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The Limnichidae (Coleoptera) of the Arabian Peninsula and the island of Socotra

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Abstract. In this work we present the first data on the family Limnichidae for the Arabian Peninsula and the island of Socotra, based on material collected in the United Arab Emirates (UAE), Oman, continental Yemen and Socotra. We describe five new species: *Pelochares sinbad* sp. nov. (Oman and UAE), *P. sabaeanus* sp. nov. (continental Yemen, Jordan and dubious from Ethiopia), *Byrrhinus socotrensis* sp. nov. (Socotra), *B. helicophallus* sp. nov. (continental Yemen, dubious from Ethiopia), and *Limnichus arabicus* sp. nov. (continental Yemen). All species of Limnichidae found on the Arabian Peninsula and Socotra were undescribed, but it is likely that some could also be found in the neighbouring areas (such as Iran or Eastern Africa), for which no or very few records of Limnichidae are known.

Key words. Limnichidae, *Byrrhinus*, *Limnichus*, *Pelochares*, new species, Ethiopia, Jordan, Oman, United Arab Emirates, Yemen, Socotra

Introduction

Limnichidae is a small family (ca. 400 described species) of Byrrhoidea, with mostly riparian or semiaquatic small and inconspicuous beetles (Hernando & Ribera 2005). The knowledge of their taxonomy and distribution is still very incomplete, with some extended geographic areas – such as the Arabian Peninsula – with no information available before this work. There are also no published records from some of the neighbouring countries, including Iran, Iraq and Jordan, with only two species recorded from Israel and Lebanon (*Pelochares murinus* Baudi di Selve, 1870 and *Limnichus punctipennis* Kraatz, 1858; Hernando & Ribera 2006). The knowledge of the limnichid fauna of eastern Africa is equally scarce, with only a handful of species known from Egypt, Sudan and Ethiopia (Delève 1968, Hernando & Ribera 2006).

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Here we provide the first records of Limnichidae for the Arabian Peninsula, based on material collected in recent years in the United Arab Emirates (UAE), Oman and Yemen, including the island of Socotra. We include data of some specimens from Jordan and Ethiopia, although in some cases, due to the absence of males, their identification is uncertain.

Material and methods

Some specimens (including holotypes) were dissected for study of the male and female genitalia; genitalia were studied in alcohol and then mounted on transparent cards with DMHF (dimethylhydantoin formaldehyde). Both specimens and genitalia were examined using a Leica MZ16 compound microscope; photographs of the genitalia were made with an Olympus C7070 camera attached to the Leica MZ16 microscope. The habitus photographs were taken using a Canon MP-E 65mm/2.8 1Macro lens with 5:1 optical magnification on bellows attached to a Canon EOS 550D camera. Partially focused images of the specimen were combined using Helicon Focus 3.20.2Pro software. The DNA of one paratype of *Pelochares sinbad* sp. nov. was non-destructively extracted using commercial columns and stored in the DNA and tissue collection of the IBEB; the extracted specimen was mounted on a card. The specimens examined for this study are deposited in the following collections:

CHBS Carles Hernando collection, Badalona (Barcelona), Spain;
CULS Faculty of Forestry and Wood Sciences, Czech University of Life Sciences, Prague, Czech Republic (J. Farkač);
IBEB Institute of Evolutionary Biology, Barcelona, Spain (I. Ribera);
MNCN Museo Nacional de Ciencias Naturales, Madrid (M. París);
NHMO Natural History Museum, Sultanate of Oman (Azza Ahmed Al-Jabri);
NHMW Naturhistorisches Museum, Wien, Austria (M. A. Jäch);
NMPC National Museum, Prague, Czech Republic (J. Hájek);
PLFG Pietro Lo Cascio and Flavia Gritta collection, Lipari, Italy;
UAEIC United Arab Emirates Invertebrate Collection, UAE (A. K. Saji).

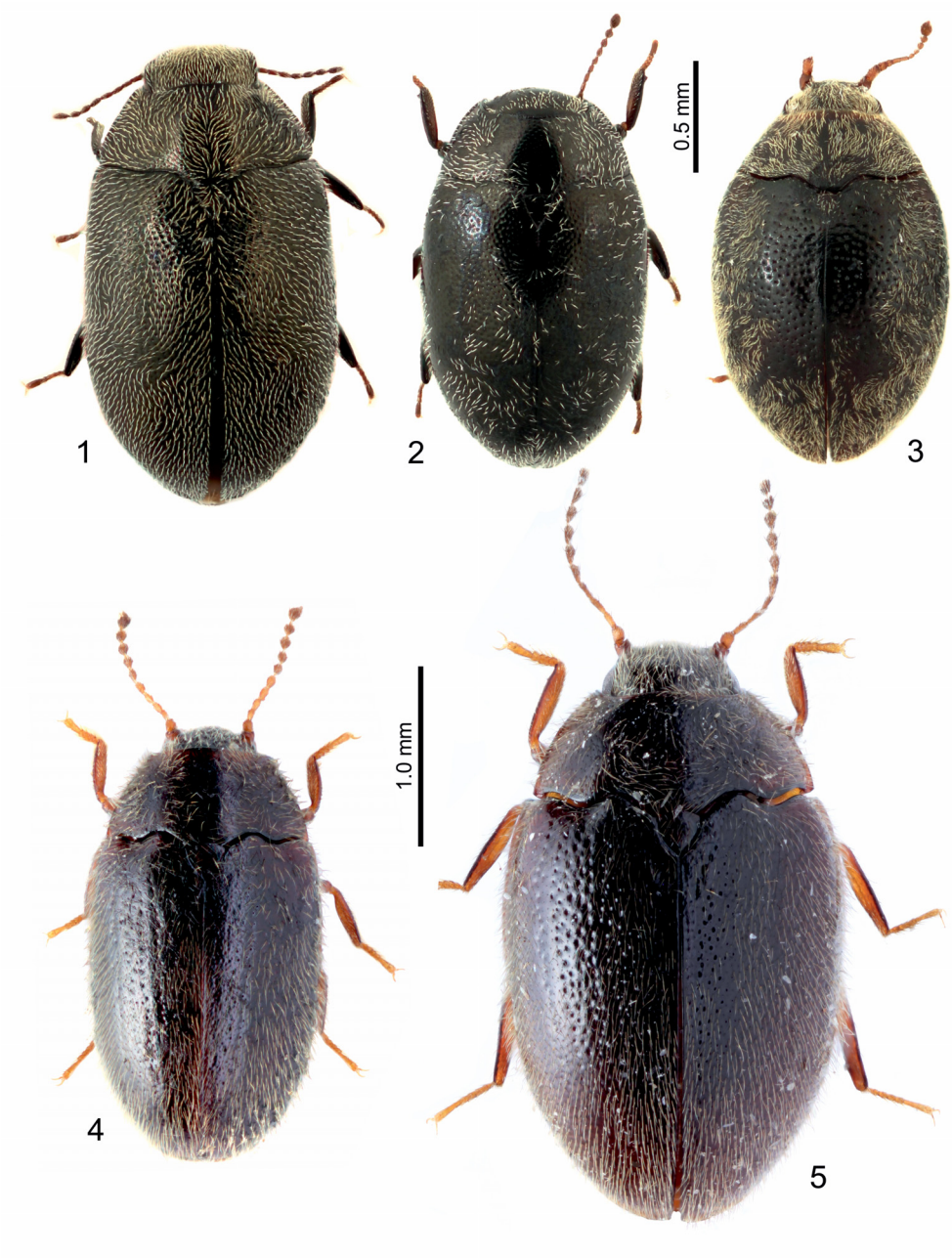
Taxonomy

Pelochares sinbad sp. nov.

