

Annotated catalogue of Iranian burrower bugs (Heteroptera, Pentatomoidea, Cydnidae)

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Academic editor: Thomas Henry | Received 21 June 2009 | Accepted 26 October 2009 | Published 30 October 2009

Citation: Ghahari H, Chérot F, Linnavuori RE, Ostovan H (2009) Annotated catalogue of Iranian burrower bugs (Heteroptera, Pentatomoidea, Cydnidae). ZooKeys 26: 1–31. doi: 10.3897/zookeys.26.214

Abstract

A catalogue of burrower bugs (Heteroptera, Pentatomoidea, Cydnidae) of Iran is provided. A total of 58 species from 5 subfamilies, 6 tribes and 22 genera is listed in this paper. Of these, 14 species are newly recorded from Iran: *Byrsinus fossor* (Mulsant & Rey, 1866), *Byrsinus nigroscutellatus* (Montandon, 1900), *Byrsinus penicillatus* Wagner, 1964, *Canthophorus wagneri* Asanova, 1964, *Crocistethus waltlianus* (Fieber, 1837), *Geotomus antennatus* Signoret, 1883, *Sehirus cypriacus* Dohrn, 1860, *Sehirus dissimilis* Horváth, 1919, *Sehirus luctuosus* Mulsant & Rey, 1866, *Sehirus ovatus* (Herrich-Schaeffer, 1840), *Sehirus parens* Mulsant & Rey, 1866, *Sehirus planiceps* Horváth, 1895, *Stibaropus henkei* (Jakovlev, 1874) and *Tritomegas delagrangei* (Puton, 1888). Additional Iranian records are provided for *Byrsinus laeviceps* (Kerzhner, 1972), *Exosehirus marginatus* (Signoret, 1881b), *Fromundus pygmaeus* (Dallas, 1851), *Geotomus elongatus* (Herrich-Schaeffer, 1840), *Geotomus punctulatus* (Costa, 1847), *Ochetostethus sahlbergi* Wagner, 1952 and *Tritomegas bicolor* (Linnaeus, 1758).

Keywords

Heteroptera, Cydnidae, Fauna, Iran

Introduction

The burrower or burrowing bugs (Insecta: Heteroptera: Cydnidae) include about 680 species worldwide, mainly in tropical parts of the both Old and New Worlds (Lis 2006). As suggested by their common name, a majority of cydnids are adapted to burrowing in the ground, feeding on roots of plants. The family does not include major agricultural pests (Lis *op. cit.*; Lis et al. 2000), although an outbreak in populations of some species could cause serious damage (Froeschner 1960, 1988).

Even if the monophyly and the delimitation of family Cydnidae has been questioned recently (Grazia et al. 2008; Pluot-Sigwalt and Lis, 2008), these insects are undoubtedly closely related to the Pentatomidae. To such an extent that they were classified as a subfamily of the Pentatomidae in early literature.

The Cydnidae can be separated from the Pentatomidae by a combination of:

- (a) their ovoid and convex body, frequently shining, black or brown;
- (b) their broad, flattened head and legs adapted for digging;
- (c) their antenna generally 5-segmented and their tarsi generally 3-segmented and
- (d) their tibial armament. Pentatomidae have tibial hairs, but lack stout, hardened tibial spines that are characteristic of the Cydnidae.

The fauna of Iranian Cydnidae has been poorly studied. The main works concerning Cydnidae from Iran are the following: Hoberlandt (1955), Safavi (1959), Baroughi (1978), Modarres Awal (1987), Hoberlandt (1995), Modarres Awal (1996a, b, 1997), Lis (1998, 1999), Linnavuori (2004), Lis (2006), Magnien (2006), Linnavuori (2007), Modarres Awal (2008), Askari et al. (2009), Hassanzadeh et al. (2009), and Sadeghi et al. (2009). In a recent checklist of Iranian agricultural pests (Modarres Awal, 1997: 71), only 18 species of Cydnidae were listed. Magnien (2006) described one new species that occurs in Iran and Linnavuori (2004, 2007) and Modarres Awal (2008) reported several other new species records for Iran. So, prior to our study, the total number of cydnids species recorded from Iran was 44.

We provide hereafter for the first time a catalog of Iranian Cydnidae, including a total of 58 species, 14 of which constitute new records for Iran. The new and additional records for Iran were analyzed by the third author and the specimens are preserved in his collection.

The arrangement of synonymies is adapted from Lis (1999, 2006); the distributional data including distribution outside Iran for each species were taken from Lis (2006). The classification of subfamilies and tribes follows in part Froeschner (1960), Lis (1994, 1999, 2006) and Pluot-Sigwalt and Lis (2008).

Catalogue

Subfamily Amaurocorinae Wagner, 1963

Tribe Amaurocorini Wagner, 1963

Genus *Amaurocoris* Stål, 1865

1) *Amaurocoris curtus* (Brullé, 1839)

Cydnus curtus Brullé, 1839: 81 (as new species).

Amaurocoris curtus: Lethierry and Severin 1893: 76 (new combination).

Iran records: Hoberlandt 1955: 122, 1995: 187–188; Linnavuori 2004: 285, 2007: 89; Lis 1999: 218–219, 2006: 138; Modarres Awal 1996a: 127, 1997: 71; Safavi 1959: 31; Wagner 1968: 438.

