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11 A direct continuation of:
The occurrence of the psammophilous species *Phimodera flori* (Heteroptera: Scutelleridae) in the Czech Republic

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Abstract *Phimodera flori* Fieber, 1863 (Heteroptera: Scutelleridae) inhabits the sandy dunes, an endangered habitat in the Czech Republic. The species was regarded as extinct from the 70’s of the last century, however it has recently been collected in two localities in Southern Bohemia. *Phimodera flori* still survives in the Czech Republic, most probably due to its obvious adaptation to an unstable habitat.

Distribution, sandy dunes, life cycle, host plant, Heteroptera, Scutelleridae, Cydnidae, *Phimodera flori*, *Byrtilus flavicornis*, Palaeartic region

INTRODUCTION

The strictly psammophilous species *Phimodera flori* Fieber, 1863 (Heteroptera: Scutelleridae) occurs in isolated areas throughout the temperate Palaeartic, due to its affinity to the sandy habitat, represented by sandy dunes in the region (e.g., Wagner 1966).


Štys (1963) reported *P. flori* from the Southern Bohemia as a new species for the former Czechoslovakia. The species was later included in the checklist of Czechoslovakian Heteroptera (Heberlandt 1977). Štys & Škapec (1992) classified *P. flori* among the considerably endangered Heteroptera species in the Red Book of Invertebrates of the former Czechoslovakia.

The present paper deals with new records of *Phimodera flori* in the Czech Republic, and reports an evidence of its occurrence in the country. The findings in the locality Pisečný presyp were done during the field courses of the Department of Zoology of Charles University at Prague.

MATERIAL AND METHODS

All material examined was identified by the senior author. The material is housed in the collection of the Department of Zoology, Charles University at Prague, Praha. The number reported before the locality name represents the grid mapping square code used for faunistic research in the Czech Republic (Pruner & Mika 1986). Authors’ comments are given in square brackets.
RESULTS

Published record

Material examined (Czech Republic, Southern Bohemia) 6654b Nature Reserve Slepičí vřesč near Lužnice and Lužnice, 17 vix 1983, David Král lgt., 1 male, open place of the sandy dune, in sand, most probably on roots of psammophyllum grass, Cynoglossum commersonii (L.) Bieber, mentioned briefly and only in Czech language by Štys & Škapac (1992). 6854d Nature Reserve Písečný prýsyp near Vlkov nad Lužnicí, 26 vix 2003, David Králova lgt., 1 male, open place on sandy dune, in sand, on roots of grasses, 28 vix 2003, Jiří Vilímček & František Skalík lgt., 3 males, open place on the sandy dune, close to its border, where it merges with cultivated field, with the growth of heather and seedlings of Cynoglossum commersonii on the ground, 26 vix 2003, Jiří Hajek lgt., 1 male, the same place as a previous one.

DISCUSSION

Both the localities with the occurrence of Phimodera florii are located in Southern Bohemia, in the area demarcated by the Lužnice and Nežárka rivers. Historically, woodless sandy dunes covered the whole area alongside the rivers. The dunes were successively afforested by pines from the 19th century, to prevent their movements toward human settlements. Recently, only the last remnants of the original large area with the sandy dunes exist, still preserving the specific psammophilous flora and fauna. The two largest and best preserved localities were declared Nature Reserves. Písečný prýsyp near Vlkov (area of 0.84 a., claimed in 1954) represents a well preserved sandy dune, 5.3 m high, 80 m long, 60 m wide, with isolated pines and psammophilous plant vegetation. Slepičí vřesč (area of 1.87 a., claimed in 1955) is the sandy dune about 6 m high, of an oval outline, with a road along its longitudinal axis, the west slope covered by a pasture, the east slope by the isolated pines and psammophilous plant vegetation. The sandy dunes were formed during the late glacial period (Maršáková-Němejcová & Mihálik 1977). Nevertheless, the illegal digging of the sand by the natives from close villages, along with the proclamation as the Nature Reserves, had probably, during the end of the last century, the same or similar positive impact to the dunes as natural factors, particularly the wind.

Štys (1965) collected the first material of Phimodera florii in the locality Písečný prýsyp [= sandy dune] near Vlkov nad Lužnicí. The species is very rare in the Central Europe, according to the author. The species still occurred in the locality in the 60's of the last century (Štys & Škapac 1992). However, Dobšík (1978) did not find P. florii during detailed faunistic survey of the locality. This published fact was a reason for a consequent statement that Phimodera florii became already extinct from the locality Písečný prýsyp. The species was classified as an endangered taxon, which disappearance from the Czech entomofauna is very probable. It was stated by Štys & Škapac (1992), that the species could not be able to survive the habitat conditions getting rapidly worse, the aggressive growth of shrubs and trees, the big water basin nearby locality changing the microclimate, and the intensively managed up fields closely surrounding the dune.

Dobšík (1978) collected in the locality one time per month, from the second half of June until the end of September. Such frequency of visits was not a sufficient basis for the conclusion about the absence of Phimodera florii. The species hibernates in the adult stage (Wagner 1966, present paper), therefore the larvae occur in summer. They do not leave sand so often as the adults, and they suck on the host plant roots deeply in the ground. The adults occur from the end of summer, however, they are active up the ground only in the warmest weather, rather rarely at the end of September. Therefore it seems evident, that Dobšík (1978) should not necessarily find the specimens
of *P. florii*, because the species could very easily be overlooked. Both the adults and the addition of minute body size, were most probably deep in the sand during Dohšík’s (1978) trips.

Recently, *Phimodera florii* has repeatedly been found in the locality Písečný přesyp. The has been checked by the authors at the end of May and in the beginning of June, 1993.

The species was even occasionally found by the junior author in the near second sandy locality, Slepičí vršek (= Hen Hill) near Lužnice nad Lužnicí.

The findings confirmed published data about the species (Stüchel 1962, Wagner 1978), adults hibernate and occur still in the end of May. The most probable, or the only host plant is *Cortinophorus canescens*, the common psammophilous species, coast dominant in the both sandy dunes. *Phimodera florii*, digged in the sand, starts on its a specimen in the warm May and late August. afternoon moved up the ground, on the surface. They dug quickly into the sand after a disturbance.

Thus the assumption of the extinction of *Phimodera florii* from Czech entomofauna (Škapec 1992) was erroneous. Recently, the species survives in the two largest localities very sandy dunes along the river Lužnice, which undoubtedly historically communicated other throughout the other dunes. *Phimodera florii* was only overlooked in the locality Písečný přesyp during the period 1970-2000.

The species, due to the unstable type of habitat which it does inhabit, possesses an ability to survive in changing conditions. *Phimodera florii* is thus able to survive despite a low population density, as an adaptation to the unstable habitat conditions.

The species *Byrsumus flavicornis* (Fabricius, 1794) (Cyclidae: Cyclinae) represent model of strictly psammophilous heteropteran species in the Czech entomofauna. The species was found in the only one locality in Bohemia, near the village Tuhaň, close to the river in the central Bohemia. The species is by its occurrence closely connected with the river Uhlava (Davidová-Vítovecová 1993, as *Aethus flavicornis*), similarly as *Phimodera florii*.

Both the psammophilous species have very probably the same host plant and the strategy, allowing them to survive in the unstable conditions of sandy habitat.

The reasonable erosion of the sandy habitat caused by human activities can probably an impact of natural factors, particularly the wind. This can help to grow up the psammophilous plants, representing the early step of succession and, consequently, to survive the psammophilous insect species.

Two species of the genus *Phimodera* Germar, 1839 have been recorded from the Czech (P. Kment pers. comm., *Phimodera florii* and *Phimodera humeralis* (Dalman, 1832) (= *Phimodera nodicollis* (Burmeister, 1835) = *Phimodera gatulina* (Herrich-Schaeffer, 1837)). How later species, distributed in Moravia, and adjacent Slovakia (Hoberlandt 1977), was re-centered Bohemia only two times in 1940s and 1950s (Hoberlandt 1944, Roubal 1960). The probable that *Phimodera florii* is currently more common species of the genus in the Czech

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REFERENCES

DAVIDOVÁ VILKOVÁ J 1963 Occurrence of Aeschnus flavicornis (Heteroptera: Cydnidae) in former Czechoslovakia Acta Soc Zool Bohem 57 77-80


KLIEK S. A. 1965 Die Pentatomidenfauna (Heteroptera, Pentatomoidea) Ostsibiriens und des Fernen Ostens Acta Fann Entomol Mot Nauí Prauge 139-161 (in Russian with German summary)

MAŠÁROVA NÉMLÉKOVÁ M. & MÍHALÍK V. 1977 Narodni parky rezervace a jinu ochranu v terci perioð y Czechoslovenska [National parks, nature reserves and other protected natural areas in Czechoslovakia] Praha Academia 474 pp

PUDERI L. & MÍRA P 1986 List of settlements in the Czech Republic with associated map field codes for faunistic grid mapping system Keszthelyiana 52 Suppl 1-175


ŠTÝL W 1980 Illustrierter Bestimmungstafel der Wannen II. Europa (Hemiptera – Heteroptera Europae) 4 285-544

ŠTÝL P 1963 Notes on some Czechoslovak Pentatomidae and a complete list of them (Heteroptera) Acta Univ Carol – Brno 1963 217-223


WAGNER E 1966 Wannen oder Heteropteren 1 Pentatomoidea Die Tierwelt Deutschlands 54 1-235
First record of *Euscorpius (Polytrichobothrius) italicus* (Scorpiones: Euscorpiidae) from Iraq

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Abstract. A disjunct scorpion population of *Euscorpius italicus* (Herbst, 1800) is reported for the first time from Iraq. Morphology, ecological conditions, and possible source of anthropogenic introduction are discussed.

**Taxonomy, distribution, anthropochora, Scorpiones, Euscorpius italicus, Iraq, Palaearctic region**

**INTRODUCTION**

*Euscorpius italicus* (Herbst, 1800) has a naturally disjunct geographic distribution divided in two unequal parts: it is found in southern Europe (mainly in Italy, Slovenia, Croatia, Montenegro, Albania, and northwestern Greece) and in a narrow coastal strip along the Black Sea coast of northern Turkey (from Istanbul in the west), Georgia and Russia (Krasnodar Region) (Fet & Sissom 2000). Populations outside of the main geographic range are assumed to have been introduced by man (Gantenbein et al. 2002). Here we report a new disjunct population of *Euscorpius italicus* from Iraq.

**RESULTS**

We examined one adult female and two adult males from Iraq in the collection of F. Kovarič (Prague, Czech Republic). These specimens were collected at Ashuluk (Ash-Sheikh, Shabekah, Shabekah), Geophysics BIno base camp, 150 km SW of An-Najaf (Najaf), An-Najaf Province, Iraq, 262 masl, 31° 06′ N, 43° 95′ E, 2M1Fe, October–December 1978, leg. O. Jakes. We scored the morphological characters of those three specimens as described in Vachon (1981) and Gantenbein et al. (2002).

The pectinal tooth count in the pinned specimens could be scored only on the right pectinal organ of the female and was 8. In six pedipalps analysed, the number of trichobothria (sensory bristles) on the ventral surface of the pedipalp chela (P) was 9 (n=4) and 10 (n=2), the number of trichobothria on the ventral surface of the pedipalp patella (1) was 12 in all six cases. The number of trichobothria in the *eT* series on the external surface of the pedipalp patella was 5 (n=5) and 4 (n=1), the number of trichobothria in the *eSb* series on the external surface of the pedipalp patella was 5 (n=1), 6 (n=2), 9 (n=2), and 10 (n=1). The number of trichobothria in the *eT* (7), *eSt* (4), *eSb* (2), eT (1), and *eSt* (4) series on the external surface of the pedipalp patella was constant.

According to the diagnostic criteria given by Vachon (1981) and Gantenbein et al. (2002), especially the trichobothrial numbers and pattern on the ventral aspect of the pedipalp chela and the external aspect of the pedipalp patella, it is clear that this scorpion population from Iraq belongs to *Euscorpius italicus* (Herbst, 1800). The statistical data on pectinal teeth and trichobothria from the Iraqi specimens fall within the limits of those known for *E. italicus*.
DISCUSSION

The remarkable fact about the Iraqi record of *E. italicus* is its disjunct geographic location. Presence of three adult specimens indicates a reproducing population. There can be little doubt that this population was introduced by humans in historical times with trade routes. Another disjunct, reproducing population of *E. italicus* in the Middle East was reported from Sanaa, Yemen (Birula 1937). Such populations were also found in other places closer to the main range of this species, but still disjunct, lower Don in southern Russia (Zykov 1912); southwestern Romania (Vachon 1981); and Stor in Valais, Switzerland (Braunwalder 2001). Other congeneric scorpion species were also reported to establish anthropochoric reproducing populations. Of these, well-known are obviously introduced populations of *Euscorpius flavovulvatus* (DeGeer, 1778) in England (Cloudsley-Thompson & Constantiou 1983; Benton 1992) and Uruguay (Toscano-Gadea 1998). Also possibly introduced are *E. tergestimenus* in Austria (Huber et al., 2001; reported as *E. capathicus* (Linne, 1767)) and in Bohemia (Kovařík & Fet in press).

The Ash-Shabakah locality lies on the crossroads of two major desert routes: one connects Baghdad to Saudi Arabia all the way down to the Red Sea coast, and the other leads from Basra northwest through the Syrian Desert toward Damascus and Beirut. The delivery by humans was possible along these routes from the Mediterranean or Red Sea coasts. The closest known populations of *E. italicus* are those in northern Turkey, which is the likely source of introduction; still, the distance to this source is impressive, over 1000 km. The distance from Ash-Shabakah to the introduced population in Yemen is almost 2000 km.

Meristic (trichobothrial) characters of the studied specimens lie within the limits known for the Anatolian populations (which, in turn, do not significantly differ from the populations in Italy and the Balkans). Values for chela ventral (P), patella ventral (v), and patella external (e, em, and eb) variable series of trichobothria are very close to average for the entire species (Gantenbein et al., 2002). Of patella external series, the highly variable series eva, even within our three samples varied from 5 to 10. A loss of one trichobothrium in series patella external eva in one instance is a rare event. Both types of variation were noted before for *E. italicus*.