(Figs 1, 6–7)

Type locality. Oman, Sur (Fig. 15A).

Type material. Holotype: ♂ (MNCN), '11 Oman 9.4.2010 15 km SW Sur / residual pools in wadi Rd. 23 / N22º27′51.9″ E59º23′15.2″ 85m, Ribera, Cieslak & Hernando leg.' [genitalia dissected and mounted in DMHF on a transparent card pinned with the specimen]. Paratypes (67 specimens, CHBS, IBEB, MNCN, NHMO, NHMW, NMPC, UAEIC): 9 spec.: same data as holotype; 6 spec.: '8 Oman 7.4.2010 Murri env. / wadi Bani Ghafir, stream with pools / N23º29′46.2″ E56º53′34.8″ 759m / Ribera, Cieslak & Hernando leg.' [1 spec. used for DNA extraction, voucher IBE-RA123; preserved in absolute ethanol]; 1 spec.: '10 Oman 9.4.2010 Muqal / wadi Bani Khalid residual pools / N22º36′16.9″ E59º05′15.2″ 649m / Ribera, Cieslak & Hernando leg.' [preserved in absolute ethanol]; 12 spec.: '12 Oman 9.4.2010 1 km W Qalhat / residual pools in wadi / N22º41′25.4″ E59º22′03.0″ 88m, Ribera, Cieslak & Hernando leg.'; 15 spec.: 'UAE 10387 - Wadi Wurayah farm / 25º23′N 56º19′E, 15.01-22.02.2009 / light trap, leg. A. van Harten'; 4 spec.: 'UAE 12169 - Wadi Maidaq / 25º18′N 56º07′E, 12.06-15.07.2006 / light trap, leg. A. van Harten'; 20 spec.: 'UAE 15642 - Wadi Safad / 25º13′N 56º19′E, 04.03-04.05.2006 / light trap, leg. A. van Harten'; 19 spec.: 'UAE: Ras al-Khaimah / (south), Wadi Shawkah / Hajar Mountains (UAE 2) / ca. 80 km ESE Dubai / 23.I.10, leg. M.A. Jäch // residual pools / above dammed area / ca. 303 m a.s.l. / 25º06′14.1″N / 56º02′46.4″E'; 1 spec.: 'UAE: Fujairah (north) / Wadi Wurayah (UAE 4) / Hajar Mountains, ca. 10 / km NW Khor Fakkan / 24.I.10, leg.



Figs 1–5. Habitus of the Limnichidae of Arabian Peninsula and Socotra Islands. 1 – *Pelochares sinbad* sp. nov.; 2 – *P. sabaeanus* sp. nov.; 3 – *Limnichus arabicus* sp. nov.; 4 – *Byrrhinus socotrensis* sp. nov.; 5 – *B. helicophallus* sp. nov. Upper scale bar applied to Figs 1–3, bottom scale bar to Figs 4–5.

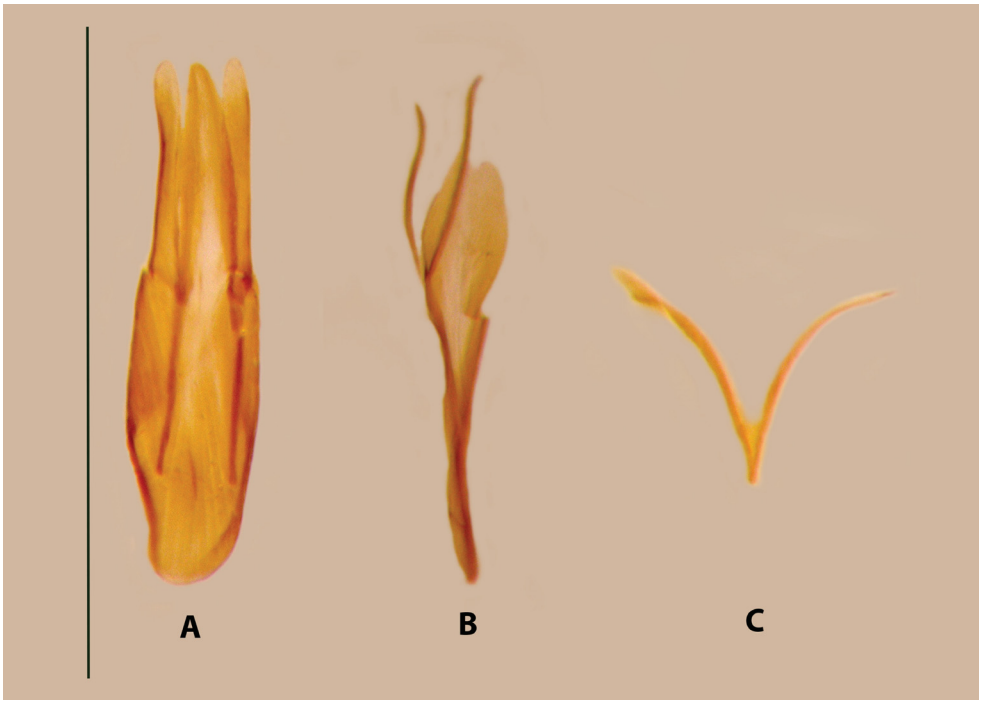


Fig. 6. Male genitalia of a paratype of *Pelochares sinbad* sp. nov. A – aedeagus; B – genital segment; C – ventrite VIII. Scale bar: 0.5 mm.

M.A. Jäch // stream, flowing through / trough valley / ca. 222 m a.s.l. / 25º23′41.8″N / 56º16′04.8″E'; 7 spec.: 'UAE: Fujairah (north) / Wadi Wurayah (UAE 5) / Hajar Mountains, ca. 10 / km NW Khor Fakkan / 24.I.10,leg. M.A. Jäch // residual pool / in main valley / ca. 240 m a.s.l. / 25º23′14.9″N / 56º15′55.5″E'; 10 spec.: 'UAE: Fujairah (UAE 11) / Wadi Hayl / Hajar Mountains / 26.I.10, leg. M.A. Jäch // ca. 2 km SW Hayl Village / ca. 12 km SW Fujairah / City, small stream // flowing trough oasis / ca. 234-240 m a.s.l. / 25º04′58′N / 56º13′28″E'.