Distribution in Iran: Abbassi, Bushehr, Fars, Hormozgan, Kerman, Khorasan, Khuzestan, Sistan & Balouchestan provinces.

Distribution outside Iran: Afghanistan, Algeria, Armenia, Azerbaidjan, Canary Islands, Cape Verde Islands, Cyprus, Egypt, Eritrea, Ethiopia, Greece, India (?), Iraq, Israel, Kenya, Jordan, Libya, Mauretania, Morocco, Pakistan, Saudi Arabia, Senegal, Somalia, Sudan, Syria, Tadzhikistan, Tunisia, Turkey, Turkmenistan, Uzbekistan, Yemen.

Genus *Linospa* Signoret, 1881a

2) *Linospa candida* (Horváth, 1889)

Amaurocoris candidus Horváth, 1889: 173 [name only].

Linospa candida: Lis 1993a: 70 (new combination).

Iran records: Hoberlandt 1995: 188–189 [under the original combination]; Linnavuori 2007: 89; Lis 1999: 219, 2006: 138.

Distribution in Iran: Khorasan province.

Distribution outside Iran: Afghanistan, Kazakhstan, Turkmenistan, Uzbekistan.

3) *Linospa orbicularis* (Jakovlev, 1885)

Amaurocoris orbicularis Jakovlev, 1885: 110 (as new species).

Linospa orbicularis: Lis 1993a: 72 (new combination).

Iran records: Hoberlandt 1995: 188; Lis 1999: 219, 2006: 139; Seidenstücker 1957: 73 [under the name *A. aspericollis* Puton, 1886 a junior synonym]; Wagner 1968: 438 [under the combination *A. orbicularis* Jakovlev, 1885].

Distribution in Iran: Abbassi, Kerman, Khorasan, Khuzestan, Sistan & Baluchestan provinces.

Distribution outside Iran: Afghanistan, Algeria, Canary Islands, Egypt, Eritrea, Iraq, Israel, Libya, Morocco, Pakistan, Saudi Arabia, Sudan, Tadzhikistan, Tunisia, Turkmenistan, Uzbekistan, Yemen.

Subfamily Amnestinae Hart, 1919

Tribe Amnestini Hart, 1919

Genus *Amnestus* Dallas, 1851

4) *Amnestus raunoi* Lis, 1998

Amnestus raunoi Lis, 1998: 5–7 (as new species).

Iran records: Linnavuori 2007: 88; Lis 1998: 5–7, 2006: 119.

Distribution in Iran: Gilan province.

Distribution outside Iran: Unknown, apparently endemic to Iran.

Comment: *Amnestus raunoi* is very close to the species *Amnestus pusillus* Uhler. These two species were studied and compared taxonomically by Lis (1998).

Subfamily Cephalocteinae Mulsant & Rey, 1866

Tribe Scaptocorini Froeschner, 1960

Genus *Stibaropus* Dallas, 1851

5) *Stibaropus henkei* (Jakovlev, 1874)

Pachynemis henkei Jakovlev, 1874a: 56 (as new species).

Stibaropus henkei: Signoret 1881a: 46 (new combination).

Material examined: East Azarbaijan province, Arasbaran (835m), 1♂, 3♀♀, September 2005. **New record for Iran.**

Distribution outside Iran: Armenia, Azerbaidjan, Bulgaria, Hungary, Kazakhstan, Kirgizia, Romania, Russia (Central and South European Territory), Tadzhikistan, Turkmenistan, Ukraine, Uzbekistan.

Subfamily Cydninae Billberg, 1820**Tribe Cydnini Billberg, 1820****Genus *Cydnus* Fabricius, 1803****6) *Cydnus aterrimus* (Forster 1771)**

Cimex aterrimus Forster, 1771: 71 (as new species).

Cydnus aterrimus: Dallas 1851: 121 (new combination).

Cydnus infernalis Kiritshenko 1966: 799 (as new species ; the synonymy by Lis 1996: 405).

Iran records: Askari et al. 2009: 562; Baroughi 1978: 22; Hassanzadeh et al. 2009: 22; Hassanzadeh et al. 2009: 529; Hoberlandt 1955: 122, 1995: 187; Lindberg 1938: 89; Linnavuori 2007: 88; Lis 1999: 180, 2006: 124; Modarres Awal 1987: 19, 1996a: 127, 1997: 71, 2008: 246; Sadeghi et al. 2009: 499; Safavi 1959: 31; Wagner 1968: 438.

Distribution in Iran: Bushehr, East Azarbaijan, Fars, Golestan, Gorgan, Kerman, Khorasan, Mazandaran, Sistan & Balouchestan, Tehran, Zanjan provinces.

Distribution outside Iran: Afghanistan, Albania, Algeria, Armenia, Austria, Azerbaijan, Bangladesh, Belgium, Bosnia Herzegovina, Bulgaria, Canary Islands, China (Neimenggu, Ningxia), Congo (?), Crimea, Croatia, Cyprus, Czech Republic, Egypt, France, Georgia, Germany, Greece, Hungary, Iraq, India, Israel, Italy, Jordan, Kazakhstan, Kirgizia, Lebanon, Libya, Lithuania, Luxembourg, Macedonia, Madeira, Malta, Malaya (?), Malta, Moldavia, Morocco, Netherlands, Pakistan, Poland, Portugal, Romania, Russia (South European Territory, West Siberia), Senegal, Serbia and Montenegro, Slovakia, Slovenia, South Africa (introduction), Spain, Sri Lanka, Switzerland, Syria, Tadzhikistan, Tunisia, Turkey, Turkmenistan, Ukraine, USA (introduction), Uzbekistan, West Indies (introduction), Yemen.