Below, we characterize the ecological conditions in which this disjunct population survives. The collection site in Iraq was a base camp for oil and gas exploration by Geophysics Bmco, at the edge of a limestone region called Al-Hajari. The terrain was described to us (O. Jakes, pers. comm.) as rocky, partially weathered, with numerous limestone outcrops, locally with harder and more weathering-resistant limestone layers up to 1 m thick. The camp itself was located in a broad depression which in the rain season received water from several otherwise dry riverbeds. In the rain season it formed extensive ephemeral lakes which took 2-3 weeks to dry out. After the rain season (which occurred between December and March) the locality had only sparse vegetation that by April was scorched by the sun. Climate of the area is that of a hot and dry subtropical desert, with daily fluctuation of temperatures up to 20°C. From spring to fall sunny with frequent desert storms. In November, a sudden temperature drop, in December-January frequent rains and thunderstorms. Water lasted for several days and depressions were filled by the above noted ephemeral ponds or lakes for 2-3 weeks. Daily temperature reached 52°C in July and only 12°C in November and December. The highest night temperatures reached 40°C in July and only 3°C in November, when at 6 a.m., they were around freezing and frequently accompanied by fog. Other species of scorpions collected at this site belonged to the typical and desert fauna of the Middle East: *Androctonus crassaevulus* (Olivier, 1807), *Buthacus tabnoensis* (Simon, 1892), *Compsobuthus* sp., *Orthochirus* sp. (all Buthidae), and *Scorpio maurus* Linne, 1758 (Scorpionidae).

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Acknowledgements

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REFERENCES

BRULLA A A 1937 Notes sur les collections de scorpions recueillies dans le Jemen [Arabie S E] Arch Mus Zool Univ Moscow 4, 101-110 (in Russian, French title)
CLOUDLEY-THOMPSON J L & CONSTANTINOU C 1983 How does the scorpion Euscorpius flavicaudis (Deg.) manage to survive in Britain? Int J Biometeor 27 87-92
GANTENBEIN B., SOLEGLAD M E., FET V., CRUCITTI P. & FET E V 2002 Euscorpius nauplius (C. L. Koch, 1837) (Scorpiones, Euscorpiidae) from Greece: elevation to the species level justified by molecular and morphological data Rev. d'Arachnologie 6 33-43
HUBER D., GANTENBEIN B., FET V. & SLEIDEN B 2001 Euscorpius carpathicus (L.) from Austria (Scorpiones: Euscorpiidae) phylogenetic position clarified by mitochondrial DNA analysis Pp. 273-278 In FET V. & SLEIDEN P A (eds) Scorpions 2001 In memory of Gary A. Polis Burnham Beaches, Buck, British Arachnological Society
BOOK REVIEW


The editors are affiliated with the Wenner-Gren Institute, Stockholm University. It is the first edition of this book, although it appeared in press in 1988. As stated in the preface, in spite of all efforts to control the infection, malaria is as frequent and deadly today as it was 12 years ago when this book was first published. However, due to the rapid development of immunology and parasitology, an enormous amount of new research has come forth during this period and provided a basis for the 2nd edition. Author index comprises 42 names of well-recognized experts from the volume’s 49 chapters, arranged in three major sections. Each chapter is concluded with a list of references covering about 100 citations.

The first section “Malaria Parasites and Disease”, containing three chapters, deals with the malaria plasmodium and their interactions both with the vertebrate host and with the vectors which transmit the disease. Looked at are the structure and life cycle of malaria parasites and their development in the anopheline mosquito. Chapter on pathogenicity and disease deals with the virulence of Plasmodium falciparum, with mediators of severe disease, such as the reactive oxygen species, cytokines, nitric oxide, and red cell deformability. Further on, analysed are various aspects of clinical malaria and malaria syndromes of severe malaria, neurological sequelae, respiratory distress, disturbances of consciousness, brain swelling, and other manifestations.

The second section “Malaria Antigens”, incorporating six chapters, is concerned with detailed account of the many antigens giving rise to important immune responses in the vertebrate host. Outlined are the sporozoite antigens biology and immunology of the circumsporozoite protein (CSP) and thrombospondin-related anonymous protein (TRAP). Further on, immune responses to liver-stage parasites implications for vaccine development and malaria antigen involved in invasion are explored. Subsequent chapters centre attention upon sexual stages of male antigens, reversion and anologism in P. falciparum and upon sexual and sporozoite stage antigens.

The third section “Malaria Infection, Immunity and Regulation” constitutes in three chapters a highlight of mechanisms of immunity and their regulation by environmental and genetic factors, namely mouse models of blood-stage infections, immune responses and cytokines involved in protection and pathology, immune systems and regulation of malaria infection in humans including genetic aspects involved in susceptibility and resistance to P. falciparum.

Finally, seven chapters in the fourth section “Malaria Vaccines” move into the area of safe and effective vaccine to prevent malaria due to P. falciparum which is urgently needed tool for reducing the global burden of the disease. Outlined are pre-erythrocytic malaria vaccines, vaccines against sexual stage malarial parasites, transmission-blocking vaccines, nucleic acids vaccines, vaccines to prevent the disease, adjuvants and malaria vaccine development, and malaria vaccine tools. As declared in conclusions to this section, in the near future, malaria vaccines will be expensive to be used in the area where they are needed the most, such as rural, tropical Africa. However, increasing international support gives hope that once an effective malaria vaccine has been developed, it will be used.

The volume is illustrated by 38 figures numbered by individual chapters and composed of electronic micrographs, diagrams and schematic line drawings and presentations. 12 tables summarize biological phenomena relating to the liver stage of malaria antigens (CSP, TRAP, LSA, MSP, etc), to antigens indicated to be involved in merozoite invasion (MSP, AMA, SERA, EBA, PAR, etc.), to the molecular basis of rosetting, to diverse vaccine trials, and more. This book, now in its second edition, offers an authoritative and very accessible in-depth overview of the rapidly expanding field of malaria immunology and its importance in the control of this biggest and most devastating infectious disease worldwide.
Oxychilus alliarus (Gastropoda: Zonitidae) in the Czech Republic

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Abstract: Three isolated localities of the atlantic snail species Oxychilus alliarus (Miller, 1882) were found in the Czech Republic. The localities are located far from SE border of the distribution of this species at an elevation higher than 600 m.

Distribution, Mollusca, Gastropoda, Oxychilus alliarus, Czech Republic

Oxychilus alliarus (Miller, 1882) is an atlantic species, common in Iceland, British Islands and from West France to North Switzerland, North-West Germany, North Poland and South Norway, Sweden and Finland. Elsewhere in Scandinavia it occurs only in greenhouses (Turunen et al. 1998). This species lives in woods, fields, rocks, occasionally in gardens and greenhouses. O. alliarus is tolerant of poor acid places, such as conifer plantations.

It is smaller than our common O. cellarius (O. F. Müller, 1774) (only 5.5–7.0 mm), closer-coiled than O. cellarius, its snare is a little deeper, spire a little raised and last quarter whorl sometimes slightly compressed and down turned. Umbilicus is rather broad, eccentric (Fig. 1). O. alliarus small strongly of garlic if disturbed or fingered (Kerney et al. 1983).

In the Czech Republic Ložek (1996) found several living specimens in the nature reserve of Gệstemanica I in the Bedy Mts. (coordinates 49°35’35”N, 13°45’10”E) at an elevation 690 m (V Ložek coll. and det.). This habitat is a moor submontane deciduous forest consisting of beech with an admixture of sycamore maple, elm and ash. The herb layer is rich in nutrient-demanding plants, such as Mercurealis perennis L., Urtica dioica L., Actaea spicata L., etc.

On July 7, 1996 L. Juričková found 5 adult and 8 juvenile specimens of O. alliarus in the ruins of a cellar in the former village of Umří near Plachtin (Manětín) (49°56’29”N 13°08’58”E) at an elevation 615 m (L. Juričková coll. and det.). The humid habitat is located in relatively dry and oligotrophic surroundings. This locality was revisited on May 18, 1998 when a small population of juvenile specimens was present. On July 15, 2000 the cellar was completely destroyed and the whole population extinct.

The third locality is Kejšovice near Ulety (49°56’53”N; 13°03’13”E) at an elevation 650 m (21 August 2002 L. Juričková lqt., coll. and det.). Three specimens were found in a humid ditch with bushes (Sambucus nigra L. etc.) and Urtica dioica L.

All these localities are in West Bohemia, more than hundred km from SE border of distribution of this species and at elevations higher than 600 m in relatively rich trophic conditions. The recent transportation of this snail to a small cellar in Umří is unlikely. It is more likely it occurred during the period before II. World War when the village was inhabited. However the chance of a small population surviving more than 50 years, in a very small habitat, is negligible. The problem of how this atlantic element was transported to these isolated localities thus remains open.
Fig. 1. *Oxylus allarius* (Miller) from Umří (West Bohemia) (photo by the senior author).

REFERENCES


Taxonomic remarks on some Palaeartic Anisodactylus, Harpalus and Stenolophus species (Coleoptera: Carabidae)

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Abstract. Based on the examination of type specimens, the following new synonymies are established:

Anisodactylus poecilocoides (Stephens, 1828)

Harpalus cyanens Stephens, 1828: 153, syn. n.

Remarks. Harpalus cyanens was described from Britain on the basis of a single specimen from “Mr. Marsham’s collection.” The present synonymy is based on the examination of the female specimen with label “Anisodactylus cyanens Step. Named in Hope-Westm Coll. p. 1849, 185 by F W Hope” (HECUO) which seems to be the holotype.

Harpalus affinis (Schrank, 1781)

Carabus affinis Schrank, 1781: 212
Harpalus aeneus Stephens, 1828: 156, syn. n.
Harpalus concinnus Stephens, 1828: 158, syn. n.
Harpalus confinis Stephens, 1828: 156, syn. n.
Harpalus denius Stephens, 1828: 156, syn. n.
Harpalus subaurulentus Stephens, 1828: 157, syn. n.

Remarks. Harpalus aeneus was originally described from “near London, & c.” Later Stepber (1839) treated it as a variety of H. aeneus (Fabricius, 1775). The present synonymy is based on...
examination of the female with rather pale legs and brassy dorsum (designated herein as the lectotype for purposes of fixation of species name) which possesses the handwriting pencil label "aeœnopiceus" and two printed labels: "British Isles, J. Stephens Coll., BM 1853-46" and "Syntype, Harpalus aeœnopiceus [sic] Steph." (NHML); and 5 specimens (designated herein as paralectotypes): 1 male, 4 females, same data as lectotype but without handwriting label (NHML).

Harpalus conicus was originally described from the material collected "near London and in Norfolk". Later Stephens (1839) treated this species as a variety of H. aœneus (Fabricius, 1775). The present synonymy is based on the examination of the male with rather pale legs and reddish green dorsum (designated herein as the lectotype for purposes of fixation of species name) which possesses the printed labels "British Isles, J. Stephens Coll., BM 1853-46" and "Syntype, Harpalus conicus Steph." (NHML); and 4 specimens (designated herein as paralectotypes): 3 males, 1 female, same data as lectotype (NHML).

Harpalus conicus was originally described from the specimens collected "near London and in Suffolk". Later Stephens (1839) treated it as a variety of H. aœneus (Fabricius, 1775). The present synonymy is based on the examination of the male with dark legs and greenish black dorsum (designated herein as the lectotype for purposes of fixation of species name) which possesses the printed labels "British Isles, J. Stephens Coll., BM 1853-46" and "Syntype, Harpalus conicus Steph." (NHML); and 5 specimens (designated as paralectotypes): 4 males, 1 female, same data as lectotype (1 male also has an additional handwriting label "S") (NHML).

Harpalus dentatus was originally described from the specimens collected "near London, and in Suffolk". Later Stephens (1839) treated it as a variety of H. aœneus (Fabricius, 1775). The present synonymy is based on the examination of the female with pitchy-brass dorsum and pale legs (designated herein as the lectotype for purposes of fixation of species name) which possesses the handwriting label "dentiatus K" and two printed labels: "British Isles, J. Stephens Coll., BM 1853-46" and "Syntype, Harpalus dentatus Steph." (NHML); and 4 specimens (designated as paralectotypes): 2 males and 2 females, same data as lectotype but without handwriting label (NHML).

Harpalus subcaeruleus was originally described from the specimens collected near London: "Southend" and "Near Ipswich". Later Stephens (1839) treated it as a variety of H. aœneus (Fabricius, 1775). The present synonymy is based on the examination of the male with brown legs and subcaeruleus dorsum (designated herein as the lectotype for purposes of fixation of species name) which possesses the handwriting pencil label "brevis" and two printed labels: "British Isles, J. Stephens Coll., BM 1853-46" and "Syntype, Harpalus subcaeruleus Steph." (NHML); and 8 specimens (designated as paralectotypes): 1 male and 5 females, same data as lectotype but without handwriting label (NHML); 1 male, 1 female, each labelled "Harpalus subcaeruleus Kir. Named in Hope-Westw. Coll., pres. 1849, 1857 by F.W. Hope" (HECUO).

**Stenolophus narentinus** Drovenik et Pekš, 1999

**Stenolophus narentinus** Drovenik et Pekš, 1999, 110

**Stenolophus proximus** ap. narentinus Apfelbeck, 1994: 203 (unavailable)

**Remarks.** The name *S. narentinus* was originally proposed by Apfelbeck (1994: 203) as an aberration of *S. proximus* Dejean, 1829 and since has been unavailable. Drovenik & Pekš (1999: 110) used this name as a valid for species endemic to Croatia and Hercegovina. According to ICZN 1999, Art. 55.1, the name *S. narentinus* became an available name and should be attributed to Drovenik & Pekš (1999).
Acknowledgements

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REFERENCES


STEPHENS J F 1827-1828 Illustrations of British Entomology, or, a synopsis of indigenous insects containing their generic and specific distinctions: with an account of their metamorphoses, times of appearance, localities, food, and economy, as far as practicable. Mandibulata. Vol 1 London. Baldwin & Craddock, w + 188 pp. + 9 pls. (1827 pp. 1-70 (pls 1-4), 1828 pp. 71-186 (pls 5-9)).

Scorpion *Euscorpius* (*Euscorpius*) *tergestinus* (Scorpiones: Euscorplidae) in central Bohemia

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Abstract The scorpion population recorded from central Bohemia, Czech Republic, does not belong to *Euscorpius carpaticus* (Linnæus, 1767) as previously maintained in the literature, but to *E. tergestinus* (C. L. Koch, 1837).

Taxonomy, distribution, Scorpiones, *Euscorpius tergestinus*, *Euscorpius carpaticus*, Czech Republic, Palaearctic region

INTRODUCTION


The most recent revision of *Euscorpius carpaticus* (Fet & Soleglad 2002), species complex which included a study of the holotype, limited *E. carpaticus* to Romania (the type locality). Populations from other regions formerly classified under this name form a species complex and are currently under investigation (Fet et al. in press).