Description. Length 2.0–2.2 mm; maximum width 1.0–1.1 mm. Body elongate, oval but with middle part rather parallel-sided (Fig. 1). Dorsal surface black, covered with golden-silvery, short, very dense recumbent pubescence, with an alternate orientation forming a zig-zag; covered with uniform, strong setiferous punctures; surface between punctures smooth and shiny. Body appendages dark brown.

Head. Eyes flat, although visible from above; upper margin of eyes bordered, border reaching insertion of antennae. Surface of head posterior to eyes flat, without depressions or fossae. Antennae with 11 symmetrical antennomeres, apical four forming a loose club.

Pronotum transverse (ratio median length / width at base = 0.50); anterior angles acute; anterior margin of pronotum straight, without crenulations; with a weak border close to angles; posterior margin with a double sinuation; lateral margins slightly convergent, strongly bordered. Hypomeron flat, without depressions or fossae.

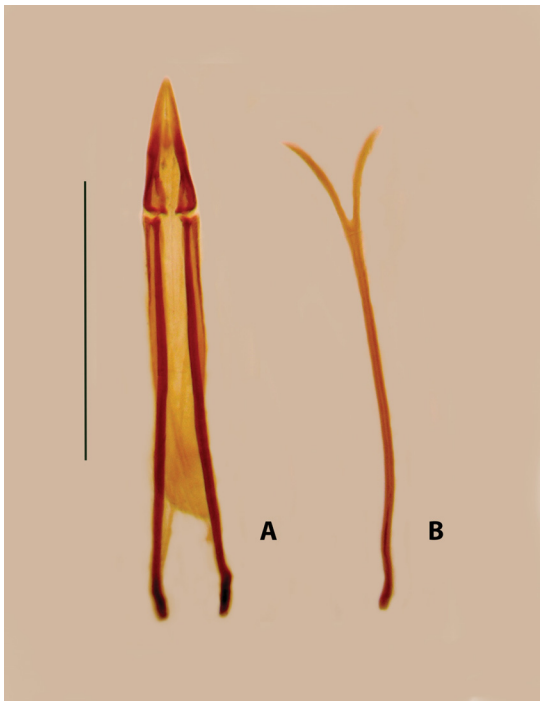


Fig. 7. Female genitalia of *Pelochares sinbad* sp. nov. A – ovipositor; B – spiculum ventrale. Scale bar: 0.5 mm.

Elytra with humeral callus; lateral margins bordered from humerus to apex; apex acuminate, with a locking device. Membranous wings well developed.

Ventral surface with fine, long pubescence except on metaventrite. Surface of abdominal ventrites with uniform, strong and very dense punctures; surface between punctures reticulated-shagreened. Ventrites I–III connate (fused). Inter-metacoxal plate on first ventrite triangular, strongly acuminate; first ventrite with depressions for reception of metafemora and metatibiae. Apical ventrite strongly emarginate, with a blunt medial protuberance; pubescence denser in medial area (in males denser than in females).

Protibia without preapical comb of setae, with a small preapical denticle (as typical of the genus).

Male genitalia (Fig. 6). Median lobe of aedeagus as long as parameres, apex acuminate. Parameres shorter than phallobase; apex of parameres slightly dilated, poorly sclerotised. Phallobase very long; base asymmetrical, with struts as long as median lobe. Genital segment symmetrical, spatuliform, with lateral paramere narrow and slightly shorter than medial lamina. Ventrite VIII V-shaped.

Female genitalia (Fig. 7). Ovipositor relatively short, straight.

Etymology. Named after Sinbad the Sailor (noun in apposition), a figure of the Middle Eastern folklore believed by some to be born in Sohar (Oman).

Collection circumstances. We collected the specimens from Oman inhabiting the margins of residual pools in wadis (temporary rivers), on a substratum of gravel and stones (Figs 15A,B). Specimens from the United Arab Emirates were collected at light, in the proximity of wadis.

Distribution. Known from the north of Oman and the United Arab Emirates (Fig. 16).
Remarks. *Pelochares sinbad* sp. nov. differs from the African species described and figured by Delève (1968) by the male aedeagus. It differs from *P. murinus* (Baudi, 1870) in the body shape (in *P. murinus* more oval, with acuminate elytra) and the shape of the margins of the pronotum (completely straight in *P. murinus*). There are no known species of *Pelochares* in other nearby areas, the nearest being in the Himalayas (Champion 1923; Spangler et al. 2001).

Pelochares sabaeanus sp. nov.

(Figs 2, 8–9)

Type locality. Yemen, Al Hudaydah Governorate, Jabal Bura (Fig. 15C).
Type material. Holotype: ♂ (NMPC), 'YEMEN, Al Hudaydah gov. / Jabal Bura valley forest NP / (stream valley; at light), 240-350m / 14º52.4-5′N, 43º24.6-25.2′E / J. Bezděk leg. 4.xi.2010' [genitalia and abdominal ventrites mounted in DMHF on a transparent card pinned with the specimen]. Paratypes (50 specimens; CHBS, IBEB, NHMW, NMPC): 16 spec.: same data as holotype; 1 spec.: same data, but Jiří Hájek leg.; 1 spec.: 'W YEMEN, Jabal Bura´, / NEE Al Hudaydah, N14º52′ / E43º24′, 225-600 m, / 30.X-1.XI.05, lgt. S. Kadlec', 'ex coll. S. Kadlec / National Museum / Prague, Czech Republic'; 1 spec.: 'W YEMEN, JABAL BURA / NEE Al Hudaydah, N14º52′ E43º24′, 261-600m / 9.-11.IV.2007, lgt. S. Kadlec', 'ex coll. S. Kadlec / National Museum / Prague, Czech Republic'; 30 spec: 'YEMEN, Hadramawt gov. / GHAYL BA WAZIR, NE env. / bottom of karstic abyss 118m a.s.l. / 14º47′33″N; 49º22′46″E [GPS] / 6.-7.xi.2007 A. REITER lgt.' [7 cards and 1 pin with 3 spec. each]; 1 spec.: 'W YEMEN, 10 km W Al / Manşūrīah, N14º43′ / E43º12′, 110 m, 8.IV.2007, / lgt. P. Kabátek'.
Additional material examined. 1 ♂ 2 ♀♀ (NMPC): 'JORDAN mer.occ. -280m, / 30º52,906′ N 35º26,015′ E / 20 km W of At Tafila, / J. Bezděk leg., 31.v.-1.vi.2007'.
Dubious specimen. 1 ♀ (NMPC): 'ETHIOPIA, Dire Dawa, / 9º40,934′N, 41º57,930′E, / 1055 m, 2.vi.2011, / V. Hula & J. Niedobová leg.' [genitalia dissected and mounted in DMHF on a separate transparent card pinned with the specimen, together with two eggs].