Genus *Nishadana* Distant, 1899b**7) *Nishadana arabica* Horváth, 1919**

Nishadana arabica Horváth, 1919: 265 (as new species).

Iran records: Hoberlandt 1995: 190; Lis 2006: 120.

Distribution in Iran: Lorestan province.

Distribution outside Iran: Chad, Gambia, Ghana, Senegal, Somalia, Yemen.

Remark: the genus *Nishadana* Distant, 1899 was reclassified in the tribe Cydnini of the subfamily Cydninae by Pluot-Sigwalt and Lis (2008) on the basis of spermatheca structure.

Tribe Geotomini Wagner, 1963**Genus *Aethus* Dallas, 1851****8) *Aethus hispidulus* (Klug, 1845)**

Cydnus hispidulus Klug, 1845: [10] (as new species).

Aethus hispidulus: Walker 1867: 154 (new combination).

Iran records: Hoberlandt 1995: 191; Lis 1999: 186, 2006: 126; Putshkov 1965: 35.

Distribution in Iran: North Iran (Putshkov 1965, without exact locality).

Distribution outside Iran: Afghanistan, Armenia, Azerbaidjan, Cyprus, Egypt, Greece, Iraq, Israel, Jordan, Saudi Arabia, Somalia, Syria, Turkey, Turkmenistan (Kugitang-Tau Mountains), Uzbekistan.

9) *Aethus ostiolatus* Signoret, 1882

Aethus ostiolatus Signoret, 1882: 433 (as new species).

Iran records: Hoberlandt 1995: 183 [under the name *Aethus macrophthalmus* Wagner, 1951, a junior synonym]; Lis 1999: 187, 2006: 126; Seidenstücker, 1957: 73 [under the name *Aethus macrophthalmus* Wagner, 1951].

Distribution in Iran: Abbassi, Baluchestan, Bushehr, Khuzestan provinces.

Distribution outside Iran: Algeria, Chad, Egypt, Kenya, Saudi Arabia, Somalia, Sudan, Yemen.

10) *Aethus pilosus* (Herrich-Schaeffer, 1834)

Cydnus pilosus Herrich-Schaeffer, 1834: plate 22 and legend.

Aethus pilosus: Walker 1867: 148 (new combination).

Iran records: Hoberlandt 1955: 121, 1995: 191; Lis 1999: 188, 2006: 126; Modarres-Awal 1997: 71; Safavi 1959: 31.

Distribution in Iran: Sistan & Balouchestan province.

Distribution outside Iran: Afghanistan, Algeria, Cameroon, Croatia, Egypt, Ethiopia, France, Greece, Israel, Italy, Jordan, Libya, Malta, Portugal, Saudi Arabia, Senegal, Serbia and Montenegro, Spain, Syria, Tunisia, Turkey.

Genus *Alonips* Signoret, 1881b**11) *Alonips acrostictus* (Distant, 1918)**

Geotomus acrostictus Distant, 1918: 118 (as new species).

Alonips acrostictus: Lis 1994: 156 (new combination).

Iran records: Linnavuori 2004: 286; Lis 2006: 127.

Distribution in Iran: Hormozgan province.

Distribution outside Iran: China (Hainan), India, Laos, Pakistan, Sri-Lanka, Thailand, Vietnam.

12) *Alonips intrusus* (Wagner, 1953)

Geotomus intrusus Wagner, 1953: 467 (as new species).

Alonips intrusus: Lis 1994: 155 (new combination).

Iran records: Linnavuori 2004: 285; Lis 2006: 127.

Distribution in Iran: Hormozgan province.

Distribution outside Iran: Algeria, Burkina Faso, Canary Islands, Egypt, Eritrea, Iraq, Mali, Saudi Arabia, Senegal, Sudan, Tanzania, Tunisia, Yemen.

Genus *Byrsinus* Fieber, 1860**13) *Byrsinus comaroffii* (Jakovlev, 1879)**

Cydnus comaroffii Jakovlev, 1879: 21 (as new species).

Byrsinus komaroffi: Wagner 1965: 50 (new combination).

Byrsinus comaroffii: Lis 1993b: 85 (revision, spelling).

Iran records: Hoberlandt 1995: 185 [under the name *Aethus comaroffi* (Jakovlev, 1879)]; Lis 1999: 191, 2006: 128.

Distribution in Iran: Abbassi, Baluchestan, Kerman, Khorasan.

Distribution outside Iran: Armenia, Afghanistan, Azerbaidjan, China (Neimeng-gu, Xinjiang), Kazakhstan, Kirgizia, Mongolia, Russia (South European Territory), Tadzhikistan, Turkmenistan, Uzbekistan.

***Byrsinus discus* Jakovlev, 1906**

Byrsinus discus Jakovlev, 1906: 52 (as new species).