One of the species already confirmed by Fet & Soleglad (2002) as a valid taxon inhabiting southern and central Europe (France, Italy, Slovenia, Croatia, Austria) is *E. tergestinus* (C. L. Koch, 1837) (type locality: Trieste) Three isolated populations from Austria (two in Carinthia and one in Krems, Lower Austria; Scherabon 1987) were recently characterized by genetica data (Huber et al. 2001). These populations belong to *E. tergestinus* as most recently defined by Fet & Soleglad (2002). In this paper we report new taxonomic data on the Bohemian population.

RESULTS

We examined 34 specimens (5 males and 29 females) from Nebtrich (map square no. 6252, 49° 46' 00" N, 14° 25' 36" E, 394 m a.s.l. see Perner & Misra 1996) deposited in the National Museum Prague (4 males and 24 females; see Kovarik 1992: 184) and in the collection of F. Kovarik (1 male, leg. Lang, 5 females, April 24, 1960, leg. J. Vodrážka) (Figs 1, 3–4). Their morphology matches that of Austrian populations described in detail by Scherabon (1987).

Fet & Soleglad (2002) demonstrated a diagnostic difference in the number of trichobothria in *am* series on the external aspect of the of the pedipalp patella, of which there are three in *E. carpaticus* (Fig. 5) and four in *E. tergestinus* (Figs 3 and 4). In contrast, the position of some trichobothria and, more importantly, the numbers of trichobothria in *er* series are variable even within a population.
(Figs 3 and 4). Another character used earlier by Kinzelbach (1975) to diagnose species (the number of trichobothria on the ventral surface of the pedipalp patella) is also variable geographically and within populations, and therefore has only limited diagnostic value. *E. carpathicus* usually has 7 or 8 of these trichobothria (Fig. 2), whereas *E. tergestinus* has 8 to 12 (Fig. 1). Specimens of *E. tergestinus* in the eastern part of its range (Adriatic coast of Slovenia and Croatia) tend to have higher numbers of ventral trichobothria.

In the analysed Bohemian specimens, the pectinal tooth count was 9 (n=5) and 10 (n=3) in males and 7 (n=12), 8 (n=35) and 9 (n=1) in females. In 68 pedipalps analysed, the number of trichobothria on the ventral surface of the pedipalp patella (s) was 9 (n=1), 10 (n=29), 11 (n=36) and 12 (n=2); the number of trichobothria in the et series on the external surface of the pedipalp patella was 6 (n=11), 7 (n=20), 8 (n=33) and 9 (n=7); the number of trichobothria in the est (=4), em (=4), esb (=2) and eb (=2) series on the external surface of the pedipalp patella was constant.

For comparison, 72 specimens from Austria studied by Scherhaufer (1987) had pectinal tooth count 9 (n=61) and 10 (n=51) in males and 7 (n=20) and 8 (n=42) in females; the number of trichobothria on the ventral surface of the pedipalp patella (v) was 9 (n=9), 10 (n=90) and 11 (n=45); the number of trichobothria in the et series was 5 (n=1), 6 (n=4), 7 (n=64), 8 (n=72) and 9 (n=3); the number of trichobothria in the est (=4), em (=4), esb (=2) and eb (=2) series on the external surface of the pedipalp patella also was constant.

According to the diagnostic criteria given by Fet & Soleglad (2002), especially the trichobothrial numbers and pattern on external aspect of the pedipalp patella and well-expressed metasomal carination, it is clear that the scorpion population in central Bohemia belongs to *E. tergestinus*.

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Figs 1-5 Patella of pedipalp, ventral view (1-2) 1 - *Euscorpius tergestinus* (C. L. Koch) male from Neštich, Bohemia. 2 - *E. carpathicus* (Lamereau) male from Romania. Patella of pedipalp, external view (3-5) 3, 4 - two females of *E. tergestinus* from Neštich, Bohemia. 5 - *E. carpathicus* male from Romania.
DISCUSSION

When Karel Táborský of the National Museum Prague identified the first two females brought him on August 31, 1959 by a student J. Gottlieb, he had four known species of the genus *Euscorpius*, 1876 to choose from: *E. carpathicus*, *E. flavicaudis* (De Geer, 1778), *E. germanus* (C. L. Koch, 1837), and *E. italicus* (Herbst, 1800). At that time he correctly identified the specimen as *E. carpathicus*. (Táborský 1959, 1961) As the study of the European populations of *E. carpathicus* continued, this species came to be treated as a complex which includes several species. Its various subspecies have been either synonymized or elevated to species (Gantenbein et al. 2001, Fet & Soleglad 2002).

Fet & Soleglad (2002) give the diagnostic criteria for the five European species currently recognized in the *Euscorpius carpathicus* complex: *Euscorpius carpathicus* (Linnaeus, 1767); *E. tergestinus*, *E. borealici* Caporiacco, 1950; *E. haetzii* Caporiacco, 1950; and *E. koschewnikowi* Brühl, 1900. In addition, Fet et al. (in press) supply further criteria for distinguishing *E. sicamus* (C. L. Koch, 1837) from southern Europe, which belongs to the same species complex. The name *E. tergestinus* has been cited by Fet & Sissom (2000) as valid species, but its taxonomic and geographic limits were not clear at that time. Fet & Sissom (2000) included under this name also the morphologically distinct form from Greece, characterized by Kinzelbach (1975) as a separate species and identified as *E. mesotrichius* Haęzi, 1929. However, current studies (Fet et al. in press) show that this Greek form, together with a number of other southern European populations, belongs not to *E. tergestinus* but to *E. sicamus* (C. L. Koch, 1837). Additional populations from Europe (including Kinzelbach, 1975) in *E. mesotrichius* belong to a number of species. The major taxonomic criteria used by Kinzelbach (1975) (number of ventral trichobothria on pedipalp patella) are not diagnosable for those species.

Examination of specimens from Nebřich deposited in the National Museum Prague and in the collection of E. Kovářík (Figs 1-4) convinces us that the Bohemian population belonged to *E. tergestinus* and delineated the northern limit of its distribution. Huber et al. (2001) suggested that the occurrences in Austria are possibly due to human introduction. The same has been repeatedly proposed for the occurrence in Nebřich, where, however, introduction cannot be demonstrated. Unfortunately, the unique locality at Nebřich was destroyed by commercial development and its adverse effect on the vegetation cover, and *Euscorpius* has not been found there since September 13, 1983.

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We are grateful to Antonín Künk and Jan Budík for help in obtaining information on the Bohemian scorpion population, to Michael Soleglad and Benjamin Gantenbein for their constant enthusiastic cooperation with us in morphological and molecular analyses of *Euscorpius*, and to Jiri Zadák for his help to FK with English translation.

REFERENCES

Fet V, Gantenbein B., Soleglad M. E., Vrchní V, Salomova N., Fet E. V. & Schmid P. J. (in press) Ne molecular and morphological data on the "Euscorpius carpathicus" species complex (Scorpiones, Euscorpiidae) from Italy, Malta, and Greece justify the elevation of *E. sicamus* (C. L. Koch, 1837) to the species level. Re Skrivar Zool.


GANTENBEIN B., SOLFGLAD M E & FET V 2001 Euscorpia balcanica Capomarco, 1956 stat. nov. (Scorpiones, Euscorpidae) molecular (allozymes and mtDNA) and morphological evidence for an endemic Balearic Island species. Organisms, Diversity & Evolution 1 301–320
KOVÁŘ F. 1999 Review of European scorpions, with a key to species. Serket 6 38–44
SCHERBORN B. 1987 Die Skorpione Österreichs in vergleichender Sicht unter besonderer Berücksichtigung Karnten. Carinthia 11 45 78–158

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The genus *Haroldius* (Coleoptera: Scarabaeinae): two new species, range extension, catalogue

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**Abstract** The following two new species of the genus *Haroldius* Boucomont, 1914 are described and illustrated: *Haroldius parangae sp. n.* from Malaya (Pahang province) is related to *H. rainieanus* Boucomont, 1914 by absence of basal pronotal and elytral depressions and by presence of pronotal striae. It can be distinguished from this species mainly by microsculptured surface of pronotum and elytra. *Haroldius turmae sp. n.* from China (Hubei province) belongs to the species with strongly developed basal depression on elytra. Due to presence of pronotal striae it seems to be most similar to *H. rainieanus* Paulian, 1945 from which it can be separated mainly by absence of ventral and apical thirds of elytra. Known distribution areas of several species are extended. Catalogue of all so far described species is added.

**Taxonomy, new species, distribution, catalogue, Coleoptera, Scarabaeidae, Scarabaeinae, Haroldius, Palaearctic region, Oriental region**

**INTRODUCTION**

The scarabaeine genus *Haroldius* Boucomont, 1914 is distributed in the Afrotropical (three species) and the Oriental (20 species) zoogeographical regions (Paulian 1985, Schuermann 1995). Seven species are known to penetrate to the transition zone between the Oriental and the Palaearctic regions, especially to China and Himalaya (Cambefort 1986, Paulian 1985, Masumoto & Wen-yu 1993). In the present paper two additional new species are described.

**MATERIAL AND METHODS**

The following codes (after Arnett et al. 1993) identify the material depositaries:

DKCP – Czech Republic, Praha, Charles University David Kral collection, DMW – Austria, Wien, Naturhistorisches Museum (Hedon Schönhammer Heinrich Schornmann)

Specimens of the newly described species are provided with one red printed label: "name of taxon sp LOLOTPUS, David Kral det. 2003". Exact label data are cited for the type material only. Author’s remarks are found in square brackets, [p] – the preceding data within a quotation are printed, separate label is reindicated by slash "/" separate labels by double slash "//"

**TAXONOMY AND DISTRIBUTION**

*Haroldius heimi* Wassmann, 1918

Material examined. Nepal: E Nepal Arun valley Mure vi 1980 C Hollestein flg. 1 spec. in DKCP

Distribution. So far known only from India (Bombay) and Pakistan (Swat) (Paulian 1985), record from Nepal
Haroldius lausallei Cambefort, 1986

**Material Examined** Nepal: 29.4.1988 300 m Sw Boly lgh 1 spec in DKCP

**Distribution** The species was so far known only from the type locality (Nepal central, note Gorakha) in central part of Nepal (Cambefort 1986). First record from eastern part of Nepal

*Haroldius pahangensis* sp. n.
(Figs 1, 2)

**Type Material** Malaysia, Pahang: holotype (not sexed) labelled: Prov. PAHANG (19) / Fraser Hill 102 / BM 950 / MALAYSIA 1992 / leg. Schuhmacher [p]. Holotype in NHMW

**Description of Holotype** Body length 2.6 mm, Strongly convex, broadest at middle of elytra (Fig 1, 2), colour black with fine metallic shine, and with reddish brown overtones on anterior margin of elytra, head appendages, anterior corners of pronotum and legs.


Pronotum: convex, about twice as wide as long, anterior margin bisinuate, anterior angles broadly rounded to straight subparallel-sided lateral margins, basis simply rounded, finely rimmed. Anterior two thirds of surface including disc densely and finely punctate, posterior third of pronotum distinctly densely obliquely striate, striae not along lateral margins and not reaching anterior margin.

Scutellum absent.

Elytra: distinctly convex, elytral base not considerably depressed (Fig 2), striae finely divided, intervals flat, all of approximately same width, distinctly microsculptured and covered with two rows of setiferous punctures (except for suture amidst, with only one row). Setae not expanded apically, erected only their apices bent slightly posterolectrum.

Prothorax: moderately widened towards apex, bilobate: meso- and metaventrite rather strongly widened, slightly arcuate, apical margin of metaventrite not angulately emarginate.

**Differential Diagnosis** *Haroldius pahangensis* sp. n. is related to *H. rugatulus* Boucomont, 1914 by absence of basal pronotal and elytral depressions and by presence of prominent striae. It can be distinguished from this species by microsculptured surface of pronotum and elytra (in *H. rugatulus* not microsculptured, shining).

**Distribution** Malaysia (Pahang province)

**Name Derivation** Derived from the area of origin of the new species, the Pahang province of Malaysia.

*Haroldius rugatulus* Boucomont, 1914

**Material Examined** Singapore: Singapore, 21.4.1997 Nee Soon Swamp Forest; flight intercept trap by Balke & Hendrich 1 spec in NHMW.

**Distribution** The species is known only from Singapore (Paulian 1985, Scheuern 1995).

*Haroldius turnai* sp. n.
(Figs 2, 4)

**Type Material** China, Hebei: holotype (not sexed) labelled: China, SE Hebei, 2000, Moju Shan 29.4.1994 L. JUGONGSHAN forest; park 1000 m 12 June, Agrodia Turnai leg [p]. Holotype in DKCP.

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Figs 1–4. *Hrodoldius pakangensis* sp. n. (1, 2), *H. tumai* sp. n. (3, 4); 1, 3 – habitus of holotype, dorsal aspect;
2, 4 – dorsal outline of pronotum and elytra, left lateral aspect.
DESCRIPTION OF HOLOTYPE. Body length 2.4 mm. Almost hemispherical, broadest at middle of elytra (Figs 2, 4); colour black with brown overtones on anterior margin of elytra, head appendages, anterior corners of pronotum and legs, dorsal surface moderately shining.

Head. Anterior margin of clypeus with two sharp parallel denticles separated by trapezoidal emargination. Clypeo-genal sulcus absent. Frons moderately convex. Dorsal surface of head distinctly microsculptured and covered with shallow punctures separated by more than three their diameters. Ultimate maxillary palpomere much longer than three proximal together.

Pronotum convex, about twice as wide as long, anterior margin sinuate, anterior angles subangular to strongly subparallel-sided lateral margins; basis distinctly rounded, not rimmed. Surface (including disc microsculptured and punctate as in head, basal part distinctly densely obliquely striate.

Scutellum absent.

Elytra distinctly convex, elytral basal spine depressed (Fig. 4); striae finely but distinctly impressed in all length, intervals flat, all of approximately same width, covered only with several irregularly spaced setiferous punctures basally, setae expanded apically, erected, only their apices bent slightly posteriorly.

Prothorax moderately widened towards apex, plate-like, meso- and metatibiae rather strongly widened, slightly arcuate, apical margin of metatibiae not angulately emarginate.