Description. Externally very similar to *P. sinbad* sp. nov., from which only main differences are noted. Length 1.6–1.7 mm; maximum width 0.9–1.0 mm. Body slightly narrower than in *P. sinbad* (Fig. 2); dorsal pubescence shorter and less dense, more silvery than golden. Pronotum slightly more transverse (ratio median length / width at base = 0.42–0.46). Eyes very flat, hardly visible from above. Eye border very prominent, especially next to insertion of antennae. Lateral border of pronotum less marked. Elytral border finer than in *P. sinbad*; elytral margin with acute denticles from median part to elytral locking device (not visible from above).

Male genitalia (Fig. 8). Median lobe of the aedeagus slightly shorter than parameres, apex acuminate. Parameres as long as phallobase; apex of parameres straight. Phallobase shorter than in *P. sinbad* sp. nov.; base asymmetrical, with long struts, almost as long as phallobase.

Female genitalia (Fig. 9): ovipositor longer than in *P. sinbad* sp. nov., with a marked angle in median region.
Etymology. Named after the ancient Kingdom of the Sabaeans, in what is nowadays Yemen and north Ethiopia, with an area similar to the distribution of the new species; adjective.
Collection circumstances. Most specimens were collected at light. The type locality (Jabal Bura, Fig. 15C) is a stream on stony substratum in an area with dense scrubland and palm trees.
Distribution. Known from continental Yemen and Jordan, likely to be present in Ethiopia (Fig. 16).

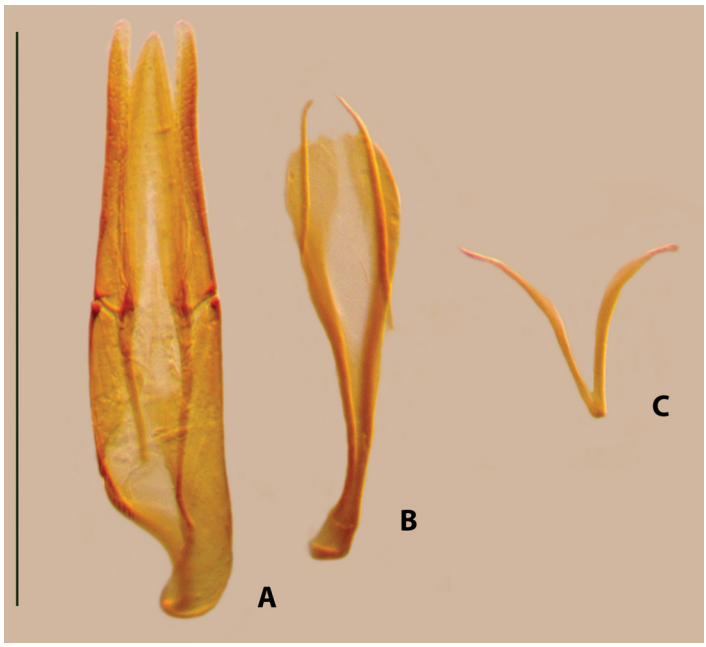


Fig. 8. Male genitalia of the holotype of *Pelochares sabaeanus* sp. nov. A – aedeagus; B – genital segment; C – ventrite VIII. Scale bar: 0.5 mm.

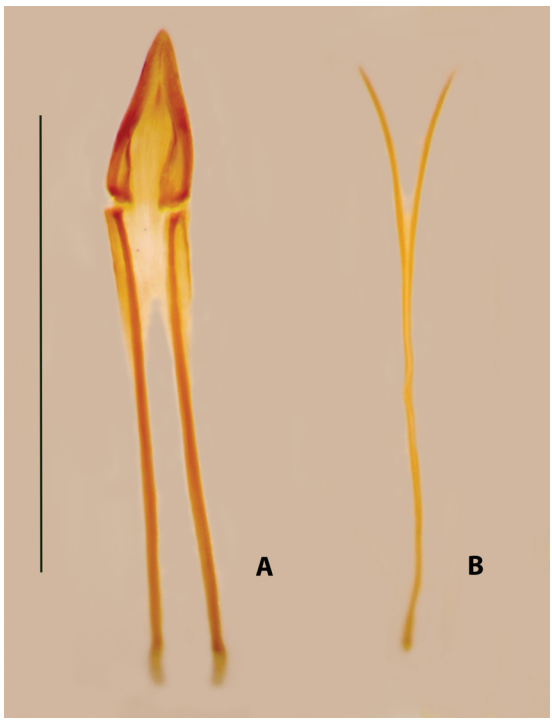


Fig. 9. Female genitalia of *Pelochares sabaeanus* sp. nov. A – ovipositor; B – spiculum ventrale. Scale bar: 0.5 mm.

Remarks. We could not appreciate any difference in the external morphology or the male and female genitalia between the specimens from Jordan and Yemen, but did not include them as paratypes due to the scarcity of the material for study. The female from Ethiopia is also identical to those from Yemen, including the shape of the ovipositor and spiculum ventrale, but due to the absence of males its identity remains uncertain. According to the general shape of the ovipositor, *P. sabaeanus* sp. nov. seems to be related to some Afrotropical species (e.g. *P. congoensis* Delève, 1968) (Delève 1968), although this author did not note the presence of denticles in the elytral margin in any of the African species of the genus.

Byrrhinus helicophallus sp. nov.

(Figs 5, 10–11)

Type locality. Yemen, Al Hudaydah Governorate, Jabal Bura (Fig. 15C).

Type material. Holotype: ♂ (NMPC), 'YEMEN, Al Hudaydah gov. / Jabal Bura valley forest NP / (stream valley; at light), 240-350m / 14º52.4-5′N, 43º24.6-25.2′E / J. Bezděk leg. 4.xi.2010' [genitalia and abdominal ventrites mounted in DMHF on two transparent cards pinned with the specimen]. Paratypes (26 specimens, CHBS, IBEB, NHMW, NMPC): 6 spec.: same data as holotype; 4 spec., same data as holotype, but L. Purchart leg.; 6 spec. same data as holotype, but Jiří Hájek leg.; 1 spec.: 'W YEMEN, Jabal Bura´ NEE / Al Hudaydah, N14º52′ / E43º24′, 261-600 m, / 9.-11.IV.2007, lgt. P. Kabátek'; 3 spec.: 'W YEMEN, Jabal Bura', / NEE Al Hudaydah, N14º52′ / E43º24′, 225-600m / 30.X.-1.XI.05, lgt. S. Kadlec', 'ex coll. S. Kadlec / National Museum / Prague, Czech Republic'; 5 spec.: 'W YEMEN, Jabal Bura' NEE / Al Hudaydah, N14º52′ / E43º24′, 225-600 m, 30.X.- / 1.XI.05, lgt. P. Kabátek'; 1 ♂: 'W YEMEN, 20 km NW / Dhawran, N14º40′ E44º13′ / 1794 m, 29.X.2005, ['*ex larva*' crossed with pencil], / lgt. S. Kadlec', 'ex coll. S. Kadlec / National Museum / Prague, Czech Republic' [immature specimen, genitalia dissected and mounted in DMHF on a transparent card pinned with the specimen].