Iran records: Putshkov 1965: 41 [under the combination *Peribyssus discus* (Jak., 1906)]; Hoberlandt 1995: 185 [under the combination *Peribyssus discus* (Jakovlev, 1906)].

Distribution in Iran: The mention of *Byrsinus discus* Jakovlev, 1906 from North Iran, without exact locality information, by Putshkov (1965: 41) was hypothetical. Putshkov wrote “Described from Repetek (Turkmenistan), mostly it occurs in the upper layer of sandy soil near tufts of grasses. Recorded also from Uzbekistan and certainly *will be* recorded from grasslands in other Central Asian countries, including (...) northern Iran...” (Translated by D. Redei, our italicization). Hoberlandt (1995: 191) recorded the species from Iran referring only to Putshkov’s work but as a “published records”. Because Lis (2006: 128) did not list *B. discus* from Iran, its presence in Iran needs confirmation.

Distribution outside Iran: Turkmenistan, Uzbekistan.

14) *Byrsinus flavicornis* (Fabricius, 1794)

Cimex flavicornis Fabricius, 1794: 124 (as new species).

Byrsinus flavicornis: Lis 1993b: 86 (new combination).

Iran records: Hoberlandt 1955: 122, 1995: 190; Lis 1999: 192, 2006: 128; Modarres-Awal, 1997: 71; Safavi 1959: 31 [under the combination *Aethus flavicornis*, doubtful data].

Distribution in Iran: Khuzestan.

Distribution outside Iran: Afghanistan, Algeria, Armenia (?), Azerbaidjan (?), Belgium, Bulgaria, Byelorussia (?), Canary Islands, China (Neimenggu, Xinjiang), Croatia, Cyprus, Czech Republic, Egypt, France, Germany, Great Britain (as migrant), Hungary, Italy, Kazakhstan, Latvia (?), Libya, Lithuania (?), Macedonia, Madeira, Malta, Moldavia, Mongolia, Morocco, Netherlands, Poland, Portugal, Romania, Russia [Central and South European Territory, East and West Siberia, Far East (?)], Serbia and Montenegro, Slovakia, Spain, Tunisia, Turkey, Turkmenistan, Ukraine.

15) *Byrsinus fossor* (Mulsant & Rey, 1866)

Cydnus (*Byrsinus*) *fossor* Mulsant and Rey, 1866: 18 (as new species).

Byrsinus fossor: Walker 1867: 164 (new combination).

Material examined: Mazandaran province, Beshahr (57m), 1 ♀, September 2006. **New record for Iran.**

Distribution in Iran: Mazandaran province.

Distribution outside Iran: Armenia, Azerbaidjan, Bulgaria, China (Xinjiang), France, Hungary, Kazakhstan, Romania, Russia (South European Territory), Serbia and Montenegro, Spain, Ukraine.

Comment: The records of *Byrsinus fossor* from Afghanistan, Egypt, Mongolia, Tadzhikistan and Turkmenistan pertain to other species of the genus, according to Lis (2006: 19).

16) *Byrsinus laeviceps* (Kerzhner, 1972)

Aethus laeviceps Kerzhner, 1972: 363 (as new species).

Byrsinus laeviceps: Lis 1993b: 87 (new combination).

Iran records: Hoberlandt 1995: 184–185 [under the original combination]; Linnavuori 2007: 88.

Additional data: Khorasan province, Serakhs (330m), 2♂♂, June 2001.

Distribution in Iran: Baluchestan, Kerman, Khorasan and Tehran provinces.

Distribution outside Iran: China (Xinjiang), Kazakhstan, Mongolia, Turkmenistan, Uzbekistan.

17) *Byrsinus laticollis* (Wagner, 1954)

Aethus (*Cydnus*) *laticollis* Wagner, 1954: 1 (as new species).

Byrsinus laticollis: Lis 1993b: 88 (new combination).

Iran records: Hoberlandt 1995: 183 (under the name *Aethus laticollis*).

Distribution in Iran: Tehran province.

Distribution outside Iran: Canary Islands, Italy, Libya, Madeira, Morocco, Spain, Tunisia.

***Byrsinus minor* Wagner, 1964.** The record of *Byrsinus minor* Wagner, 1964 from Gilan province (Assalem, 8 km NW Bandar-Pahlavi) by Wagner (1968: 437), also quoted by Hoberlandt (1995: 191), is erroneous, according to Lis (2006: 129). Consequently, this species is still not known from Iran.

18) *Byrsinus nigroscutellatus* (Montandon, 1900)

Byrsinocoris nigroscutellatus Montandon, 1900: 157 (as new species).

Byrsinus nigroscutellatus: Lis 2003: 40 (new synonymy and combination).

Material examined: Ilam province, Ilam (1430m), 1♂, 3♀♀, May 2004. **New record for Iran.**

Distribution outside Iran: Algeria, Chad, Egypt, Libya, Mauretania, Oman.

19) *Byrsinus pallidus* (Puton, 1887)

Cydnius pallidus Puton in Puton and Lethierry, 1887: 298 (as new species).

Byrsinus pallidus: Lis 1993b: 89 (new combination).

Iran records: Hoberlandt 1995: 184 [under the name *Aethus pallidus* (Puton, 1887)]; Linnavuori 2004: 285 ; Lis 1999: 193, 2006: 130; Wagner 1968: 437 [under the name *A. pallidus* (Puton, 1887)].