DIAGNOSTIC DIAGNOSES. Haroldius turman sp. n. belongs to the species with considerable basal elytral depression. Due to presence of pronotal striae it seems to be most similar to H. fleitaux Paulian, 1945 from which it can be separated by absence of setae on two apical thirds of elytra (H. fleitaux with elytral intervals completely setaceous, see Paulian 1945: 60, fig. 40).

DISTRIBUTION. China (Hubei province).

NAME DERIVATION. Patronymic, named in honour of my friend Jaroslav Tuma (Kostelec na Hané, Czech Republic), an auspicious student of Tenebrionidae.

CATALOGUE

Genus Haroldius Boucomont, 1914, 252 (type species Haroldius regius in Boucomont, 1914)
syn. Cyclotrogus Wasmann, 1918: 211 (type species Haroldius heinei Wasmann, 1918) (syn by Arrow 1931: 531)
syn. Panorhagida Silvestri, 1924: 583 (type species Panorhagida amandulae Silvestri, 1924: 583) (syn by Paulian 1985: 197)

Haroldius amandulae (Silvestri, 1924: 586) (P. amandulae) (type locality Banakoda Island in the Chila lake) [India; Bangalore, Madras]
syn. Haroldius chapmani Paulian, 1933: 165 (type locality Bangalore Chikkangale) (syn by Paulian 1985: 197)

Haroldius borneensis Paulian, 1991: 170 (type locality, Sabah, Poring Hot Springs, Langatan Falls) [Malaysia Sabah]

Haroldius cardoni Boucomont, 1923: 83 (type locality Chota Nagpur, Nowato) [India; Chota Nagpore]
syn. Haroldius oberhumeri Paulian, 1934: 163 (type locality Chota Nagpur, Nowato) (syn by Paulian 1985: 197)

Haroldius dactyloides Paulian, 1993: 170 (type locality Sabah, Poring Hot Springs, Langatan Falls) [Malaysia Sabah]

Haroldius entomothorax Jannsen, 1949: 182 (Afroharoldius) (type locality Elisabethville) [Dem Rep Congo]

Haroldius fischeri Boucomont, 1911: 254 (type locality Singapore) [Singapore]

Haroldius florentina Paulian, 1945: 60 (type locality Yen Bay) [North Vietnam]

Haroldius globulus Boucomont, 1925: 151 (type locality Luzon Mnt Banahao) [Philippines Luzon Is.]

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REFERENCES


CAMBORDIO Y. 1986 Un Haraldus nouveau du Nepal (Coleoptera, Scarabaeidae) Revue Française Entomol. 1 S 69-70


Description of the female of Nauticiella stygivaga
(Coleoptera: Leiodidae; Cholevinae: Leptodirini)

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Abstract. Description of the female of troglobite Nauticiella stygivaga J. Moravec et Mlejněk, 2002 from the Vjetrenica Cave (S Herzegovina) is given for the first time. Morphologically, the female specimen is markedly different from male, particularly by the conspicuous shape of elytral apex. A text correcion of our previous paper (Moravec & Mlejněk 2002) is added.

Taxonomy, description, female, Coleoptera, Leiodidae, Cholevinae, Leptodirini, Nauticiella stygivaga, Bosnia & Herzegovina, Palaeartic region

Following our recent paper (Moravec & Mlejněk 2002) we described a new genus and new species of troglobitic lepidopterine, Nauticiella stygivaga, based on five males only. During the collecting trip to southern Herzegovina in July 2002 was taken one female specimen. In the present paper, the female of N. stygivaga is described.

The suprageneric nomenclature of Leiodidae used here is adopted from that of Newton (1998). The terms on the female genitalia morphology follows Giachino et al. (1998) and Newton (1998) and the terminology of spermaticheal types is that of Perreau (1989, 2000).

TAXONOMIC PART

Nauticiella stygivaga J. Moravec et Mlejněk, 2002
(Figs 1, 2, 5–9)

Nauticiella stygivaga J. Moravec et Mlejněk, 2002 300

Material examined. One female (from the same locality as the type material), labelled “S. Herzegovina. Popava polje plateau, Zavala Env. Pećina Vjetrenica Cave, 256 m a s l. 2.3 km from entrance, 1.vii.2002, R. Mlejněk.” Deposited in the collection of R. Mlejněk (Pardubice, Czech Republic).

Description of female (Fig. 1). Body small, flattened, scaphoid-shaped, semiopulvus, yellow palps, antennae and tarses somewhat paler. Head and pronotum with very short, sparse, yellow whitish setation, elytra with dense, short, decumbent, hydrophobous, yellow–whitish setation. Body length (measured from anterior margin of epistoma to apex of elytra) 3.3 mm.

Head large, not retractile, slightly convex and narrower than pronotum; length/width ratio 1.48.

Eyes totally absent. Antenna (Fig. 2) long and slender, not exceeding length of body, length of antenna/length of elytron ratio 1.3.

Antennomere I rhomboid, longer than II, ultimate antennomere subconical. Lengths of individual antennomeres I to XI (in mm) as follows: 0.23: 0.15: 0.36: 0.27: 0.35: 0.31: 0.28: 0.27: 0.22: 0.18: 0.25. Sculpture of head indistinct, very finely punctate.
Figs 1-9. 1-6. *Nannotettix argyronota* Monné et Mlýnek. 1 - female habitus, dorsal view, 2 - female right antenna, dorsal view, 3 - male apical portion of elytra, dorsal view, 4 - delta, lateral view, 5 - female apical portion of elytra, dorsal view, 6 - delta, lateral view. Scale 10 mm (A Figs 1-2, B Figs 3-6). 7-9 - *N. argyronota*, female. 7 - tergum IX, ventral view, 8 - sternum VIII, ventral view, 9 - spermatheca, dorsolateral view. Scale 0.2 mm (Figs 7-9).
Pronotum moderately convex, length/width ratio 1.59. Lateral margins regularly arcuate anterior half and very slightly curved in posterior third. Posterior angles subrectangular. Basis almost straight. Disc moderately vaulted, with medial depressions shallowly indicated. Sculpture similar to that on head, with very fine, dense punctuation intermixed.

Scutellum small, triangular.

Elytra elongate, flat; length/width ratio 2.58. Lateral margins regularly rounded, gradually tapering posteriorly, bordered, sharply projecting at apex (Figs 1, 5, 6). Surface coarsely punctuate than on pronotum, punctures rougher and denser.

Legs long and slender. Prefemora somewhat robust, slightly thickened premedially. Protibia not extended distally; length of protibia/length of protarsus ratio 1.31. Protarsus tetramerous basally protarsomere undilated, distinctly narrower than the distal part of protibia (see Fig 1). Meso- and metatibiae sinuous, with small and short inner spurs. Tarsal claws simple.

Tergum IX (Fig. 7). Lateral sclerites of tergum considerably elevated proximally. Abdominal sternum VIII (Fig. 8) shallowly impressed in medial part anteriorly, without spiculum ventrale moderately projecting on posterior margin.

Genitalia. Spermatheca (Fig. 9) “Type 1”, tubular-shaped, 0.2 mm long. Proximal bulb small with a subspherical, membranous impression in medial part, hyaline; distal bulb elongate, oval, very weakly sclerotized. Accessory gland oblong oval. Duct of spermatheca relatively short, inserted in its proximal portion.

Sexual Dimorphism. Distinctly expressed. Female specimen differs from male by the following combination of characters: the sharply pointed elytral apex (Figs 1, 5, 6; compare with obtusely, separately rounded apex of each elytron in males – Figs 3, 4), the unique tetramerous, not dilute protarsus (see Fig. 1; protarsomeres moderately dilated in males). Female elytra very flatly vaulted in lateral view (Fig. 6; moderately convex in lateral view in males – Fig. 4).

Collection Circumstances. Female of **Naucrateria stygivaga** was captured on the wall of waterfalls in the Vytenica Cave, 2.3 km from entrance, together with **Hadesia vasiceki** vasiceki J. Míle 1911 (Leptodirini Antrodieroponina) (det. R. Mejnek, 2002). During the study, air temperature (measured on 1.vii.2002) was 11.5 °C, water temperature (in waterfall) was 11.2 °C (see Mejnek & Moravec 2003).

ERRATA

In our previous paper (Moravec & Mejnek 2002) several unfortunate mistakes occurred in the key.

On page 360, line 22 from top, should be now corrected: 12 (1) Antennal insertion on the middle third of head on some p. 360, line 7 from top, added: ‘Behind “Serbia”’, Montenegro (see Giachino & Etomo 1995, Newt. 1998).

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We wish to thank Karel Háčka and David Kell (both Department of Zoology, Charles University, Praha) and Jiří Růžička (Faculty of Forestry, Agricultural University, Praha) for reading of the manuscript. Thanks are due to F. G. Dixon for his correction of the early English version.

REFERENCES


Brain size and foramen magnum area in crows and allies (Aves: Corvidae)

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Abstract Allometric relations between body mass, brain size and foramen magnum dimensions were studied in the Corvidae. Numerical results are given in tables 1 and 2.

Aves, Corvidae, brain size, foramen magnum, encephalization

INTRODUCTION

Brain size is well known to be related to body size in vertebrates, including birds (Snell 1892, Jerison 1973). Early researchers believed that the slope of this relation is invariable (see Jerison 1973, 1979), but subsequent research showed that considerable variation occurs between families of mammals (Witz 1950, Portmann 1972) and birds (Míkůvský 1985, 1989a, b, c, 1990a), and the evolution of the brain size cannot be properly studied without detailed knowledge of brain size within higher taxa (see Míkůvský 1985). The area of foramen magnum is less studied, although it is a useful measure of the transverse area of the spinal cord in the place where it enters brain (see Míkůvský 1990b).

Brain size in the Corvidae is of particular interest, because crows and allies are generally considered highly intelligent birds, which was confirmed in a variety of experiments (see Krutenzki 1977). First data on the brain size of corvids were presented by Hrdlička (1905) and Lapicque & Girard (1905). Subsequent data were contributed by Girard (1908), Doss (1937), Portmann & Sutter (1940), Kortmann & Vischer (1943), Sutter (1943), Portmann (1947), Vaughan (1949), Skvorcovi (1952), Spector (1956), Senglaub (1963) and Míkůvský (1977, 1985a). Foramen magnum area in the Corvidae was measured only by Míkůvský (1985, 1990b). Overall, these authors presented data on the brain size in 20 species and on the foramen magnum area in 6 species of the Corvidae.

In addition, I studied brain size and the foramen magnum area in this family in the Smithsonian Institution in Washington, D.C., in 1997, which resulted in the knowledge of the brain size in 71 species, and of the foramen magnum area in 69 species of the Corvidae. My previous studies were done in the Institute of Zoology of the Martin Luther University in Halle and der Saale, Germany, Natural History Museum of the Humboldt University in Berlin, Germany, and in the National Museum in Prague, Czech Republic.

MATERIAL AND METHODS

Brain size was estimated as endocastual volume. The volume was determined using small, metal particles of different size, up to 0.5 mm in diameter. For detailed description of the method see Míkůvský (1989a, see also Dubrava 1979). The avian brain almost completely fills the cavum cranii (with negligible exceptions of sinus cavernosus and sinus foranom magnum), so that volume of cavum cranii equals volume of the brain. Brain density was 1.03 g/cm³ (Schadnags 1979). Hence, brain volume nearly equals brain mass numerically.
Body size was expressed as body mass. Intraspecific variation in body mass is known to be considerable (Baldwin & Kendrigh 1939, Clark 1979). Nevertheless, standard body mass is known for many bird species (Dunning 1993) and references cited therein. Data on body mass of corvids were taken from Dunning (1993) for the purpose of the present paper.

Foramen magnum area was calculated from maximum dorsoventral and transversal diameters using the formula for the area of ellipses (Bartosh 1981). The diameters were measured with a sliding caliper to an accuracy of 0.1 mm (see Milkovsky 1989a).

Relation between variables was studied by allometric equations $Y = aX^b$, where $X$ is independent variable, $Y$ is dependent variable $a$ is allometric exponent or slope and $b$ is intercept. The coefficients $a$ and $b$ were determined by reduced major-axis analysis (see Searm & Sotcher 1983). The relative coefficient of encephalization was derived from the allometric equation as follows: $Q_e = b - s$ (Milkovsky 1985, 1989b).

RESULTS AND DISCUSSION

Primary data are summarized in Tab 1. As expected, all studied variables were found to be closely correlated with each other (see Tab 2). The relative size of both brain size and foramen magnum area to body mass decrease with increasing body mass, which agrees with previous findings (Milkovsky 1989a,b,c, 1990a,b). Body size and brain size are positively correlated also when the effect of the foramen magnum area is removed ($r = 0.479$, $p = 0.003$, $n = 71$).

Relative size of the foramen magnum (all three dimensions) to the brain size decrease with increasing brain size, which agrees with previous findings (Milkovsky 1990b), where, however, only the foramen magnum area was studied. Body size and foramen magnum area are not correlated when the effect of the brain size is removed ($r = 0.197$, $p = 0.157$, $n = 69$).

Tab 1. Body mass, brain size and foramen magnum dimensions in the Corvidae. $n$ = number of measured brain volumes foramen magnum areas, $S = \text{body mass (g)}$, $E = \text{brain volume (mm}^3\text{)}$, $FM = \text{foramen magnum width (mm)}$, $FH = \text{foramen magnum height (mm)}$, $FA = \text{foramen magnum area (mm}^2\text{)}$, $Q_e = \text{relative encephalization (dimensionless)}$. Author = source of brain size data. All foramen magnum dimensions were measured by JM.

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<td>250</td>
<td>0.067</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td><em>Cyanocitta cristata</em> (Boddart, 1783)</td>
<td>1</td>
<td>100</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>9</td>
<td>250</td>
<td>0.067</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1 Relation between body mass [g] and brain size (mass = volume; g = cm³) in the Corvidae.

Fig. 2 Relation between body mass [g] and the width of foramen magnum [mm] in the Corvidae.
Tab. 2 Regression between individual variables. The values refer to the following equation: $\log Y = \beta_0 + \beta_1 \log X$. Standard errors for $\beta_0$ and $\beta_1$ are added in each case. All correlations ($r$) are significant at $p < 0.001$. $n =$ number of species.