Dubious specimens. 2 ♀♀ (NMPC): 'ETHIOPIA, Dire Dawa, / 9º39,27′N, 41º55,813′E, / 1133 m, 5.vi.2011, / V. Hula & J. Niedobová leg.' [genitalia dissected and mounted in DMHF on separate transparent cards pinned with the respective specimens].

Description. Length 3.1–3.3 mm; maximum width 1.8–1.9 mm. Body oval, strongly convex (Fig. 5). Dorsal surface brown to dark brown, covered with yellowish, long, dense erect pubescence. Body appendages paler than body.

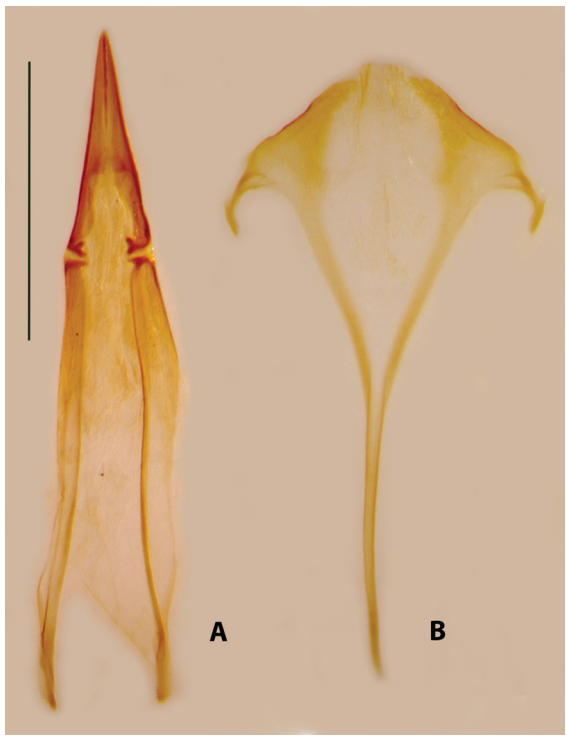
Head. Eyes convex, visible from above; upper margin of eyes bordered, border reaching anteriorly insertion of antennae; extended posteriorly to eyes, weakening when reaching posterior margin of head. Surface of head posterior to eyes flat, without depressions or fossae, with erect pubescence and fine and sparse puncturation, denser and coarser on clypeus; surface between punctures smooth and shiny. Antennae strongly pubescent, antennomeres I–X symmetrical, antennomere XI asymmetrical, apical four antennomeres forming a loose club.

Pronotum transverse (ratio median length / width at base = 0.45–0.47); anterior margin straight, without crenulations, very finely bordered; posterior margin with a strong double sinuation; lateral margins arched, with prominent borders. Puncturation similar to that on head; pubescence slightly decumbent posteriorly. Hypomeron flat, without depressions or fossae.

Elytra with a weak humeral callus; lateral margins bordered from humerus to apex, finer towards apex; apex acuminate, with a locking device. Membranous wings well developed. Surface of elytra with strong irregular punctures; pubescence slightly bent backwards.

Ventral surface with strong and dense puncturation, with dense, long recumbent pubescence except on metaventrite, which has only isolated setae. Surface of abdominal ventrites with uniform, fine and very dense punctures. Three first ventrites connate, surface between punctures with polygonal reticle, with median pore; from ventrite IV without polygonal reticle.

▲ Fig. 10. Male genitalia of the holotype of *Byrrhinus helicophallus* sp. nov. A – aedeagus; B – spiculum; C – ventrite VIII; D – genital segment. Scale bar: 0.5 mm.



◄ Fig. 11. Female genitalia of *Byrrhinus helicophallus* sp. nov. A – ovipositor; B – spiculum ventrale. Scale bar: 0.5 mm.

Inter-metacoxal plate on ventrite I triangular, strongly acuminate; abdominal ventrite I with depressions for reception of metafemora and metatibiae. Ventral surface with pubescence finer than on dorsal surface, recumbent. Apical abdominal ventrite strongly emarginate, with blunt median protuberance; pubescence denser in medial area (in males denser than in females). When seen with transmitted light, posterior margin of apical abdominal ventrite of male with a series of likely glandular tubules, not visible in dry specimens.

Protibia without preapical comb of setae or denticles; apex of protibia with sulcus for reception of tarsi on external surface; apex of meso- and metatibiae with anterior surface flattened, not forming sulcus.

Male genitalia (Fig. 10). Parameres, median lobe of aedeagus and phallobase twisted, strongly asymmetrical and strongly sclerotized. Genital segment asymmetrical, strongly sclerotized; struts asymmetrical, with different length; short strut fused with lamina. Ventrite VIII U-shaped, with narrow apical membranous lamina. Spiculum as in Fig. 10D.

Female genitalia. Ovipositor as in Fig. 11.

Differential diagnosis. *Byrrhinus helicophallus* sp. nov. does not seem to be closely related to any of the Afrotropical species figured by Delève (1968): the whole aedeagus is strongly asymmetrical, heavily sclerotized, with a very peculiar spiculum. Only one of the known African species has an asymmetrical aedeagus (*B. bomansi* (Delève, 1968); see Delève 1968: Fig. 43), but nothing comparable to that of *B. helicophallus* sp. nov. which is more likely to be related to some Middle Eastern species (unpublished observations).

Etymology. Named in reference to the shape of the aedeagus, twisted like a helix; noun in apposition.

Collection circumstances. Most species were collected at light. See notes on *P. sabaeanus* sp. nov. for description of the type locality.

Distribution (Fig. 16). So far only known from continental Yemen, likely to be present in Ethiopia.

Remarks. The genitalia of the two females from Ethiopia appear identical to that of the specimens from Yemen. There are small differences in the external morphology, which could well be due to intraspecific variability, but in the absence of males any identification remains uncertain. In Spangler et al. (2001) *B. marginatus* Champion, 1923 is recorded from Pakistan, but we have not been able to trace the origin of this record and it is likely a mistake. *Byrrhinus marginatus* was described from the central Himalayas (Kumaon, Champion 1923), and no other records have been published after its description.

Byrrhinus socotrensis sp. nov.

(Figs 4, 12–13)

Type locality. Yemen, Socotra, Dixam plateau, wadi Esgego (Fig. 15D).