Distribution in Iran: Abbassi, Baluchestan, Golestan, Hormozgan provinces.

Distribution outside Iran: Algeria, Canary Islands, Djibouti, Egypt, Iran, Israel, Italy (?), Libya, Mauretania, Morocco, Pakistan, Saudi Arabia, Sudan, Tunisia, Yemen.

20) *Byrsinus penicillatus* Wagner, 1964

Byrsinus penicillatus Wagner, 1964: 81 (as new species).

Material examined: Khorasan province, Torbat-Jam (881m), 1♂, 2♀♀, September 2003. **New record for Iran.**

Distribution outside Iran: Afghanistan, China (Xinjiang, Xizang), Kazakhstan, Mongolia, Turkmenistan, Uzbekistan.

21) *Byrsinus pilosulus* (Klug, 1845)

Cydnius pilosulus Klug, 1845: [10] (as new species).

Byrsinus pilosulus: Lis 1993b: 90 (new combination).

Iran records: Hoberlandt 1995: 183 [under the name *Aethus pilosulus* (Klug, 1845), an incorrect spelling]; Linnavuori 2004: 285, 2007: 88; Lis 1999: 193, 2006: 130; Seidenstücker, 1957: 73 [under the combination *Aethus pilosulus* Klug].

Distribution in Iran: Abbassi, Baluchestan, Fars, Gilan, Hormozgan, Kerman, Khorasan, Sistan, Tehran, Zanzan provinces.

Distribution outside Iran: Afghanistan, Algeria, Bulgaria, Canary Islands, Cape Verde Islands, Egypt, France, Germany (?), Greece, Hungary, India, Iraq, Israel, Italy, Libya, Madeira, Malta, Mauretania, Morocco, Pakistan, Romania, Saudi Arabia, Socotra, Serbia and Montenegro, Spain, Sudan, Syria, Tadjikistan, Tunisia, Turkey, Turkmenistan, Uzbekistan, Yemen.

22) *Byrsinus rugosus* (Jakovlev, 1874)

Cydnus rugosus Jakovlev, 1874b: 235 (as new species).

Byrsinus rugosus: Lis 1993b : 91 (new combination).

Iran records: Hoberlandt 1995 : 190 [under the combination *Aethus rugosus* (Jakovlev, 1874)]; Lis 1999: 194, 2006: 130; Modarres-Awal, 1996a: 126, 1997: 71 [both as *Aethus rugosus* (Jakovlev, 1874)]; Wagner, 1968: 437.

Distribution in Iran: Abbassi, Hormozgan, Khorasan provinces.

Distribution outside Iran: Afghanistan, Armenia (?), Azerbaidjan, China (Neimeng-gu, Xinjiang), Egypt, Iraq, Kazakhstan, Mongolia, Russia (South European Territory), Saudi Arabia, Tadzhikistan, Turkmenistan, Uzbekistan.

Comment: Safavi (1959) reported *Aethus flavicornis* (Fabricius) from Iran (Khuzestan province). Because specimen(s) were not available to us, we do not know if the involved species is *Byrsinus flavicornis* (Fabricius, 1794) or *B. rugosus* (Jakovlev, 1874).

Genus *Fromundiellus* Lis, 1994

23) *Fromundiellus latiusculus* (Horváth, 1882)

Geotomus latiusculus Horváth, 1882: 217 (as new species).

Fromundiellus latiusculus: Lis 1997: 4 (new combination).

Iran record: Modarres Awal 2008: 247.

Distribution in Iran: Khorasan province.

Distribution outside Iran: Afghanistan, Azerbaijan, India (North), Kirgizia, Pakistan, Tadzhikistan, Turkmenistan, Uzbekistan.

Genus *Fromundus* Distant, 1901

24) *Fromundus pygmaeus* (Dallas, 1851)

Aethus pygmaeus Dallas, 1851: 120 (as new species).

Fromundus pygmaeus: Lis 1994: 181 (new combination).

Iran records: Linnavuori 2004: 286; Lis 2006: 132.

Additional data: Kermanshah province, Sar-pole-zahab (558), 2♀, October 2001.

Distribution in Iran: Hormozgan and Kermanshah provinces.

Distribution outside Iran: Australia, Bismarck Archipelago (Manus, Mussau, New Ireland, New Britain), Burma, Brunei, Cambodia, Chagos Archipelago, China (Sichuan, Guangdong, Hainan, Guangxi, Yunnan, Jiangxi, Hubei, Taiwan), Christmas Islands, Cocos-Keel-

ing Islands, Fiji, Hawaii, Hong Kong, India (incl. Andamans and Nicobars), Indonesia, Iraq, Israel, Japan, Jordan, Korea, Laos, Malaysia, Maldives, Marquesas, Micronesia, Nepal, New Caledonia, New Hebrides, Pakistan, Papua New Guinea, Philippines, Samoa, Saudi Arabia, Singapore, Sri Lanka, Solomon Islands, Society Islands, Thailand, Vietnam, Yemen.

Genus *Geotomus* Mulsant & Rey, 1866

25) *Geotomus angustus* Wagner, 1953

Geotomus elongatus angustus Wagner, 1953: 471 [as new subspecies of *G. elongatus* (Herrich-Schaeffer, 1840)].