<table>
<thead>
<tr>
<th>Variable</th>
<th>$X$</th>
<th>$\beta$</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain volume</td>
<td>Body mass</td>
<td>$-0.859 \pm 0.1030$</td>
<td>$0.664 \pm 0.0437$</td>
</tr>
<tr>
<td>Foramen magnum width</td>
<td>Body mass</td>
<td>$0.357 \pm 0.0388$</td>
<td>$0.184 \pm 0.0164$</td>
</tr>
<tr>
<td>Foramen magnum height</td>
<td>Body mass</td>
<td>$0.783 \pm 0.0481$</td>
<td>$0.253 \pm 0.0264$</td>
</tr>
<tr>
<td>Foramen magnum area</td>
<td>Body mass</td>
<td>$0.325 \pm 0.0785$</td>
<td>$0.436 \pm 0.0332$</td>
</tr>
<tr>
<td>Foramen magnum width</td>
<td>Brain volume</td>
<td>$0.597 \pm 0.0125$</td>
<td>$0.269 \pm 0.0173$</td>
</tr>
<tr>
<td>Foramen magnum height</td>
<td>Brain volume</td>
<td>$0.416 \pm 0.0151$</td>
<td>$0.370 \pm 0.0209$</td>
</tr>
<tr>
<td>Foramen magnum area</td>
<td>Brain volume</td>
<td>$0.808 \pm 0.0234$</td>
<td>$0.639 \pm 0.0225$</td>
</tr>
<tr>
<td>Foramen magnum height</td>
<td>Foramen magnum area</td>
<td>$0.213 \pm 0.0200$</td>
<td>$0.422 \pm 0.0148$</td>
</tr>
<tr>
<td>Foramen magnum height</td>
<td>Foramen magnum width</td>
<td>$-0.108 \pm 0.0200$</td>
<td>$0.572 \pm 0.0147$</td>
</tr>
<tr>
<td>Foramen magnum width</td>
<td>Foramen magnum width</td>
<td>$-0.288 \pm 0.0611$</td>
<td>$0.227 \pm 0.0779$</td>
</tr>
</tbody>
</table>

An interesting new observation is that the shape of foramen magnum changes with both body size and brain size in a predictable manner. The slope of the regression is higher in the height than in the width of foramen magnum in both cases. This means that relative height of the foramen to its width increases with both increasing body size and brain size. Foramen magnum is flat in smallest corvids, and almost rounded in largest ones.

Evolution of encephalization within the family Corvidae has not been studied as yet. The data presented here are obscured especially by inaccurately estimated standard body masses for some species (which is indicated by outlying Q-values; see Tab. 1). In spite of these limitations, the data indicate the following: All south-east Asian genera (Dendrocitta Gould, 1833, Urocissa Cebanis

![Fig. 3](image-url) Relation between body mass [g] and the height of foramen magnum [mm] in the Corvidae.

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Fig. 4 Relation between body mass [g] and foramen magnum area [mm²] in the Corvidae

Fig. 5 Relation between brain size [mass = volume, g = mm³] and the width of foramen magnum [mm] in the Corvidae
Fig 6: Relation between brain size [mass = volume \( g = \text{mm}^3 \)] and the height of foramen magnum [mm] in the Corvidae.

Fig 7: Relation between brain size [mass = volume \( g = \text{mm}^3 \)] and foramen magnum area [mm] in the Corvidae.
1851, and Cula Bore, 1826) and the African genus *Ptiloxenous* Swannson, 1837 have very low encephalization ($Q_e<0.4$). Most Holarctic genera (*Pica* Brisson, 1760, *Patoeces* Fischer, 1821, *Naupagra* Brisson, 1760, and *Cyanopica* Bonaparte, 1850) have high encephalization ($Q_e>0.1$), while both species of the genus *Pyrhocrax* Tuntall, 1771 fall far outside the predicted range (see Table 1). The encephalization of *Corvus* Linnaeus, 1758 species ranges widely (probably as the result of insufficiently known body masses of some species), but most species fall in the range $Q_e = 0.4-0.6$, being thus comparable to the Holarctic genera. Neotropical genera of the Corvidae have highly variable encephalization, which is difficult to interpret without additional data. Further analysis of the evolution of encephalization within the family Corvidae depends on the clarification of the phylogeny of corvid genera.

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**References**

Baldwin S P & Kendeigh S C 1938 Variations in the weight of birds *Auk* 55 416-467


Clark G A 1978 Body weight in birds: a review *Condor* 81 193–202


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Observations on some acanthocephalans of fishes from Hubei Province, central China

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Abstract. The present paper comprises a systematic survey of acanthocephalans based on helminthological examinations of 176 specimens of 22 species of freshwater fishes from the Yangtze River in Hubei Province, central China, collected during the autumn of 2001. The following 4 species were recorded: Pallasentis (Nosematid) cana (Van Cleave, 1928), Hebesoma violaceum Van Cleave, 1928, Brevisentis yangtzeensis Yu et Wu, 1989 and Heteroventer parasitarius Yin et Wu, 1984. Data on their morphology, morphological variations, host range, prevalence, intensity and distribution are provided. The first SEM studies of H. yangtzeensis and H. parasitarius revealed some additional morphological details. The presence of minute spines on the posterior end of the body found in the latter species, has not yet been reported for any Heteroventer spp. The finding of H. parasitarius in P. notatus represents a new host record. All parasites from this zoogeographically interesting region are briefly described and illustrated.

Distribution, morphology, Acanthocephala, Brevisentis, Hebesoma, Heteroventer, Pallasentis, freshwater fish, China

INTRODUCTION

This paper is a continuation of the authors' earlier work (Moravec et al. 2003a, b) presenting the results of the systematic evaluation of fish helminths collected by the Chinese-Czech research team in central China in the autumn of 2001. Whereas the previous papers treated the trematodes and cestodes (Moravec et al. 2003a) and nematodes (Moravec et al. 2003b), the present paper deals with fish acanthocephalans. Partial data based on the same material have been published by Moravec & Nie (2002) and Moravec & Wang (2002).

MATERIALS AND METHODS

A survey of the fish hosts examined and their localities have already been given in the paper by Moravec et al. (2003a). The acanthocephalans were washed in physiological saline and then fixed, slightly pressed under the glass, in cold 4% formaldehyde. For light microscopic examination the acanthocephalans were stained in carmine, dehydrated through an ethanol series and mounted in Canada balsam as permanent slides. Drawings were made with the aid of a Zeiss drawing attachment. Specimens used for scanning electron microscopy (SEM) were postfixed in 1% osmium tetroxide, dehydrated through a graded alcohol series, critical point dried and sputter coated with gold; they were examined using a JSM-6300 scanning electron microscope at an accelerating voltage of 15 kV. The specimens were deposited in the Helminthological Collection of the Institute of Parasitology, Academy of Sciences of the Czech Republic (ASCR), in Ce~n~ Bud~jovice and in the Institute of Hydrobiology, Chinese Academy of Sciences, in Wuhan. All measurements are in micrometres unless otherwise stated. The scientific names of fishes are according to Froese & Pauly (2001)
REVIEW OF SPECIES

Quadrigynidae Van Cleave, 1920

*Pallaisentis (Neosentis) celatus* (Van Cleave, 1928)
*(Fig 1)*

**Description** Body cylindrical, tapering at both ends. Proboscis composed of anterior knoblike portion bearing hooks and posterior smooth neck. Collar spines forming six complete rings each consisting of 28–35 spines. Trunk spines arranged in about 12 complete transverse rings each consisting of 30–38 spines, and a few additional incomplete rings. Both collar and trunk spines consisting of relatively small spine proper and its sclerotized, variously shaped, comparatively large bed. Proboscis receptacle short, cephalic ganglion located at its posterior half. Proboscis armed with four circles of eight hooks, hooks provided with marked oval roots forming anterior process, size of hooks posteriorly decreasing. Lernisci long.


**Host** *Monopterus albus* (Zouave) (Synbranchiformes Synbranchidae)

**Site of Infection** Intestine

**Locality** Honghu Lake and Liangzi Lake, both Hubei Province (29 and 30 September 2001)

**Prevalence and Intensity** He'anghu, L. in 3 of 7 fish examined, 2–8 (mean 5) acanthocephalans per fish Liangzi L., 59% (19/32), 1–43 (mean 9).

**Comments** The morphology of the present specimens corresponds on the whole to the original species description by Van Cleave (1928) and redescription by Moravec & Sey (1989).

The definitive host of *P. celatus* is the swamp catfish *Monopterus albus* (Synbranchidae) but in China (Beijing, Provinces Fujian, Hunan, Hubei, Liaoning and Yunnan) it is also recorded from many other fish species: Cyprinidae *Ctenopharyngodon idella*, Culter cyprinoides, *Cyprinus carpio*, *Erythroculter dabryan*, *E. erythropterus*, *E. mongolicus* and *Luciobarbus macrolepidotus*, Cobitidae *Misgurnus anguillicaudatus*, Bagridae *Pelteobagrus fulvidraco* and *P. saictellus*, Suidae *Sus scrofa* and *S. scrofa* "*S. scrofa*". Anguillidae *Anguilla japonica* and *Ecodea* *Hypselocephalus svenhawii* (Van Cleave 1928, Wang 1966, Chen 1973, Wang 1981, Yin & Wu 1984, Yu & Wu 1989, Wu et al. 1991). Wang (1981) reported it also from some amphibians and reptiles. In addition to China, this parasite is found in *M. albus* in North Vietnam (Moravec & Sey 1989).

The life cycle of *P. celatus* is unknown. It is not known whether all the above mentioned fish species serve as the true definitive hosts of this acanthocephalans species.
Fig. 1. *Pallivomax (Neovomax) celatus* (Van Cleave) A. male  B. anterior part of male body  C. male proboscis  D. posterior end of female  E. egg  F-I. first second third and fourth hooks respectively. Scale bars in mm.
Neoechinorhynchidae Ward, 1917

*Hebesoma violatum* Van Cleave, 1928

(Fig. 2)

**Description.** Body small, robust, markedly broad; body wall with heavily developed muscular thicken, with gtm nuclei indistinct. Proboscis almost spherical, mostly retracted without invagin into anterior part of body cavity, less often invagin into proboscis receptacle. Proboscis with hooks arranged in 6 spiral rows, each formed by 3 hooks; anterior hooks strongly reared with conspicuous broad root, considerably larger than middle and posterior hooks. Proboscis receptacle short, single-layered, with nerve ganglion at bottom. Neck very short. Lemnisci narrow, each with 1–2 distinct nuclei.


*Female (6 gravid specimens):* Body (trunk) 1,727–2,570 long, its maximum width 938–1,86 Proboscis 150–177 long, 150–163 wide; length of anterior hooks 87–90, of middle hooks 24–34, of posterior hooks 15–18. Proboscis receptacle 245–272 long and 150–204 wide. Both lemnisci 87 long and 82 wide. Eggs numerous, size 30–36×12, occupying most space of body.

**Hosts.** *Squalerella chuatsi* (Bastlewyksy) (Perciformes: Percichthyidae) and *Odontobutis obscura* (Temminck et Schlegel) (Perciformes: Odontobutidae).

**Site of infection.** Intestine

**Locality.** Baolian Lake, Hubei Province (27 September 2001).

**Prevalence and intensity.** *S. chuatsi* in all 5 fish examined: 6–32 (mean 14) acanthocephalans per fish. *O. obscura* in 4 of 7 fish; 1–4 (mean 3).

**Comments.** Most specimens of *H. violatum* were immature, up to about 0.5 mm long, which is associated with the seasonal maturation cycle of this acanthocephalan. The morphology of the available fully mature specimens, all from *S. chuatsi*, is, more or less, in accordance with original description of this species given by Van Cleave (1928), although their body size and as large as reported (males and females up to 3.5 mm and 5.0 mm, respectively). Since the type of *H. violatum* is *S. chuatsi* and the type locality is Wuhan, China, there is no doubt that specimens of the present material belong to this species.

In China (Provinces Fujian, Hubei, Hunan and Zhejiang), *H. violatum* has been reported in many fish species of the Percichthyidae: *Squalerella chuatsi*; Odontobutidae: *Odontobutis obscura*; Gobiidae: *Ochotogobius elongatus* and *Rhinogobius girinorus*; Cottidae: *Cottus gobio*; Anguillidae: *Anguilla japonica*; Stiuridae: *Stiurus asotus*; and Cyprinidae: *Acheilognathus hypselonotus* (Cuvier), *C. erythrophrys*, *C. mongolica*, *C. oxycephalus*, *C. carpio*, *Elophichthys bambusa*, *Hemiculter leuciscus*, *Mylopharyngodon piceus*, *Squalodraca curviscutalis*, and *Zacco platy* (Van Cleave 1928, Wang 1966, 1981, Chen 1973, Yu & Wu 1989, Wu et al. 1991). It has also been reported from the Russian Far East (Amur River drainage system) from *S. chuatsi*, *C. gobio*, *Percottus glehni* (see Bychkovskiy 1962). It is not known whether this parasite can attain full maturity and produce eggs in all of the above mentioned host species; it may well be that such hosts are only transport, paratenic or paradoctive hosts of this parasite. *S. chuatsi* seems to be the principle definitive host.
From Bao’an Lake, *H. violenter* has already been reported by Wu et al. (1991) from *S. chuatsi* (prevalence 40%, intensity up to 151 specimens), *O. obscurus* (25%) and *C. erythropterus* (15%). The present data confirm a high degree of infection by this parasite in *S. chuatsi* in this locality. The life cycle of *H. violenter* is so far unknown.

Illiosentidae Golvan, 1960

*Brentisentis yangtzensis* Yu et Wu, 1989

(Figs 3, 4)

**DESCRIPTION.** Body cylindrical, slightly broader in anterior third. Proboscis more or less claviform long, armed with hooks arranged in 18–19 longitudinal rows of 16–19 hooks each; subterminal hook

![Diagram of *Brentisentis yangtzensis*](image)

Fig. 2. *Helicometra violenter* Van Cleave. A – gravid female, B – male, C – male proboscis, D – juvenile male, E – egg, F–H – anterior, middle and posterior hooks. Scale bars in mm.
Fig. 3. *Bravivertus yangzeensis* Yu et Wu. A – male; B – male proboscis; C – female proboscis; D – first hook, E – second hook; F – hook from middle region of proboscis; G – last hook; H – egg. Scale bars in mm.
largest; basal hooks more slender compared to others, longer than middle hooks. Neck short. Anterior end of trunk armed with 5–8 complete and 1–3 incomplete circles of thick spines; ventral spines more numerous, extending more posteriorly than dorsal spines. Proboscis receptacle two-walled, markedly long, narrow; oval cephalic ganglion located at anterior end of receptacle. Lemnisci long, narrow, exceeding posteriorly proboscis receptacle.