Type material. Holotype: ♂ (NMPC), 'Yemen, Soqotra Is., 2003 / 2.-3/xii., Dixam plateau / WADI ESGEGO, 300m / N12º28′09″E54º00′36″ / [GPS], David Král lgt.', 'YEMEN – SOQOTRA / 2003 / Expedition; Jan Farkač, / Petr Kabátek & David Král' [genitalia and abdominal ventrites mounted in DMHF on a transparent card pinned with the specimen]. Paratypes (87 specimens, CHBS, CULS, IBEB, NHMW, NMPC, PLFG): 21 spec.: same data as holotype; 8 spec.: 'Yemen, Soqotra Is., Dixam / plateau, WADI ESGEGO / 2.-3.xii.2003, N 12º 28′ 09″ / E 54º 00′ 36″, 300 m [GPS] / Leg. P. Kábatek', 'YEMEN – SOQOTRA / 2003 / Expedition; Jan Farkač, / Petr Kabátek & David Král"; 8 spec.: 'Yemen, Soqotra Is.: / 2.-3.xii.2003 / Dixam plat.: WADI ESGEGO / N

12º28′09″ E 54º00′36″ / 300 m [GPS]: Jan Farkač lgt.', 'YEMEN – SOQOTRA / 2003 / Expedition; Jan Farkač, / Petr Kabátek & David Král'; 3 spec.: 'Yemen, Soqotra Is., Dixam / plateau, WADI ESGEGO / 2.-3/xii.2003, N 12º28′09″ / E 54º00′36″, 300m [GPS] / Leg. P. Kabátek,', 'YEMEN – SOQOTRA 2003 / Expedition; Jan Farkač, / Petr Kabátek & David Král'; 12 spec.: 'YEMEN, SOCOTRA ISLAND / Homhil protected area / open woodland with *Boswellia* / *Dracaena* trees; 10.-11.vi.2012 / 12º34.5′N, 54º18.5′E, 360-500m', 'SOCOTRA expedition 2012 / J. Bezděk, J. Hájek,V. Hula, / P. Kment, I. Malenovský, / J. Niedobová & L. Purchart leg.'; 17 spec.: 'YEMEN, SOCOTRA Island / Zemhom area, 270-350m / N 12º30′58″, E 54º06′39″ / 3.-4.ii.2010, at light / L. Purchart & J. Vybíral lgt.'; 3 spec.: 'YEMEN, SOCOTRA ISLAND / Dixam plateau 14.-15.vi.2012 / Firmihin, *Dracaena* woodland / 12º28.6′N, 54º01.1′E, 490 m', 'SOCOTRA expedition 2012 / J. Bezděk, J. Hájek,V. Hula, / P. Kment, I. Malenovský, / J. Niedobová & L. Purchart leg.'; 2 spec.: 'YEMEN, SOCOTRA Island / Dixam plateau / Firmihin (*Dracaena* forest) / 12º28.6′N, 54º01.1′E, 490 m / J. Bezděk leg., 15.-16.xi.2010'; 3 spec.: 'YEMEN, SOCOTRA Island / Noged plain (sand dunes) / Sharet Halma vill. env. / 12º21.9′N, 54º05.3′E, 20 m / Jiří Hájek leg. 10-11. xi.2010'; 2 spec.: 'Yemen, Soqotra Is., HADIBO / env., 21.xi.-12.xii.2003, N 12º / 65′02″ E 54º02′04″, ca. 10- / 100m[GPS], leg. P. Kabátek', 'YEMEN – SOQOTRA / 2003 / Expedition; Jan Farkač, / Petr Kabátek & David Král'; 1 spec.: 'YEMEN, SOCOTRA Island / wadi Ayhaft / 12º36.5′N, 53º58.9′E, 200m / Jiří Hájek leg. 7-8. xi.2010'; 1 spec.: 'Yemen, Soqotra Is. / 21.xi.-12.xii.2003 /HADIBO env., ca. 10-100m / N12º65′02″ E54º02′04″ / [GPS], David Král lgt.', 'YEMEN – SOQOTRA 2003 / Expedition; Jan Farkač, / Petr Kabátek & David Král'; 2 spec.: 'YEMEN, SOCOTRA Island / Deiqub cave, 12.vi.2012 / cave & *Croton socotranus* + / *Jatropha unicostata* shrubland; / 12º23.1′N, 54º00.9′E, 115 m', 'SOCOTRA expedition 2012 / J. Bezděk, J. Hájek, V. Hula, / P. Kment, I. Malenovský, / J. Niedobová & L. Purchart leg.'; 1 spec.: 'SOCOTRA (YEMEN) / Zam Hom / 7.IV.2008 at lamp / leg. A. Carapezza'; 3 exx.: 'SOCOTRA: W. Ayheft / 28.II-.1.III.2009 – leg. P. / Lo Cascio & F. Grita' [three specimens in separate cards in the same pin].

Description. Length 2.3–2.4 mm; maximum width 1.1–1.2 mm. Body elongate, almost subparallel (Fig. 4). Dorsal surface brownish, covered with yellowish, long, dense erect pubescence. Body appendages slightly paler than body.

Head. Eyes slightly convex, visible from above; upper margin of eyes bordered, border reaching anteriorly insertion of antennae; extended posteriorly to eyes till posterior margin of head. Surface of head posterior to eyes flat, without depressions or fossae with erect pubescence; surface with fine and sparse puncturation, surface between punctures smooth and shiny. Antennae strongly pubescent, antennomeres I–X symmetrical, antennomere XI asymmetrical, apical four antennomeres forming loose club.

Pronotum not very transverse (ratio median length / width at base = 0.50–0.53); anterior margin of pronotum straight, without crenulations, finely bordered; posterior margin with a strong double sinuation; lateral margins slightly arched, strongly bordered. Pubescence and puncturation similar to that on head. Hypomeron flat, without depressions or fossae.

Elytra with a weak humeral callus; lateral margins bordered from humerus to apex; apex acuminate, with a locking device. Membranous wings well developed. Surface with strong punctures, forming regular series; pubescence erect, slightly bent backwards.

Ventral surface with dense and uniform strong puncturation, covered with very dense, uniform, long pubescence, including metaventrite. Surface of abdominal ventrites with uniform, fine and very dense punctures; surface between punctures reticulated-chagreened. Three first ventrites connate (fused). Metaventrite with longitudinal striae. Inter-metacoxal plate on ventrite I triangular, strongly acuminate; first abdominal ventrite with depressions for reception of metafemora and metatibiae. Pubescence finer than on dorsal surface, recumbent. Last abdominal ventrite strongly emarginate, with a blunt medial protuberance; pubescence denser in medial area (in males denser than in females).