Geotomus angustus: Stichel 1961: 692 (upgrading to species rank).

Iran records: Hoberlandt 1995: 186 (under the original combination).

Distribution in Iran: Abbassi province.

Distribution outside Iran: Algeria, Cape Verde Islands, Chad, Libya, Morocco, Spain, Sudan, Tunisia, Turkey.

26) *Geotomus antennatus* Signoret, 1883

Geotomus antennatus Signoret, 1883: 56 (as new species).

Material examined: Khorasan province, Torbat-Jam (880m), 2♂♂, 2♀♀, July 2001.

New record for Iran.

Distribution outside Iran: Afghanistan, Israel, Syria, Turkey.

27) *Geotomus brunnipennis* Wagner, 1953

Geotomus brunnipennis Wagner, 1953: 466 (as new species).

Iran records: Modarres Awal 1996a: 127, 1996b: 106, 1997: 71.

Distribution in Iran: Ardabil, Khorasan provinces.

Distribution outside Iran: Albania, Austria, Bulgaria, Croatia, France, Greece, Italy, Macedonia, Serbia and Montenegro, Turkey.

28) *Geotomus ciliatitylus*, Signoret, 1881

Geotomus ciliatitylus Signoret, 1881b: 652–653 [the synonymy with *Geotomus caucasicus* (Kolenati, 1846), now *Geotomus elongatus* (Herrich-Schaeffer, 1840), by

Horváth 1918: 323, incorrect according to Lis 2006: 133; Hoberlandt's (1995: 187) remark about *G. caucasicus* subspecies distribution, based on Wagner (1953: 472–473), unjustified].

Iran records: Safavi 1959: 31 (under the combination *Geotomus caucasicus ciliatitylus*); Modarres-Awal 1997: 71; Signoret 1881b: 652–653 (type from Tehran).

Distribution in Iran: Tehran.

Distribution outside Iran: Albania, Azerbaijan, Bosnia Herzegovina, Bulgaria, Croatia, Georgia, Greece, Israel, Macedonia, Romania, Russia [South European Territory (?)], Serbia and Montenegro, Syria, Turkey, Turkmenistan, Uzbekistan.

29) *Geotomus elongatus* (Herrich-Schaeffer, 1840)

Cydnus elongatus Herrich-Schaeffer, 1840: 96 (as new species).

Cydnus caucasicus Kolenati 1846: 70 (as new species, the new combination by Horváth 1917: 371 and the synonymy by Kerzhner 2003: 95).

Geotomus elongatus: Mulsant and Rey 1866: 38 (new combination).

Iran records: Hoberlandt 1995: 186–187 (under the name *G. elongatus* and the junior synonym *G. caucasicus*); Lis 2006: 133; Wagner 1953: 471–472, 475.

Additional data: Golestan province, National Park (185m), 1♂, 2♀♀, October 2003.

Distribution in Iran: Abbassi, Baluchestan, Bushehr, Golestan, Kerman, Tehran provinces.

Distribution outside Iran: Algeria, Armenia, Azerbaidjan, Belgium, Bosnia Herzegovina, Bulgaria, Canary Islands, China (Neimenggu), Croatia, France, Georgia, Germany, Greece, Hungary, Israel, Iraq, Italy, Kazakhstan, Kirgizia, Macedonia, Morocco, Portugal, Romania, Russia (South European Territory), Serbia and Montenegro, Spain, Switzerland, Syria, Tadzhikistan, Tunisia, Turkey, Turkmenistan, Ukraine, Uzbekistan.

30) *Geotomus punctulatus* (Costa, 1847)

Cydnus punctulatus Costa, 1847: 30.

Geotomus punctulatus: Mulsant and Rey 1866: 35 (new combination).

Iran records: Hoberlandt 1995: 187; Lis 2006: 133.

Additional data: East Azarbaijan province, Arasbaran (792m), 1♀, September 2005.

Distribution in Iran: East Azarbaijan, Khorasan, Tehran provinces.

Distribution outside Iran: Albania, Algeria, Armenia, Azerbaidjan, Azores Islands, Belgium, Bosnia Herzegovina, Bulgaria, Canary Islands, Cyprus, France, Georgia, Germany, Great Britain, Greece, Hungary, Israel, Italy, Kazakhstan, Libya, Macedonia, Malta, Moldavia, Morocco, Portugal, Romania, Russia (South

European Territory), Serbia and Montenegro, Spain, Syria, Tunisia, Turkey, Turkmenistan, Ukraine.

Genus *Macroscytus* Fieber, 1860

31) *Macroscytus brunneus* (Fabricius, 1803)

Cydnus brunneus Fabricius, 1803: 185 (as new species).

Macroscytus brunneus: Fieber 1861: 362 (new combination).

Iran records: Hoberlandt 1955: 122, 1995: 185–186; Linnavuori 2004: 285, 2007: 88–89; Lis 1999: 208, 2000: 402–404, 2006: 135; Modarres Awal 1996a: 127, 1997: 71, 2008: 247; Safavi 1959: 31; Seidenstücker, 1957: 73, 1958: 5; Wagner 1968: 437.

Distribution in Iran: Abbassi, Fars, Gilan, Hormozgan, Kerman, Khorasan, Lorestan, Sistan & Balouchestan, Tehran, Zanjan provinces.

