, 1976; MAZUR, 1984; REITER, 1883).

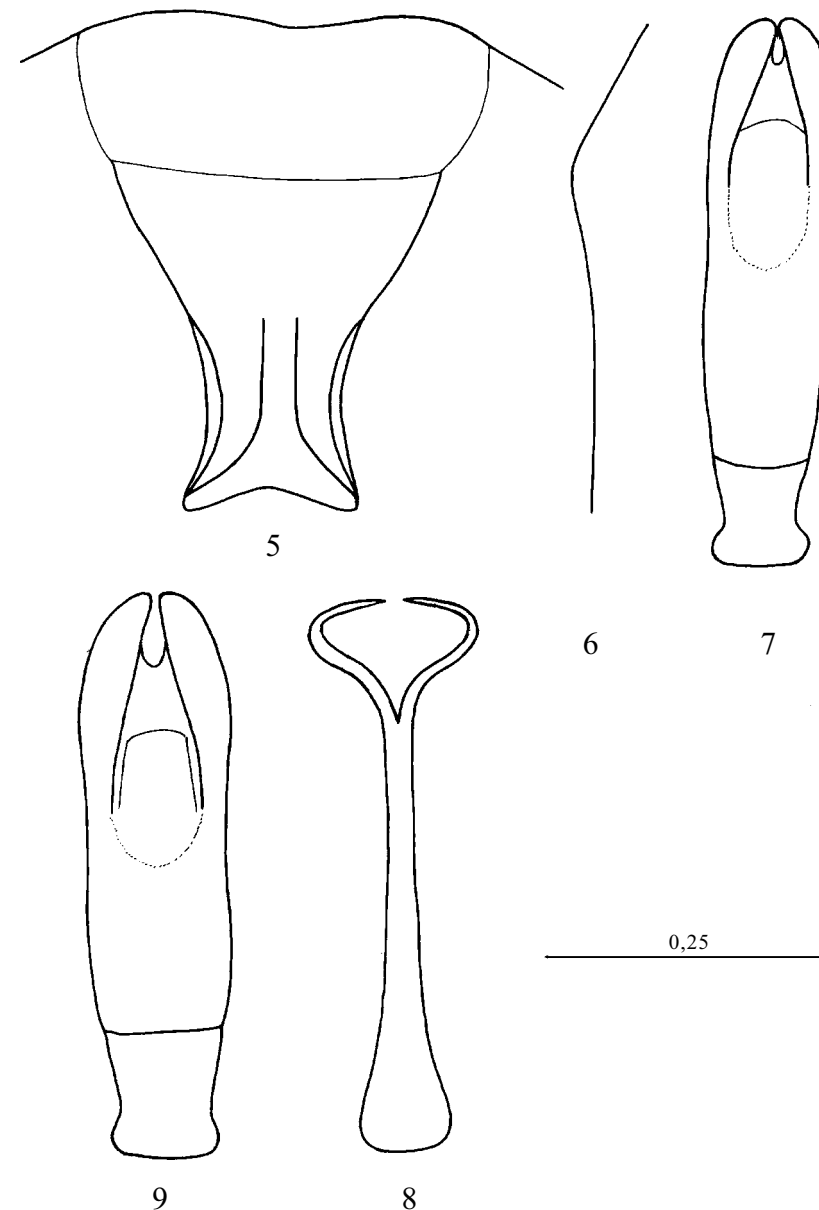
***Satrapes subglaber* Müller, 1937 Fig. 5, 6 and 7**

Satrapes sartorii subglaber Müller, 1937: 134.

Satrapes subglaber Müller, 1937: Kryzhanovskij & Reichardt, 1976: 412.

Type material

Holotype ♂, labeled /MTS. KARATEGHIN, Baldschuan, 924 m. F. Hauser 1898/, /TYPUS/, /Museo Civico di Trieste/, /sbsp. submundus m./ in the Müller collection (MCSN).



Figures 5-9. *Satrapes subglaber* Müller, 1937: Prosternum, ventral view (5); prosternum, lateral view (6); aedeagus, ventral view (7). *S. sartorii* (Redtenbacher, 1858): spiculum gastrale, ventral view (8); aedeagus, ventral view (9). Scale in mm.

Distribution

It is recorded from Tajikistan and Uzbekistan (KRYZHANOVSKIJ & REICHARDT, 1976; MAZUR, 1984; MÜLLER, 1937).

Satrapes sartorii (Redtenbacher, 1858) Fig. 8 and 9

Hetaerius sartorii Redtenbacher, 1858: 311.

Eretmotes rayei Marseul, 1864: 348.

Satrapes rayei (Marseul, 1864): Reitter in Heyden, Reitter & Weise, 1883: 93.

Satrapes sartorii (Redtenbacher, 1858): Schmidt, 1885: 441.

Satrapes peyerimhoffi Bedel, 1899: 184.

Satrapes sartorii peyerimhoffi Bedel, 1899: Müller, 1937: 134.

Type material

Holotype ♀, labeled /Sartorius 1856./, /TYPUS/, /Sartori Redt./ (NHMW).