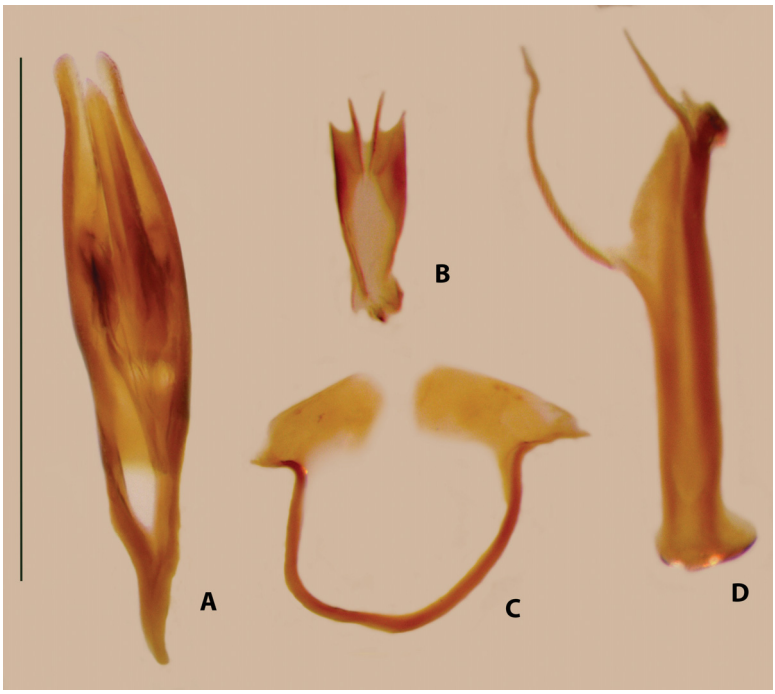


Fig. 12. Male genitalia of the holotype of *Byrrhinus socotrensis* sp. nov. A – aedeagus (with spiculum); B – spiculum (of a different specimen); C – ventrite VIII; D – genital segment. Scale bar: 0.5 mm.

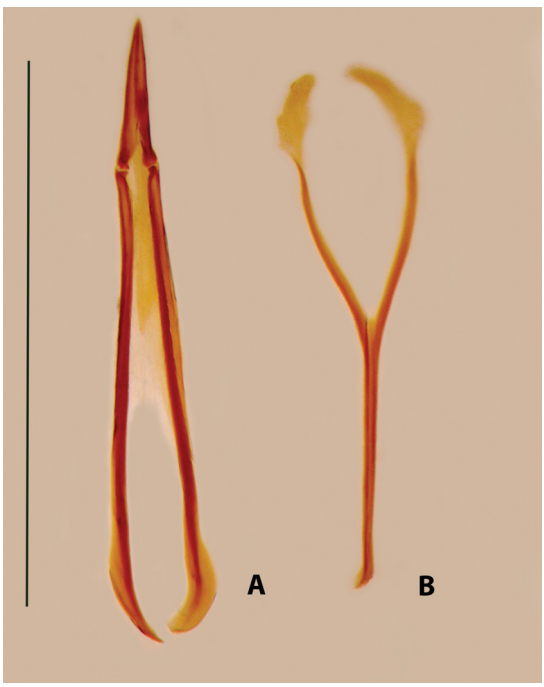


Fig. 13. Female genitalia of *Byrrhinus socotrensis* sp. nov. A – ovipositor; B – spiculum ventrale. Scale bar: 0.5 mm.

Protibia without preapical comb of setae or denticles; apex of protibia with sulcus for reception of tarsi on external surface (shallower than in *B. helicophallus* sp. nov.); apex of meso- and metatibiae with anterior surface flattened, but not forming sulcus.

Male genitalia (Fig. 12). Median lobe of aedeagus shorter than parameres, apex acuminate. Parameres symmetrical, not articulated (as typical of the genus); wider at base, narrower towards apex; apex rounded. Base asymmetrical. Genital segment asymmetrical, strongly sclerotized; struts asymmetrical, with different length. Ventrite VIII U-shaped, with wide apical membranous lamina. Spiculum strongly bilobed.

Female genitalia. Ovipositor as in Fig. 13.

Etymology. Named after the island of Socotra.

Collection circumstances. Most specimens were collected at light, in the proximity of a wadi on stony and sandy substratum and open woodland (Fig. 15D).

Distribution (Fig. 16). So far only known from the island of Socotra, in the Indian Ocean, where it seems to be common and widespread.

Remarks. According to Delève (1968) the species would have to be included in his group III, with species with median lobe of the aedeagus with subparallel sides, slightly narrowed at the apex. Within this group, it will be the most similar to the species with bifid spicula, *B. grossepunctatus* (Delève, 1968) and *B. seydeli* (Delève, 1968) from the Democratic Republic of the Congo.

Limnichus arabicus sp. nov.

(Figs 3, 14)

Type locality. Yemen, Al Mahrah Governorate, Al Ghaydah, Jabal al Fattk.

Type material. Holotype: ♂ (NMPC), 'E YEMEN, Jabal al Fattk, / Hawf NE Al Ghaydah, / N16º40′ E53º05′, 729 m / 12.-13.X.05, lgt. P. Kabátek' [genitalia and abdominal ventrites dissected and mounted in DMHF on a transparent card pinned with the specimen; right antennae missing from antennomere III].

Description. Length 1.7 mm, maximum width 1.1 mm. Body shape oval, strongly convex (Fig. 3). Dark brown, all body covered with dense, short, hydrophobic decumbent pubescence; pubescence with golden or silvery reflects depending on setal orientation.

Head. Eyes slightly convex, prominent in dorsal view; with strong border reaching insertion of antennae. Surface of head with supraocular depression, as typical of the *Limnichus* group of genera. Antennomere I (scape) wider and shorter than II (pedicel), quadrangular in shape; antennomere III narrower than II, shorter; antennomeres V and VI elongate, subparallel, VI slightly shorter than V; antennomere VII very short; antennomeres IX to XI forming a loose club, XI larger and longer, with apex slightly asymmetric. Antenna with two kinds of pubescence, one short and dense, and the other formed by long sparse setae, particularly apparent on club.

Pronotum trapezoidal, very finely bordered on lateral and anterior margin, posterior margin not bordered. Anterior margin regularly concave, posterior margin bisinuate on both sides. With very dense and poorly impressed puncturation uniformly distributed, similar to that on head.

Maximum width of elytra in middle part, apex rounded. With two types of puncturation, one less impressed, similar to that on pronotum, and other formed by larger punctures, well

Fig. 14. Male genitalia of the holotype of *Limnichus arabicus* sp. nov. A – aedeagus; B – genital segment; C – ventrite VIII. Scale bar: 0.5 mm.

impressed, uniformly distributed on whole surface, with no recognisable striae. Space between punctures larger than their diameter. Metathoracic wings well developed.