Female (10 gravid specimens): Length of trunk 5,712–7,657, maximum width 653–816. Length of proboscis including neck 952–1,343, maximum width 190–258. Length of anterior hooks 48–51, of subapical hooks 66–72, of middle hooks 45–54, and of basal hooks 57–60; hooks arranged in 18

Fig. 4. *Brevicercus yangzeensis* Yu et Wu, SEM micrographs. A – proboscis and anterior part of trunk, lateral view; B, C – proboscis, apical and dorsal views.
Fig. 6  *Heterosentis parvithor* Yin et Wu. SEM micrographs. A – proboscis, lateral view; B – proboscis and anterior part of trunk; C – spines on anterior part of trunk; D – proboscis, apical view; E – minute spines on posterior end of trunk.
longitudinal rows of 18–19 hooks each. Trunk spines 15–30 (including their submerged parts 245) long. Proboscis receptacle 1,537–2,054 long and 150–245 wide. Lemnisci 2,244–2,584 long and 68–95 wide. Posterior end of body rounded. Entire body cavity filled with large number of eggs measuring 57–63×12–15.

HOSTS. Leioacanthus cassilabris Günther and L. longirostris Günther (both Siluriformes: Bagridae).

SITE OF INFECTION. Intestine.

LOCALITY. Yangtze River at Wuhan (2 October 2001).

PREVALENCE AND INTENSITY. L. cassilabris: in 7 of 8 fish examined; 1–88 (mean 36) acanthocephalans per fish. L. longirostris: in both of 2 fish examined; 1 and 7.

COMMENTS. The general morphology of specimens of the present material agrees, more or less, with the original description of B. yangtzei (see Yu & Wu 1989); however, they differ in having somewhat more numerous longitudinal rows (18–19 vs. 17) of proboscis hooks and smaller eggs (57–63×12–15 μm vs. 68–78×13–16 μm). But these differences can be considered to be within interspecific variability; taking into account the fact that the present material originates from the same host species and the same river, there is no doubt that these worms belong to B. yangtzei. A very interesting feature of this species, not mentioned in the original description, is the situation of the cephalic ganglion at the anterior end of the proboscis receptacle.

This species was previously recorded only by Yu & Wu (1989) from the catfishes Leioacanthus longirostris (type host), L. cassilabris, Pelleobagrus fulvidraco and Sinarhynchus asotus and some other fishes from the middle reaches of the Yangtze River (Hubei Province), by Wang et al. (1989) in the Wujiang River, a tributary of the upper reaches of the Yangtze River, and by Fang (1990), who had studied its population biology. The present data confirm the high degree of infection by the parasite of catfishes in this river found by Yu & Wu (1989).

**Arythmacanthidae Yamauchi, 1935**

**Heterosentis parasiliuri Yin et Wu, 1984**

(Figs 5, 6)

**DESCRIPTION.** Body fusiform. Proboscis composed of anterior oval portion bearing hooks on a posterior smooth neck. Proboscis hooks of two types differing markedly in size: anterior larval hooks (anteriormost hooks somewhat shorter than others) with long, slender blades and well-developed, posteriorly directed simple roots, arranged in 6 spiral rows of 7 hooks each; posterior small hooks in 13 longitudinal rows of 2–3 hooks each. Neck short. Anterior part of trunk densely covered by numerous small, posteriorly oriented spines; minute spines irregularly scattered on posterior end of trunk (Fig. 4E). Proboscis receptacle short, double-walled; large oval cephalic ganglion located at base of receptacle. Lemnisci short, saccular.


HOSTS: *Pelteobagrus mutius* (Sauvage et Dabry de Thiersant), *P. vacheli* (Richardson) and *Leiocassis crassilabris* Günther (all Siluriformes, Bagridae)

SITE OF INFECTION: Intestine

LOCALITY: Yangtze River at Wuhan, Hubei Province (2 October 2001)

PREVALENCE AND INTENSITY: *P. mutius*: 1 of 2 fish examined, 1 specimen *P. vacheli*: 1 of 8; *L. crassilabris*: 1 of 8, 26

COMMENTS: The morphology of specimens of the present material corresponds, more or less, to that of *H. parasitum* and, therefore, they are considered to belong to this species. In contrast to the original description, their body is generally somewhat smaller, which is evidently due to the fact...
that all are young worms (females non-gravida) The presence of minute spicules on the posterior end of the body has not previously been reported for any Heterosentis spp., in this, H. parasita resembles some species of the families Illosentidae and Rhadomorhynchidae

This species was described by Yin & Wu (1984) from specimens found in the catfishes Sillago mindorica (type host), S. soldaati, L. abusus, S. soldaati, L. brachimbo, and L. longirostris of the Liulhe and Yangzte Rivers in Liaoning Province. Later Yu & Wu (1989) recorded this species from fishes of the middle reaches of the Yangzte River and immature forms in the catfishes L. mizaki, P. eugonon, P. venellus, and M. acrpaefolius, and seven species of Bogaeidae (Coris, Myctoepus, Pteronurus, Rhyporhina), Cobidae (Leptobrakia and Aepycobidae). The present finding of H. parasita in P. niutius is a new host record.

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REFERENCES


Morgan F & Nie J P 2002. Observations on two species of phylodistome (Trematoda: Procolsentidae) from fish of the Hubei Province, central China with an erection of Neophylodistomum gen. n Helminthologiae 1 221-225


Morgan F Nie P & Wang G 2003b. Some nematodes of fishes from central China with the redescription of Helminthidae (Class). Theristotes and Paranectes (Nematoda). Fish Paricol. 68 220-229


Taxonomic status of *Acarystus* (Coleoptera: Carabidae: Harpalina) and description of the larva of *Harpalus (Acarystus) flavescens*

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Abstract First and second larval instars of *Harpalus flavescens* (Piller et Mitteracher, 1783) are described and illustrated. Additionally, a differential diagnosis of the subgenus *Acarystus* Reitter 1908, based on both larval and imaginal characters, is provided. A unique larval feature was found to be the densely thorny pleural parts of the metasomata and abdominal terga I-VIII(IX). Finally, the taxonomic significance of subgenus *Acarystus* and *Loboharpalus* Schaeffer, 1932, are demonstrated and discussed.

**Larval taxonomy, preimaginal characters, Coleoptera, Carabidae, Harpalus, Acarystus Loboharpalus, Palaeartic region**

INTRODUCTION

Recently, the larval taxonomy of the genus *Harpalus* has been summarized and data provided for the differential larval diagnosis of the subgenus *Harpalus* (Hůrka & Papoušek 2002). Therefore, the purpose of the paper is to describe the larval stage of *Harpalus flavescens*, to provide a differential diagnosis of the subgenus *Acarystus* in both larval and adult stages as well as to discuss taxonomic significance and relationships with *Loboharpalus*.

**MATERIAL AND METHODS**

Two larval instars of *Harpalus flavescens* (10 L1, 3 L2) were reared ex ovo in 1993 and 1994 following a technique described by Hůrka (1996). The parental pairs were found in central Bohemia, Tuháč (district Mělník, code of mapping square 5573, for details see Pramer & Mika 1996) 16.4.1992 and 12.6.1993, K. Hůrka.

Twelve first instar larvae were collected from a sandbank of the river Tisa near Male Traškany (876 m) in southeastern Slovakia on 7.7.1989, D. Král & J. Vítovský.


All the above-mentioned larvae have been deposited in the Collectio Hůrka of the Charles University, Prague, Department of Zoology. The notation of setae and pores follows those of Bouček & Goudi (1994) - Bouček (1985).

The larval descriptions of *H. (Loboharpalus) planus* Bates, 1873 by Habe & Sada (1970) and of *Acarystus deput splendidus* (Geihe, 1829) by Puchkov (1992) have been used.
DESCRIPTION OF LARVA

_Harpalus (Acarydus) flavescens_ Latreille, 1804
(Figs 1–18)

**First instar**

**Habitus and color.** Head capsule and pronotum conspicuously broad and transverse; lobes yellow-brown, nasale, retinaculum and apex of mandible dark brown. Width of head capsule 2.20–2.25 mm (M–2.06 mm, n=10) in reared larvae, 1.99–2.32 (M–2.21 mm, n=12) in collected larvae.

**Microsculpture.** Weak isodiametric microsculpture on frontale, transverse, narrow isodiametric microsculpture on abdominal scuta II–VIII; granulated microsculpture on pronotal prescutum and postscutum and on postscuta of mesonotum and metanotum, pointed and granulated microsculpture on abdominal postscuta I–IX; pointed and multipointed microsculpture on anterior part of metanotum and on abdominal scuta I–IX.

**Chaptostryx.** Head: Except for ancestral chaetotaxy 2–5 (3) additional setae on dorso-lateral surface on each side of frontale, 1 (2) pronounced and many diminutive setae or pores on place of inner stemmatal furrows, anteriorly seta PA4, 1 or more setae or pores on place of inner stemmatal furrows (frequently one seta and one pore) posteriorly seta PA4, setae PA4–PA5 very short, setae PA5 5–6 times as long as seta PA4, as long as coronal suture, setae PA4 more than two times as long as seta PA5, group gM2 consists of 8 or 9 thick and more than 70 thinner setae. Thorax: Except for ancestral chaetotaxy 11–12 additional spiniform setae on either side of anterior femora, setae on apex of tarsus markedly spiniform. Except for ancestral chaetotaxy on abdominal terga: one additional seta near TE1, 1–2 setae near TE6, 1 additional seta between TE5 and TE6, sometimes 1 seta between TE6 and TE7. Seta TE6 as long as seta TE1 (Fig. 8). Some setae pores irregularly developed.

**Head.** (Fig. 1) distinctly transverse (index width/length 1.50); nasale (Fig. 2) protruding, not reaching the top of adnasalia, with 13–16 central, and two lateral teeth on each side twice as long as the others, ventral row consists of 39–40 teeth; cervical grooves bent, reaching the level of seta Pa4 on dorsal side, not reaching the ventral side; coronal suture as long as antennomere II; egg base consists of 5–10 small, irregular teeth on each side of frontale. Antennae (Fig. 3) rather short, antennomere IV small and short, as long as width of antennomere I; mandible (Fig. 4) triangular, 2.5 times as long as basal width, with one small swelling in front of retinaculum, penicillus present.

**Maxillae.** (Fig. 5) slender, stipes more than 4 times as long as wide; lacinium (Fig. 6) slender, digitating reaching the level of one fifth of palpomere I, distinctly bifid at apex.

**Thorax.** Pronotum transverse but not as wide as head; legs (Fig. 7) strongly developed and hairy claws unequal, anterior curved, more than twice as long as posterior in the first pair and distinctly longer than posterior in other two pairs. Pleural parts of metanotum densely thorny.

**Abdomen.** Pleural parts of segments I–VIII(IX) densely thorny. Urogomphi subparallel, as long as width of mesum IX or longer, and longer than length of anal tube. Setae Ur1 as long as urogomphi, seta Ur6 relatively long. Near (below) pores Ur6Kf and in place of Ur6Kf sometimes a short beak-like sensilla (Fig. 9).

**Second instar**

Same character states as in first instar except for the following: Width of head capsule 2.35–2.44 mm (M=2.40 mm, n=3).

**Microsculpture.** Isodiametric microsculpture on head and thoracic scuta, granulated microsculpture on pronotal prescutum and postscutum and on postscuta of meso- and metanotum, pointed microsculpture on abdominal scuta.
Figs 1–9. *Harpalus flavescens* (Puller et Mitterpacher). First instar larva: 1 — head capsule (dorsal view); 2 — nasale; 3 — antenna; 4 — mandible; 5 — maxilla; 6 — labium; 7 — first leg; 8 — abdominal tergum I; 9 — urogomphi.

Scales: 0.5 mm (Figs 1, 8, 9); 0.3 mm (Figs. 3, 4, 5, 6, 7); 0.2 mm (Fig. 2).
CHAETOTaxy. Head (Fig. 10): 4–5 secondary setae on inner side of antennomere I and antennomere II, 2–3 secondary setae neighbouring the apex of antennomere III (Fig. 12), 5–6 setae on outside of sipes (Fig. 14), 2 (3) secondary setae neighbouring the apex of labial palpomere I, 9–10 setae on dorsal-lateral surface of prementum (Fig. 15), 2–3 setae on place of inner and 2–3 setae on place of outer stemmatial furrows. 1–2 secondary setae between the setae PA_{I}; and setae PA_{II}; anteriorly the setae PA_{I}, 1–2 setae on each side of frontae on the place of egg burster of first star. Row of small secondary setae on pores along cervical suture and coronal sulcus. Many secondary setae between setae PA_{II} and setae PA_{III}. Thorax: Many secondary setae along notal carina and anterior, lateral and posterior margins of pronotum, 6–7 secondary setae on each side of stouter femora excepting ancestral and additional chaetotaxy in first instar larva. Abdomen: Terga (Fig. 17) with 3–4 secondary setae neighbouring setae TE_{I}, and setae TE_{II}, 1 secondary setae neighbouring TE_{II}, 2 secondary setae neighbouring TE_{III}; 3–4 secondary setae neighbouring TE_{I} laterally and 3–4 secondary setae between TE_{I} and TE_{III} except for ancestral and additional chaetotaxy in first instar larva. Urogomphi (Fig. 18) with 6 longer (UR_{III}), 1 shorter (UR_{II}) and some small secondary setae, UR_{I} 0.3–0.4 as long as UR_{II}, UR_{I}<0.4 a little shorter than UR_{II}. Thorax: Prothorax distinctly wider than head; legs (Fig. 16) with anterior claw nearly half long as posterior claw in the first pair and only a little longer than posterior claw in other tarsus pairs. Thorns of pleural parts of metanotum smaller.

Abdomen. Thorns of pleural parts of abdominal segments smaller. Urogomphi nearly as long as anal tube.

DIAGNOSIS. First and second larval instars of Acarystus Reitter, 1908 differ from species of the subgenera Artabas Gozis, 1882, Harpalus Latreille, 1802, Loboharpalus Schauberger, 1922 and Semiophonus Schauberger, 1933 by having densely thorny pleural parts of metanotum and of abdominal segments I–VIII (IX) (pleural parts are in these subgenera smooth or at most sparse granulated). Second instar differs from Loboharpalus also by additional setae on frontae and urogomphi and by more scaly chaetotaxy of abdominal terga. From Artabas, Harpalus and Semiophonus differs Acarystus in the second instar also by additional setae on urogomphi Acarystus, Artabas and Loboharpalus differ from Harpalus and Semiophonus in L by 3–5 additional setae on antennomere I (0–2).