Distribution outside Iran: Afghanistan, Albania, Algeria, Azerbaidjan, Bosnia-Herzegovina, Botswana, Cameroon, Canary Islands, Cape Verde Islands, Central African Republic, China (North ?), Congo, Croatia, Cyprus, Egypt, Ethiopia, France, Gambia, Ghana, Greece, Guinea, Iraq, Israel, Italy, Ivory Coast, Jordan, Kazakhstan, Kenya, Lebanon, Libya, Macedonia, Mali, Malta, Morocco, Mozambique, Namibia, Nigeria, Oman, Pakistan, Portugal, Saudi Arabia, Senegal, Socotra, Somalia, South Africa, Serbia, Spain, Sudan, Switzerland, Syria, Tadjikistan, Tanzania (incl. Zanzibar), Turkey, Turkmenistan, Tunisia, Uganda, Uzbekistan, Yemen, Zaire, Zambia, Zimbabwe.

Comment: Lis (2000) redescribed and illustrated *M. brunneus*.

Genus *Microporus* Uhler, 1872

32) *Microporus nigrita* (Fabricius, 1794)

Cimex nigrita Fabricius, 1794: 123 (as new species).

Microporus nigrita: Horváth 1917: 369 (new combination).

Iran records: Lis 1993b: 94, 1999: 212, 2006: 137.

Distribution in Iran: Gilan Province.

Distribution outside Iran: Albania, Armenia, Austria, Azerbaidjan, Belgium, Bulgaria, Byelorussia, Canary Islands, China (Beijing, Guangdong, Neimenggu, Shandong, Shanghai, Tianjin, Xinjiang, Xizang, Yunnan), Croatia, Czech Republic, Denmark (?), Ethiopia, France, Georgia, Germany, Greece, Hungary, India (Kashmir), Iran, Italy, Japan, Kazakhstan, Kirgizia, Korea, Latvia, Lithuania, Luxembourg, Macedonia, Moldavia, Mongolia, Netherlands, Poland, Romania, Russia (European Territory, Siberia, Far East), Senegal (?), Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden,

Switzerland, Tadjikistan, Tunisia, Turkey, Turkmenistan, Ukraine, United States of America (introduced), Uzbekistan.

Subfamily Sehirinae Amyot & Serville, 1843

Tribe Sehirini Amyot & Serville, 1843

Genus *Adomerus* Mulsant & Rey, 1866

33) *Adomerus congener* (Jakovlev, 1879).

Sehirus [sic!] *congener* Jakovlev, 1879: 25 (as new species).

Adomerus congener: Kerzhner and Jaczewski 1964: 825 (new combination).

Iran records: Lis 1999: 220, 2006: 139; Modarres-Awal 1987: 19 [under the combination *Sehirus congener* Jak], 1997: 71 [under the subsequent incorrect spelling *Sehirus congenes* (sic)].

Distribution in Iran: East Azarbaijan.

Distribution outside Iran: Armenia, Azerbaidjan, Georgia, Lebanon, Russia (South European Territory), Turkey.

Genus *Canthophorus* Mulsant & Rey, 1866

34) *Canthophorus coeruleus* (Reuter, 1902)

Sehirus coeruleus Reuter, 1902: 144 (as new species).

Canthophorus coeruleus: Asanova 1964: 143 (new combination).

Iran records: Brown 1966: 44; Hoberlandt 1955: 122 [under the combination *Sehirus coeruleus*], 1995: 191; Lis 1999: 220–221, 2006: 140; Modarres-Awal 1997: 71; Safavi 1959: 31 [under the combination *Sehirus coeruleus* (Reuter, 1902)]; Wagner 1968: 438.

Distribution in Iran: Tehran province.

Distribution outside Iran: Kirgizia, Tadjikistan (?), Turkmenistan, Uzbekistan.

35) *Canthophorus dubius* (Scopoli, 1763)

Cimex dubius Scopoli, 1763: 121 (as new species).

Canthophorus (*Canthophorus*) *dubius*: Mulsant and Rey 1866: 63 (new combination).

Iran records: Brown, 1966: 44 [under the combination “*Sehirus dubius* Scop.”]; Hoberlandt 1995: 191; Lindberg 1938: 89 [under the combination “*Sehirus dubius* Scop.”];

Lis 1999: 221, 2006: 140; Modarres-Awal 1997: 71; Safavi 1959: 31 [under the combination “*Sehirus dubius* (Scopoli, 1763)”].

Distribution in Iran: Hamadan, Kerman, Tehran provinces.

Distribution outside Iran: Albania, Algeria (?), Austria, Bosnia Herzegovina, Bulgaria, Croatia, Cyprus (?), Czech Republic, Egypt (?), Finland, France, Germany, Great Britain, Greece, Hungary, Israel, Italy, Lebanon, Liechtenstein, Lithuania (?), Macedonia, Madeira, Moldavia, Poland, Romania, Russia (NW Caucasus), Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria (?), Turkey, Ukraine.

36) *Canthophorus melanopterus* (Herrich-Schaeffer, 1835)

Cydnus melanopterus Herrich-Schaeffer, 1835: 55 (as new species).

Canthophorus melanopterus: Asanova 1964: 143 (new combination).