Ventral side with strong, dense puncturation; with dense, recumbent pubescence except for metaventrite which is glabrous. Last visible ventrite with semicircular indentation, with glandular pores on whole surface of ventrites III, IV and base of V, except lateral areas. Ventrites I and II connate; with two types of puncturation, one very fine and dense over whole surface, other coarser and less dense in intercoxal area of ventrite I and middle part of II; ventrite I with line of strong punctures bordering depression for reception of legs. Last abdominal ventrite slightly emarginate.

Anterior side of apex of protibia with comb of spines, as typical of the *Limnichus* group of genera.

Male genitalia (Fig. 14). Aedeagus symmetrical, except phallobase; median lobe as long as parameres and much longer than phallobase, apex acuminate; struts symmetrical, as long as phallobase; apex of parameres with triangular membranous expansions. Base of genital segment slightly asymmetrical; parameres equal in length, elongate; apex of membranous expansion pubescent. Ventrite 8 V-shaped, with apical membranous semicircular expansions; with pubescence in apical margin.

Females unknown.

Fig. 15. Representative habitats where specimens of Limnichidae were found. A – Oman, wadi 15 km southwest of Sur, type locality of *Pelochares sinbad* sp. nov.; B – Oman, wadi west of Qalhat, also with *P. sinbad* sp. nov.; C – Western Yemen, Jabal Bura, type locality of *Pelochares sabaeanus* sp. nov. and *Byrrhinus helicophallus* sp. nov.; D – Socotra, wadi Dirhor (Esgego), type locality of *B. socotrensis* sp. nov. (photos: A–B – A. Cieslak; C–D – J. Hájek)

Etymology. Named after the Arabian Peninsula; adjective.
Distribution (Fig. 16). So far only known from the type locality in continental Yemen.
Remarks. The peculiar shape of the apex of the parameres of the aedeagus is not found in any of the known Afrotropical species of the genus (Delève 1968). In the description of *Limnichus micraspis* Champion, 1923, from northeast India, it is noted that some specimens from Karachi and Fyzabad (Pakistan) could belong to this species (Champion 1923). This would be the only known record of Limnichidae from Pakistan. According to the description, *L. micraspis* seems to be smaller (1.25 mm), with the ventral side rufescens and the appendixes rufo-testaceous (Champion 1923).

Discussion

The very incomplete knowledge of the taxonomy and distribution of the family Limnichidae is clearly exemplified by the fact that all the species found on the Arabian Peninsula and Socotra were new to science, despite the wide geographical distribution of many of the species of Limnichidae (Hernando & Ribera 2006). It is expected that further research

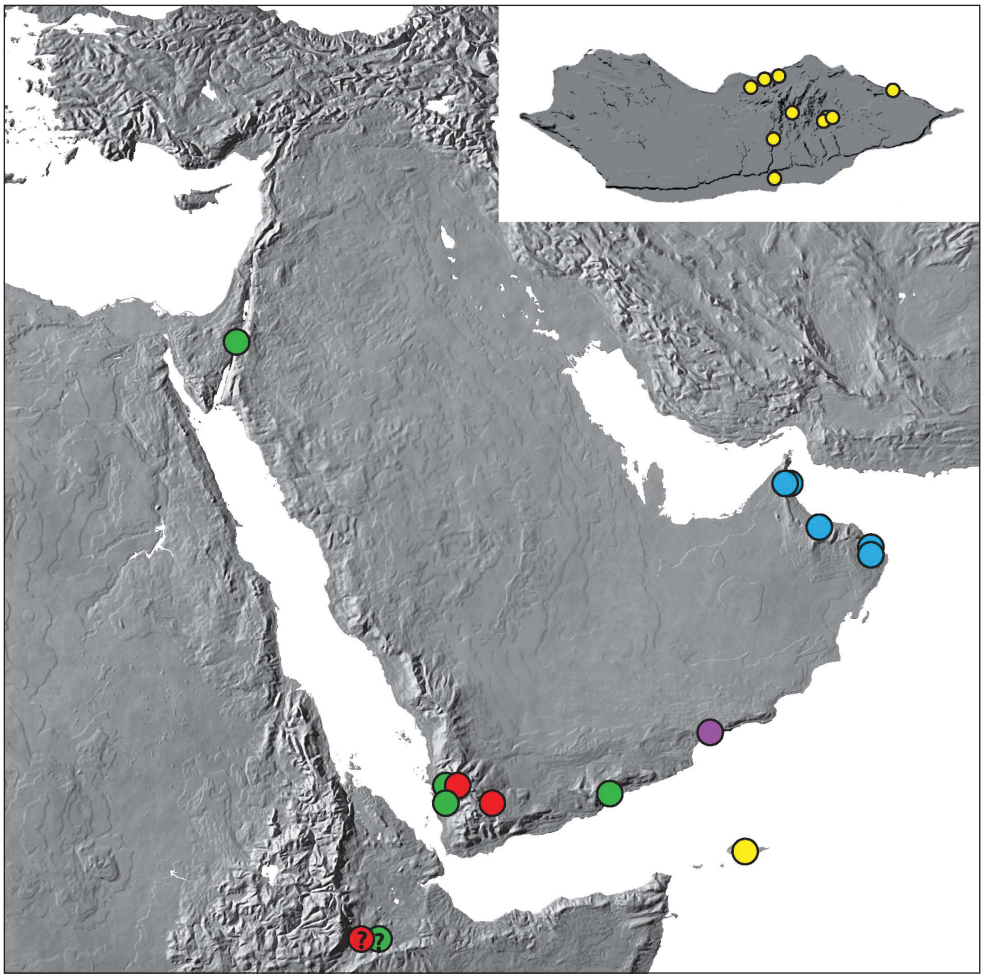


Fig. 16. Distribution of the known Arabian Limnichidae. Blue circles – *Pelochares sinbad* sp. nov.; green circles – *P. sabaeanus* sp. nov.; red circles – *Byrrhinus helicophallus* sp. nov.; yellow circles – *B. socotrensis* sp. nov.; purple circle – *Limnichus arabicus* sp. nov. With question marks, specimens of uncertain identity from Ethiopia; inset – detailed distribution of *B. socotrensis* sp. nov. in Socotra.

in the area would result in new records and new species, but also in the finding of some of the species newly described here in other localities in the Middle East or in northeast Africa. It was unfortunate that all studied Ethiopian specimens were females, but it seems likely that both *Pelochares sabaeanus* sp. nov. and *Byrrhinus helicophallus* sp. nov. occur in north Ethiopia and west Yemen. The two areas are separated by less than 40 km of shallow sea through the strait of Bab-el-Mandeb between the Red and Arabian seas, and were connected during the cold periods of the Pleistocene due to the associated descent of the sea level. More surprising is the presence of *Pelochares sabaeanus* sp. nov., a species

seemingly of Afrotropical affinities, in Jordan, with a typical Palaearctic fauna. However, at present it is not possible to give a global assessment of the geographic or phylogenetic relationships of the species.

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