Acarystus and Loboharpalus differ from Artabas, Harpalus and Semiophonus in L by 2–3 additional setae on antennomere III (0).

DISCUSSION

Reitter (1908: 172) determined the subgenus Acarystus for four, evidently unrelated, species: Harpalus rufus Brüggemann, 1873 (= H. flavescens Piller et Mitterpacher, 1783), H. pygmaeus Dejean, 1829, H. antennatus Stephens, 1828, and H. aratus Latreille, 1804. These species share the following common features: side margins of pronotum below middle with only one setiferous puncture; outer elytral intervals without fine punctuation; penultimate and preceding abdominal ventrites except for 2 setiferous punctures smooth and glabrous; pronotum cordate, posterior angles more or less rectangular; elytra with a small, fine hemeral tooth, surface shiner in males, duller in females. Reitter did not designate the typus subgeneris; however, according to the sequence of species, H. rufus represents the valid typus subgeneris.

Schauberger (1926: 42) elevated Acarystus to the generic level based on the special morphology of protibiae. Tibiae are flat and broadened apically, row of spines on ventral side joining gape of spines on outer edge. Schauberger divides the genus in three subgenera: Phylgos Motschulsky, 1848 (= Neophylagos Noeman, 1976), Haplooharpalus Schauberger, 1926, and Acarystus s. str. The
Figs 10–18. *Harpalus flavescens* (Piller et Mitterpacher). Second instar larva: 10 – head capsule (dorsal view), 12 – antenna, 13 – mandible, 14 – maxilla, 15 – labrum, 16 – first leg, 17 – abdominal tergum 1. 1 urogomph. Scales: 0.5 mm (Figs 10, 17, 18), 0.2 mm (Figs 12, 13, 14, 15, 16), 0.2 mm (Fig. 11).
genus *Acardystus* sensu Schauburger, 1926 is evidently not a monophyllum. Additionally, *Nephyxus* has been elevated to the genus level by most authors (e.g. Kataev 1995, Lorenz 1988), whereas *Haploharpalus* and *Acardystus* are treated as subgenera of *Harpalus* or as the species groups (species aggregates) *H. inquinus* and/or *H. flavescens*.

Schauberger (1926: 45) defined the subgenus *Acardystus*, compared to *Haploharpalus*, as follows: flat, red-yellow, pronotum cordate, first elytral interstria roof-like lifted, third elytral interstria without setiferous puncture, metapodal epitarsus shortened.

Habu (1973: 133), followed by Noonan (1976: 35), synonymized *Loboharpalus*, described for *H. platynotus* Bates, 1873, as a type species and for *H. rubefactus* Bates, 1873 and *H. lohosi* Tschitscherine, 1898 with *Acardystus*, as both having prothorax dilated at outer apical angle in the adult stage, a row of spines on anterior outer margin composed of rather many spines, and the tarsomere 5 setose on ventral side. Nevertheless, constant morphological differences exist between both groups in the arrangement of rows of spines on ventral side of prothorax, in chaetotaxy of third elytral interval and in morphology of aedeagus including inner sac. In *Loboharpalus*, rows of spines separated from preapical spines is on outer edge of the tuba, one setiferous punctum elytral interval 3 is present in *Acardystus*, both protubial rows of spines are joined in one row; one setiferous puncture in the third elytral interval is present only rarely, and is only one sided. Kane et al. (2003, 384) treated *Loboharpalus* as a subgenus of *Harpalus*.

Habu & Sadanaga (1970) described the larva of *H. (Loboharpalus) platynotus*; Habu (1973: 9, 12) distinguished it from the larvae of four species of the subgenus *Harpalus* s. str by its prementum being longer than wide and by its chaetotaxy of urogomphi: generally 5–6 (rarely 7–8) long setae besides distinct apical seta (URs) in L2, and 6 long setae besides relatively long apical setae in L1, epiphragma with 2 distinct secondary setae near P1 (P1).

The larva of *H. (Acardystus) flavescens*, described here, also have a long prementum (Fig. 6, 15); however, they do not have 2 additional setae near P1 (Fig. 1) and only have 5 long setae (Fig. 9) in L1. In L2, additional setae are not only present on parastyle also on frontal (Fig. 10), urochaetae with 12 (13) long setae besides URs (Fig. 18) and secondary chaetotaxy on abdominal terga more scanty (Fig. 17).

According to Habu (1973: 9, 12) larvae of *Harpalus* s. str have prementum that at most only a little longer than wide and urogomphi with 9 long setae in L2, and in L1 urochaetae bear 5 long setae besides short apical seta, epiphragma without secondary setae. Detailed larval diagnosis of the subgenus *Harpalus* has recently been given by Hürka & Papoušek (2002). The most important feature of *H. (Acardystus) flavescens*, which is not found in any larva of the subgenus *Harpalus* studied, are the densely thorny pleural parts of metanotum and of abdominal segments I–VIII(X) in both larval instars, and thorns that are longer in the first instar than in the second.

Both larval and imaginal features, based on the species *H. flavescens* and *H. platynotus*, provide evidence for the taxonomic significance of the taxa *Acardystus* and *Loboharpalus*.

Larval stage of *H. (Acardystus) flavescens* and of *H. (Loboharpalus) platynotus* has only two larval instars. Nevertheless, the presence of two instars is a convergent adaptation of carabids living in substrates which easily desiccate, i.e. sand, and is known in different genera and tribes of Carabidae (e.g. *Anocerus* (*Terrophelina*) *exmaculata* (Fabricius, 1787), *H. (Harpalus) automolus* (Deutschschmid, 1812), species of the subgenus *Xenocela* Hieke, 2001). In larvae of these taxa, the convergent increasing of bristles and setae is also obvious. Adaptation to living in loose substrates in the adult stage manifests itself in the dilatation of fore tibia at outer apical angle, in increasing of spines and bristles, and eventually in the yellow coloration of the adults live in the ground.
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REFERENCES


Ultrastructure of labial glands of *Scolytus intricatus*
(Coleoptera: Curculionidae: Scolytinae)

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Abstract: The paired labial gland is located only in the head in adults of *Scolytus intricatus* (Ratzburg 1837). Both glands open symmetrically in the submaxilla. Secretory cells are of only one type. The main cytoplasmic organelle is smooth endoplasmic reticulum, Golgi apparatuses and rough endoplasmic reticulum are present in smaller amounts. Mitochondria are numerous and usually associated with well-developed basal invagination. The secretary cells are smaller in males. As the glands are not involved in production of proteronaceous substances, their secretion is possibly for either self-protection or regulation of gut chemical parameters.

Ultrastructure, labial gland, smooth endoplasmic reticulum, Golgi apparatus, Coleoptera, *Scolytus*

INTRODUCTION

The labial glands of Coleoptera are paired tubular organs emptying into the pharynx by a common duct (Grasse 1949). They are usually very long, up to six times longer than the whole body. Coccinellidae (Coleoptera: Polyphaga); shorter (located only in head) and star-like in cross section in Staphylinidae (Coleoptera: Polyphaga). Labial glands are completely lacking in Coleoptera Adephaga (Grasse 1949). Two functions of the labial gland secretion are mentioned by Gré (1949): production of either silk or digestive enzymes. In *Rhynchophorus palmarum* (Linnaeus 1764), the labial glands are strongly modified and produce an aggregation pheromone (Sánchez et al. 1998).

Pheromones of bark beetles in general are produced in the hindgut but there are two source *Scolytus multistriatus* (Marsham, 1802) (see Gore et al. 1977).

There is a surprising disproportion in the many papers dealing with communicative substances in Scolytidae and the few on organs responsible for the production of these chemicals. Moreoover little work has been done on labial glands in Coleoptera, in general. The aim of this study is to describe the fine structure of labial glands as potential source of communicative substances.

MATERIAL AND METHODS

All individuals of *Scolytus intricatus* (Ratzburg, 1837) originated from branches cut from oak trees (*Quercus robur*) growing near Khrvoklán (45 km west of Prague, Central Bohemia). The branches were collected on October 28th, 2000, and kept outside till February 3rd, 2001. Then they were transferred to a laboratory temperature...
22±2°C until imaginal emergence. After emergence, some beetles were placed in plastic boxes containing coleoptile for maturation feeding. The fixation of animals started on February 27th, 2001. Whole heads of male and female beetles (both of individuals freshly emerged and after maturation feeding) were fixed in a mixture of formaldehyde (10%, E-M grade), glutaraldehyde (8%, E-M grade) and phosphate buffer (0.2M, pH=7.2) in a ratio of 1:2, respectively. After 2 days of fixation at laboratory temperature, the samples were washed in phosphate buffer (0.1M, pH=7.2), postfixed in 1.5% osmium tetroxide in phosphate buffer (0.1M, pH=7.2) for 2 hours, washed with distilled water and dehydrated through series of ethanol (50, 75 and 100%). The specimens were embedded in standard Spurr resin. Ultrathin sections (silver to gold) were made using a Retcher Ultracut ultramicrotome and stained with uranyl acetate and lead citrate (standard recipe). They were studied using a JEOL 1010 transmission electron microscope.

RESULTS

Labial glands are tubular, always situated in the ventral part of the head. Their cuticle is medium thick, but the cellular envelope often varies in thickness. Both glands open independently into the posterior part of the salivarium. Each gland is a simple tubular structure, straight or anterior but convoluted posteriorly (Fig. 1).

The gland is formed by a monolayer of secretory cells, which are all similar in appearance (Fig. 2, 3). Secretory cells are apically covered by a cuticle (class I secretory cells according to Nentwich, Quenneveld 1974) from 0.9 to 1.2 mm thick. The cuticle is slightly porous and composed of inner layers, of which the three inner layers are not fully discrete. An electron-lucent outer layer about 25 nm thick, represents the epicuticle. The following layer is about 30 nm thick and electron-dense. The two inner layers probably represent the endocuticle. They are approximately of the same thickness; the median layer is more electron dense than the innermost one. The thickness of secretory cells is highly variable, varying from 1 to 8 mm anteriorly to from 2 to 25 mm posteriorly. The base of the secretory cells is covered by a diffuse basal membrane about 100 nm thick.

The nuclei of secretory cells are irregular, and their largest diameter ranges from 5 to 6 mm. They contain several chromatin aggregates and a rounded nucleolus. All nuclei are situated in the basal region of the secretory cells (Fig. 2). Neighbouring secretory cells are connected by an apical desmosome followed by a septate junction. The connection is limited approximately to the basal third of the cell layer and basally the membranes are free. Most of the secretory cells that consist of smooth endoplasmic reticulum (SER) that forms a tubular system throughout the whole cell (Fig. 4). The tubules of the SER are oriented predominantly apically and their diameter varies from 40 to 50 nm. The apical parts of secretory cells consist of long and dense microvilli with central tubules continuous with the SER. The microvilli are up to 2 mm long and about 100 nm thick. Rough endoplasmic reticulum commonly occurs in the secretory cells, but smaller amounts (Figs 3, 4) Electron dense granules are common in some cells (Fig. 3) but completely lacking in others. Their size is usually about 200 nm and infrequently reach up to 600 nm. Fine dense granules are often degraded by myelin figures. Golgi apparatuses are common but not numerous (Fig. 4). Their size is from 0.5 to 1.5 μm. Secretory cells contain large numbers of small or slightly elongated mitochondria with numerous flat cristae. Mitochondria are localized primarily in the basal parts where they are associated with extensively developed basal invaginations (Figs 3, 4). Basal invaginations are very numerous and may be as long as two thirds the thickness of the secretory cells layer. Small hyaline vacuoles (about 250 nm in diameter) space the basal invaginations (Figs 3, 4) and migrate to the apical part, where they penetrate the plasma membrane. The space between secretory cells and cuticle contains remnants of waste membranes, some fine particles of secretion and small myelinic figures (Fig. 5).

There is sexual difference in the smaller thickness of the secretory cell layer in males, which it does not exceed 20 μm. No differences were observed in relation to age of individuals, which were compared freshly emerged and mature individuals.
DISCUSSION

The structure of labial glands in *Scolytus intricatus* differs from the general scheme described by Grassé (1949). They are relatively small, and located only in the head. A common unpaired outlet is lacking.

The labial glands in *Scolytus intricatus* are very similar in both sexes. The only difference lies in the smaller size of the secretory cells of males. The glands consist of a single type of secretory cell. The most abundant secretory organelles in the cells of labial glands are the smooth endoplasmic reticulum and Golgi apparatuses. Such a cytological organization is typical for pheromone-producing cells (Percy-Cunningham & MacDonald 1987, Vinson 1994, Sánchez et al. 1998, Wenseleers et al. 1998, Billen et al. 2000). Two modes of action of SER are described: (i) transport of material within the cell (Crossley & Waterhouse 1969, Quennedey 1971); (ii) production of small, non-proteinaceous molecules, such as lipidic substances, hydrocarbons or quinones (Eisner et al. 1964, Percy 1974, Lulamne-Cassou et al. 1977, Billen 1987, Billen et al. 1999). Since lipid droplets were not observed within secretory cells, the first possibility appears to be more probable. Electron dense vesicles, produced probably by RER, are degraded by myelinic figures before excluding.

The presence of well-developed basal invaginations indicates an enlarged surface, which enables an increased level of precursor intake from haemolymph (Dominique et al. 1997, Sorour & Larink 1997, Billen et al. 2001). This view is supported by the vacuole flow from the basal invaginations into the cells. Numerous mitochondria present in the cells are regarded as a common feature of highly active organs and may be related to the energetic costs of the transport of secretory products (Billen et al. 2001).

The function of labial glands in *S. intricatus* is not clear but several possibilities may be hypothesized. The gland may produce self-protective (antibacterial or antimycotic) substances or

![Fig. 1. Scheme of organization of labial glands in *Scolytus intricatus* (Ratzeburg) (bar = 1 mm).](image)
Figs 2-5. 2 – posterior part of labial gland in a male of *Scaphyopus auriticeps* (Ratzeburg) (bar = 5 μm); 3 – anterior part of labial gland in a male of *S. auriticeps* (bar = 1 μm); 4 – basal part of labial gland cell in a female of *S. auriticeps* (bar = 1 μm); 5 – apical part of labial gland cell in a male of *S. auriticeps* (bar = 1 μm). White arrows mark rough endoplasmic reticulum, black arrows basement membrane, asterisks hyaline vacuoles divided from basal invaginations, bi – basal invaginations, c – cuticle, g – dense granule, GA – Golgi apparatus, m – mitochondria, mf – myeloid figure, mv – microvilli, n – nucleus, s – fine particles of secretion, SER – smooth endoplasmic reticulum.
chemicals used in communication, e.g., in aggregation or dispersion, sexual stimulation or repellency (against occupation of a chamber). Another possibility is the secretion is used to regulate social chemical parameters, e.g., pH. Production of an aggregation pheromone by modified labial glands is described for *Rhyynchophorus palmarum*. The main organelle of the secretory cell in this case was also SER (Sanchez et al. 1998).