Other material examined

One specimen labeled /26.4.68 Kirf./, /Mödling, 29.4.866/, /Sartorius 1876/. Another specimen labeled /Mödling 8/4/866/, /Coll. Türk./ (NHMW).

One specimen with 10 ants labeled /Mt. Ventoux. Maison Cantonnière, 28.IV.1918/. Another specimen labeled /Vaucluse, Ch. Fagniez/, /Chasses en auto/. Another specimen with an ant labeled /Mts. Luberon, Fagniez 1-V/, /Tetramorium caespitosum/. Seven specimens labeled /Mts. Luberon, Fagniez, V-VI/ (TY).

A female accompanied by an ant labeled /Archail, Basses-Alpes/, /Peyerimhoff 1903/, /Satrapes peyerimhoffi Bedel/ (NHMW).

Distribution

Central Europe: France, Italy, Switzerland, Germany, Austria, Hungary and Croatia (AAUZAT, 1916-1925; BEDEL, 1899; MAZUR, 1984; REDTENBACHER, 1858).

Comments

The differences between *S. sartorii peyerimhoffi* and the nominal subspecies do not justify the existence of both subspecies (humeral area with or without two shallow dorsal striae, and relative width between pronotal and elytral bases) (VIENNA, 1980).

Satrapes reitteri Lewis, 1888

Satrapes reitteri Lewis, 1888: 153.

Satrapes sartorii reitteri Lewis, 1888: Müller, 1937: 134.

Type material

Two specimens in the NHML, both collected by Hans Leder. One of them only labeled as «Type». I think that the other specimen should not be considered as a syntype. The description of the species does not include the number of specimens.

Holotype ♂, labeled /Satrapes Reitteri Lewis, Type/, /Talyschgeb Transcaucas, Leder, Reitter/, /George Lewis Coll. B.M. 1926-369/, /Type/.

Other material examined

One specimen ♂ labeled /Satrapes Reitteri Lewis/, /Reitteri/, /Kaukas, Leder/, /George Lewis Coll. B.M. 1926-369/.

Distribution

Type found in «Talyschgeb (Transcaucasia)» (Azerbaijan), also recorded from Kura (Azerbaijan) (MÜLLER, 1937).

Comments

Species closely related to *S. sartorii* and *S. subglaber*. After revision of the type material, its uncertain taxonomic status is confirmed (KRYZHANOVSKIJ & REICHARDT, 1976; LEWIS, 1888; MÜLLER, 1937). Maybe it would be a vicariant Caucasian species.

Key to genera of Palearctic Hetaeriinae

- 1 Body elongate, subcylindrical; tibiae short and very wide, rounded; labrum triangular..... *Satrapes*
 - Body short and wide, oval; tibiae long, variably expanded, not rounded; labrum either truncate or arcuate 2
- 2 Disc of mesosternum and metasternum quite depressed; mesosternum long, not subtriangular..... *Sternocoelis*
 - Disc of mesosternum and metasternum flat or slightly depressed; mesosternum very short, sometimes subtriangular..... 3
- 3 Sides of pronotum with a striate depression with striae, parallel to margins; prosternal keel very narrow; upper side of body with long setae
 - *Hetaerius*
 - Sides of pronotum without a striate depression, parallel to margins; prosternal keel very wide; upper side of body without setae or only with microsetae *Eretmotus*

PHYLOGENY OF PALEARCTIC GENERA OF HETAERIINAE

The only existing study on the phylogeny of Hetaeriinae was carried out by HELAVA *et al.* (1985). They studied the American genera. They assumed that the outgroup of the Hetaeriinae are the Histerinae, mainly the Exosternini, being probably the sister group of the Hetaeriinae. OHARA (1994) also agrees with this opinion. The Afrotropical genus *Paratropus* show many plesiomorphic characters closely related to the Exosternini. It seems that NEWTON & THAYER (1992) do not agree with this proposal. The genera *Satrapes*, *Eretmotus*, *Sternocoelis* and the Palearctic *Hetaerius* share many morphological characters that demonstrate their monophyly (see tables 1 and 2). The Nearctic *Hetaerius* may be a polyphyletic genus composed of three groups of species (HELAVA *et al.*, 1985), but they are not studied here. All of these genera share a synapomorphy

on the morphology of the antennal club (cylindrical and apically truncate) together with other Nearctic genera, like *Mroczkowskiella*, *Euxenister*, *Convivister*, *Synoditinus* and *Hippeutister*, among other.

Other characters like the female genitalia could be also analysed. A new and more complete cladistic analysis would be desirable, but the Hetaeriinae is a very extensive subfamily and this work is in its infancy.

The genus *Hetaerius* Erichson, 1834 is distributed in the Holarctic region, and is therefore included in this work. Together with Nearctic *Mroczkowskiella* Mazur, 1984, they form the subgroup C3 within group C (HELAVA *et al.*, 1985). The group C of these authors includes those genera in which the aedeagus has a short basal piece and long parameres and the 8th tergite does not have inward extensions along the ventral hind margin, a plesiomorphic character state. Most of the genera (except subgroup C4, *Ulkeopsis* HELAVA *et al.*, 1985 and *Satrapes*) are apomorphic in that the 8th sternites are without disks or are fused or both. HELAVA *et al.* (1985), showed that subgroup C is not defined by a synapomorphy. *Hetaerius* and *Mroczkowskiella* are placed together because they both share apomorphic character states with the Palearctic genus *Satrapes*.