On the basis of previous results, a communicative function of the labial gland secretion may be excluded because the fore parts of the beetles' bodies did not show any measurable FAG response (B. Kalinov, personal communication). On the other hand, labial glands may produce precursors of communicative molecules, which obtain their definite structure during their passage through the gut.

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REFERENCES


Quinn A D 1971 The glandular exocrine secretions of the termite *Zotea Zetlach*, *Entomologia* 121, 27–47.


Nomenclatural changes in the genus *Patrobus*  
(Coleoptera: Carabidae: Patrobinii)

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**Abstract** Treatment of the name *Patrobus septentrionalis* Dejean, 1828 as nomen protectum and *P. algirus* Curtis, 1827 as nomen oblitum is proved, the name *P. circumus* Motschulsky, 1860 is resurrected and a new synonymy is established. *P. australis* Sahlberg, 1873 is regarded to be a new synonym of *P. septentrionalis* Dejean, 1828. *P. tricuspidus* Motschulsky, 1860 and *P. tricuspidus* Casey, 1920 - synonyms of *P. circumus* Motschulsky, 1860, and *P. borealis* Motschulsky, 1844 - synonym of *P. australis* Sahlberg, 1873.

**Taxonomy, nomenclature, synonymy, Coleoptera, Carabidae, Patrobus, Holarctic region**

**INTRODUCTION**

The genus *Patrobus* Dejean, 1821 houses species, possessing the widest ranges of all known patrobinid, only three genera, namely *Archipatrobus* Zamotajlov, 1992, *Diplalus* Motschulsky, 1850 and *Platidius* Chador, 1878 being comparable in this respect. Several congeners from continuous Palaearctic, Nearctic or Holarctic (mainly circumpolar, boreal or hombogenous) ranges, reaching the Lower Arctic. *Patrobus septentrionalis* and related taxa seem to have the largest range, manifesting simultaneously the highest ecological valency. They occur at the bank of rivers and lakes with extremely humid conditions, at bogs, in bushes, heather and willow undergrowth, at grassy slopes, meadows and in tundra. Some of them easily bear cold, being common near snow or even on snow, larvae are known hunting on snow in winter e.g. Böcher (1988). This abundance of populated biotopes and localities results in numerous form hither described, with the taxonomic status requiring precision. The present paper deals with some names utilized earlier for such taxa or as synonyms of *P. septentrionalis* and is based on the morphological studies of the extensive material deriving from different localities of the Holarctic Realm.

**ABBREVIATIONS USED**

ECORCO - Eastern Cereal and Oilsseed Research Centre, Agriculture and Agri-Food Canada, Ottawa;  
HNHM - Hungarian Natural History Museum, Budapest;  
ISU - Irkutsk State University, Irkutsk;  
NMNHP - National Museum of Natural History, Paris;  
ZISP - Zoological Institute, Russian Academy of Sciences, St.-Petersburg;  
ZMU - Zoological Museum, Moscow State University, Moscow;  
ZMUC - Zoological Museum, University of Copenhagen, Copenhagen;  
ZMUFI - Zoological Museum, University of Helsinki, Helsinki.
Patrobus septentrionis Dejean, 1828, nom. protectum


The type specimens of P. septentrionis kept at the NMNH represent actually undescribed species, treated below as P. septentrionis and P. cinctus. Since type locality of P. septentrionis has been pointed by Darlington (1938) as Lapland, we choose as lectotype a specimen, which agrees in its characters with Scandinavian populations.

Examination of the extensive material from different localities of Europe, Asia and North America revealed highly developed external polymorphism of P. septentrionis. This resulted in development of numerous forms, possessing, however, almost identical male genitalia structure (f. 3, 4), showing constant difference from its two species (P. cinctus see below). Several surveys have already realized this fact. Noteworthy, the subspecies relickus Neresheimer & Wagner is synonymized with P. bitschmai Reitter by Kuhlau (1941). Furthermore, it is obvious that several authors, including Balsberg, Freude (1976) and Balsberg, Wagner synonymized the subspecies with P. bitschmai Reitter and as a synonym of P. australis. All forms mentioned above were informally called “the bitschmai-group”. Lindroth (1935) elevated status of australis Sahlgren to specific, with no comments, however, all the diagnostic features given by him are actually highly variable within P. septentrionis Dejean, for instance robust bitschmai-like specimens with characteristic palpi and very slender septentrionis-like ones, as well as transitional individuals, occurs in Fennoscandia, no distinct morphological differences are being observed (studied 47 ex. from Finland – ZMUH and 39 ex. from Kolvåg Peninsula 5 km Kuhlau (1941) made similar observations based on the material from Alps.

* During my visit to the NMNH in 1991 I have had an opportunity to study the old R. Obrecht collection comprising Deguen and Chauder material. All Patrobus species were kept in the box No 10, labelled “R. Obrecht’s collections” and 22 ex. However, this collection included also further specimens, even their treatment as synonyms is not completely obvious.
point of view was shared by several successive authors, including Kryzhunovskij et al. (1995), Lorenz (1998). We found no strict geographic regularity in the distribution of "the Hitaumber group" and similarity of its forms seem to reflect ecological adaptations (sometimes of alpine and mountain nature) rather than geographic speciation, both "homotypic subspecies" and "the Hitaumber group" occur sympatric, thus no form deserves the subspecific status, i.e. *Patrobus austral -* Sahlberg, 1873, syn. n. pro *Patrobus septentrionalis* Dejean, 1828.

Lectotype of *P. hyperboreus* Dejean is a normally colored, fully pigmented specimen (in spot the description original, even color is only an individual variation, as pointed by Darlington, 1972). All specimens from Greenland (studied 226 ex. - ZMUC - and 9 ex. - ZISP) belong to *P. septentrionalis* Dejean, thus confirming previously established synonymy. Some populations resemble *atra* or *morsus* - like forms from Europe.

Populations from the extreme East of the species' range (Altai, Tuva, partially Krasnoy. Prov. and Baikal Region) possess usually smaller body size, partly reduced wings, and a distinguishable characters, representing an unnamed subspecies (being described separately).

The recent American authors synonymized all the forms from North America, related to *septentrionalis* Dejean, with this species. Still we had no opportunity to study the types of spec. described by Casey, however, based on the available comparative material (studied 89 ex. of *septentrionalis* - ECORCO), and taking into account distributional reasons, this synonymy is probably correct as regards *P. labradorinus* Casey and *P. minutus* Casey**.

Distribution. Northern Europe, including Faeroe Is. and Iceland, Middle Europe (represented there by several disjunct populations or forming boreomontane disjunction), its range coinciding with the territory covered by Valday Glaciation during its maximum and contemporary mountain glaciers, North-West Siberia nearly till Ob, mountains of Middle and Southern Siberia, Baikal, Greenland, North America (at least Middle and Northern Alaska, North-West Can., Northern Quebec, Labrador Peninsula, and isolated mountain population in Leavenworth, Colorado "Leavemth Vall. Col. 10-11000 f."). American area being also highly disjunct and resembling general pattern that of *P. stygicus* Chaudort.

** Patrobus cinclus Motschusky, 1860, sp. resurr.**

*Material studied.* 1 M (ZMMU), labelled "Patrobus cinclus Mesin. Kamtsch. Kurilsk." (Motschusky's handwriting), "16" (designated here as lectotype), 2 M, 1 F (ZMMU), labelled as lectotype, all mounted type; 1 M, 2 F (NMNEP), labelled "M" or "F", "Patrobus septentrionalis Dejean" (Deveze's handwriting); 1 F (ZMMU) labelled "Kamtschatska", "juncia Millot." (Motschusky's handwriting, designated here as lectotype).

*Additional material studied.* Over 200 ex., male genitalia studied in 50 ex.

*Remarks.* This species possesses reliable differences from the previous one only in the struct of proximal copulatory piece of endophallus (Figs 1, 2), which is also longer and narrower; however, some other characters prevail in the majority of populations (at least in the Palaeartic) and can be utilized as supplementary evidences in determination: antennomeres 2 comparatively longer, pronotum stronger transverse and usually less ciliate, basal lobe of more slender, broader, almost reaching base of median line, not forming distinct outer and inner ones, the la

** Studied specimens from North America (including West St. Modest, type locality of both *P. labradorinus* Casey and *P. minutus* Casey) possess some minor (but constant) differences in the structure of proximal copal piece from the European and Asian populations and could deserve a particular taxonomic status with *septentrionalis* Dejean, though we abstain from the more definite conclusion before study of the further mate. Anyway, American populations cannot be interpreted as unequivocally transitional between *P. septentrionalis* Dejean and *P. cinclus* Motschusky, on the contrary, are obviously close to the former and possess pronotus morphological traits from the latter, apparently prevailing in America species.
not forming prominent furrow, median line more superficial. Aedeagus usually slenderer, accessory spine usually longer, stronger curved, of more complicated structure (latter both in Eurasia and America).

Lectotype of *P. fuscipennis* Motschulsky agrees in its main characters with *P. cinctus* Motschulsky, except for longer spine, and represents rufous, not fully pigmented individual. According to the map, given by Motschulsky (1860), it had to be collected not far from Petrovavlovsk-Kamchatskiy. Examination of the further material from Kamchatka (studied 12 ex – ZISP – and 1 ex – ISU) revealed its identity with *P. cinctus*. Thus, *Patrobus fuscipennis* Motschulsky, 1860, syn. n. pro *Patrobus cinctus* Motschulsky, 1860.

The most probably *P. trius* Casey is the synonym of *P. cinctus* Motschulsky too, i.e. *Patrobus trius* Casey, 1920, syn. n. pro *Patrobus cinctus* Motschulsky, 1860.

Casey's idea (1918) that *P. septentrionalis* Dejean (actually *P. cinctus* Motschulsky) "does not cross the Rocky Mountain divide, the species of eastern North America being almost invariably distinct from the Pacific species – even in comparatively northern latitudes" seems to be incorrect. *P. cinctus* Motschulsky is widely distributed in North America, even reaching Atlantic Coast (Newfoundland). We do not know the detailed distribution of *P. cinctus* Motschulsky in America, though generally it seems not to exceed the southern border of the former Wisconsin glacial maximum.

**Distribution:** Northern Siberia from Taimyr to Chukotka, Magadan Province and Kamchatka, Middle and Southern East Siberia nearly from Irkutsk and Bureya to Far East (forming in Siberia a characteristic range of the "Daecheila-type"); N Kuriles, Komakor Isles, North America (at least Aleutian Isles, S Alaska, Great Lakes, S Quebec, Newfoundland)

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**Patrobus assimilis** Chaudoir, 1844

*Type material studied:* 1 M (NMNH), labeled "M". "Suedo", "Type", "*Patrobus assimilis* Chaudoir" (Deuve's handwriting, designated here as lectotype), 1 F (NMNH) labeled "F", "*Patrobus assimilis* Chaudoir" (Deuve's handwriting), 1 M (NMNH), labeled "*Patrobus assimilis* Chaudoir" (Deuve's handwriting), 1 F (NMNH), labeled "*Patrobus assimilis* Chaudoir" (Deuve's handwriting).

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Figs 1–4: *Patrobus* spp., aedeagus. 1, 2 – *P. cinctus* Motschulsky, lectotype. 3, 4 – *P. septentrionalis* Dejean, lectotype. 1, 3 – right lateral view, 2, 4 – dorsal view. Scale bar 1 mm.
“assimilis” Chaud., “P. assimilis” Chaud. (Deuve’s handwriting), 1 M (ZMMU), labelled “Turkmen “P. borealis” mite” (Motschulsky’s handwriting, designated here as lectotype). 1 M, 1 F (ZMMU), labelled as lectotype, all mounted together.

Additional material studied: Over 350 ex., male genitalia studied in 30 ex.

Remarks: Csiki (1928), Kühnelt (1941), Kryzanovskij et al. (1955), Lorenz (1998) and some of the authors erroneously synonymized P. borealis Motschulsky with P. septentrions Deje. Examination of type specimens revealed that this form, described from Lake Balkal (“Turkmen”) has no principle difference from P. assimilis Chaud. \( v. \) P. borealis Motschulsky, 1898 syn. n. pro P. assimilis Chaudor, 1844 P. assimilis Chaudor has been already record from Balkal vicinities by Shilenkov (1944) and other authors.

Distribution: Northern Europe, including Faeroe Isles, Middle and partly Southern Europe (formed disjunct, mainly mountain populations), North-West Siberia till Ob, mountains of Middle & Southern Siberia nearly till Balkal, Tarbagatay Mts in Kazakhstan

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References

Bariševski A. 1996: The check list of the Coleoptera Carabidae of the fauna of the Pannonian Basin. 41
340 pp
Bonfert V. & Labrakelie A. 1993: Catalogue of the Geodephaga (Coleoptera: Tenebrionidae, Buprestis)
Chechelnitskii V. 1949: Ph. Carabidae in the Arctic fauna. Contribution 1 Zoologische En 1 196 4 1404–1420 (in Russian)
Darlington P. 1954: The American Rutelidae (Coleoptera, Carabidae) Enzal. Amer. (N.Y.) 13 125–1
Downe N. M. & Arnett R. H. Jr. 1996: The beetles of the northeastern North America 1. Identification
Archostemata, Adephaga, and Polyphaga, thru superfamilies Carabidae, Staphylinidae, Sandwich
341 + 880 pp
Nachr. Bayer. Entomol. 25 6–7
Hartman W. K. & Leff M. L. 1983: The identification and distribution of the three species of Parastichus
(Coleoptera, Carabidae) found in Brachytes (Coleoptera, Carabidae). Sofia-Moscow
271 pp
291 pp
Kryzanovskij O. L., Okhotina M. V., Bremsley G. F. & Laser G. Sh. 1975: Checklist of carabids (Coleoptera Carabidae) of the Kuril islands (in Russian) (In V. 5) 119–125
Kühnelt W. 1941: Revision der Laufkäferfamilien Petriini und Dephiini Ann. Naturhistorer Mus Wien. 51 15
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