The considered outgroup is constituted by the rest of C subgroups (C1, C2, C4) (HELAVA *et al.*, 1985: 149). Cladistic analysis of the genera of subgroup C3 (Nearctic *Mroczkowskiella*, Palearctic *Satrapes*, *Hetaerius*, *Eretmotus* and *Sternocoelis* was performed using HENNIG'86 (FARRIS, 1988) and PAUP (SWOFFORD, 1993). Twelve multistate characters were used (several were before used in the work here referred), as well as other different characters with generic value for the Palearctic genera. The genera were examined to determine the states of the characters to construct the matrix. The hypothesis on character state polarity are listed in table 1 and are based upon a comparison with the outgroup. The characters are treated as additive.

Table 1. Characters employed (Plesiomorphic= 0, Apomorphic= 1, 2).

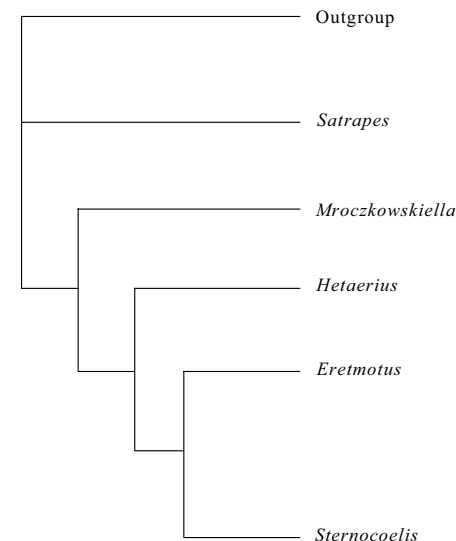
- 1 –Form of body: elongate oval (0); wide oval (1).
- 2 –Setae of body: with long setae (0); without setae, or being very short (1).
- 3 –Labrum: truncate or arcuate (0); triangular (1).
- 4 –Basal angles of pronotum and elytra: with a deep and wide depression on pronotum and elytra (0); with a shallow and small depression on pronotum near angles (1).
- 5 –Prosternal lobe: not divided (0); tripartite (1).
- 6 –Shape of mesosternum: short, sometimes subtriangular (0); long, not subtriangular (1).
- 7 –Mesosternum: without excretor orifices (0); with excretor orifices (1).
- 8 –Mesosternal disc: not depressed (0); deeply depressed (1).
- 9 –Legs: short, strongly expanded, tibiae fitted into femora (0); long, slightly expanded, tibiae weakly fitted into femora (1).
- 10 –Male eighth abdominal sternite: with disks (0); without disks (1).

- 11 –Male eighth abdominal sternite: without setae on apex (0); with setae on apex (1).
- 12 –Male ninth tergite: with internal guides for aedeagus (0); without internal guides for aedeagus (1).
- 13 –Male tenth tergite: present (0); absent (1).
- 14 –Apex of parameres, shape: variable, separated between them on a very short trait (0); regularly rounded, with a short space between them (1); not regularly rounded, more widely separated (2).

Table 2. Character state matrix for Palearctic Hetaeriinae (besides genus *Mroczkowskiella*) and characters (Plesiomorphic= 0; Apomorphic= 1, 2).

TAXA	CHARACTER NUMBER													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
outgroup	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Satrapes</i>	0	0	1	0	1	0	1	0	0	0	1	0	0	1
<i>Mroczkowskiella</i>	1	0	0	1	0	0	0	0	1	1	0	0	1	1
<i>Hetaerius</i>	1	0	0	1	1	0	1	0	1	1	0	0	1	2
<i>Eretmotus</i>	1	1	0	1	1	0	1	1	0	1	0	1	1	2
<i>Sternocoelis</i>	1	0	0	1	1	1	1	1	1	1	0	1	1	2

Table 3. The most parsimonious cladogram by the Hennig'86 program from the character matrix included in Table 2.



This cladogram is only a proposal for the phylogeny of the Palearctic Hetaeriinae. It will be necessary to study the American *Hetaerius* in order to construct a more complete cladogram.

Palearctic *Hetaerius*, *Eretmotus* and *Sternocoelis* are closely related genera, sometimes hardly distinguishable. The genus *Hetaerius* has a wide Holarctic distribution, in the Palearctic region occurring from Algeria till Japan. Both genera *Eretmotus* and *Sternocoelis* have many species in the Mediterranean area, showing more apomorphic characters than genus *Hetaerius* and a wide range of morphological variation. The genus *Satrapes* is distributed from North Africa to Central Asia, showing a narrow range of morphological variation as well as more plesiomorphic characters. The relationship of the North American genus *Mroczkowskiella* to both *Satrapes* and *Hetaerius* is unclear.

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