Iran records: Hoberlandt 1995: 189 [under the spelling *Camptoporus melanopterus*]; Linnavuori 2007: 89; Lis 1999: 221–222, 2006: 141; Modarres Awal 1996b: 107 [under the combination *Sehirus melanopterus*], 1997: 71 [under the combinations “*Sehirus dubius* var. *melanoptera* H-S” et “*S. melanopterus* H-S”, treated as the names of two different taxa]; Safavi 1959: 31 [as *Sehirus dubius* var. *melanoptera* (Herrich-Schaeffer, 1835)]; Wagner 1961: 157 [under the combination *Sehirus melanopterus*].

Distribution in Iran: Ardabil, Azarbaijan, Fars, Gilan, Golestan, Kurdistan, Tehran provinces.

Distribution outside Iran: Albania, Algeria, Armenia, Austria, Azerbaijan, Bosnia Herzegovina, Bulgaria, Canary Islands, China (Beijing ?), Croatia, Cyprus, Czech Republic, Egypt, Georgia, Great Britain, Greece, Hungary, Iraq, Israel, Italy, Jordan, Kazakhstan, Libya, Macedonia, Malta, Moldavia, Morocco, Portugal, Romania, Russia (South European Territory), Serbia and Montenegro, Slovakia, Slovenia, Spain, Syria, Tadzhikistan, Tunisia, Turkey, Ukraine.

37) *Canthophorus wagneri* Asanova, 1964

Canthophorus wagneri Asanova, 1964: 139.

Material examined: West Azerbaijan province, Seroo (1612m), 2♀♀, August 2003.
New record for Iran.

Distribution outside Iran: Armenia, Azerbaijan, Georgia, Russia (South European Territory), Turkmenistan, Turkey.

Genus *Crocistethus* Fieber, 1860

38) *Crocistethus waltlianus* (Fieber, 1837)

Cydnus waltlianus Fieber, 1837: 352 (as new species).

Crocistethus waltlianus: Stichel 1961: 678 (new combination).

Material examined: West Azerbaijan province, Piranshahr (1465m), 2♂♂, August 2004. **New record for Iran.**

Distribution outside Iran: Algeria, Canary Islands, Cyprus, Egypt, France, Greece, Iraq, Israel, Italy, Jordan, Malta, Morocco, Portugal, Serbia, Spain, Syria, Tunisia, Turkey.

Genus *Exosehirus* Wagner, 1963

39) *Exosehirus marginatus* (Signoret, 1881b)

Adomerus marginatus Signoret, 1881b: 656.

Exosehirus marginatus: Linnavuori 1984: 2 (new combination, in the framework of *E. sargon* description).

Iran records: Modarres Awal 1996a: 127 [under the combination *Sehirus marginatus*], 1997: 71.

Additional data: West Azarbaijan province, Maco (1730m), 1♀, September 2000.

Distribution in Iran: Khorasan and West Azerbaijan provinces.

Distribution outside Iran: Syria, Turkey (type locality: Taurus Mt).

40) *Exosehirus validus* (Jakovlev, 1877)

Gnathoconus validus Jakovlev, 1877: 76 (as new species).

Exosehirus validus: Wagner 1963: 107 (new combination).

Iran records: Hoberlandt 2005: 189; Lis 1999: 223, 2006: 142; Modarres Awal 2008: 247.

Distribution in Iran: Khorasan and Lorestan provinces; Semnan province: Shahkuh, near Shahrud (type locality).

Distribution outside Iran: Afghanistan, Iraq, Kazakhstan, Kirgizia, Tadjhikistan, Turkmenistan, Uzbekistan.

Genus *Legnotus* Schiödte, 1848**41) *Legnotus limbosus* (Geoffroy, 1785)**

Cimex limbosus Geoffroy in Fourcroy, 1785: 217 (as new species).

Legnotus limbosus: Stichel 1935: 362 (new combination).

Iran records: Hoberlandt 1995: 189; Lis 2006: 143; Linnavuori 2007: 89.

Distribution in Iran: Khorasan and Tehran provinces.

Distribution outside Iran: Albania, Algeria, Armenia, Austria, Azerbaidjan, Belgium, Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, France, Germany, Great Britain, Greece, Hungary, Israel, Italy, Kazakhstan, Lithuania, Luxembourg, Macedonia, Moldavia, Morocco, Netherlands, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Turkey, Ukraine, Uzbekistan.

42) *Legnotus picipes* (Fallén, 1807)

Cydnus picipes Fallén, 1807: 54 (as new species).

Legnotus picipes: Horváth 1917: 372 (new combination).

Iran records: Hoberlandt 1995: 189; Lis 2006: 143.

Distribution in Iran: Khorasan and Tehran provinces.

Distribution outside Iran: Albania, Algeria, Armenia, Austria, Azerbaidjan, Belgium, Bosnia Herzegovina, ?Bulgaria, Byelorussia, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Israel, Italy, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Moldavia, Morocco, Netherlands, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Tunisia, Turkey, Ukraine, Uzbekistan.

Genus *Ochetostethus* Fieber, 1860**43) *Ochetostethus heissi* Magnien, 2006**

Ochetostethus heissi Magnien, 2006: 513–516 (as new species).

Iran records: Magnien 2006: 513–514; Linnavuori 2007: 89.

Distribution in Iran: Gilan and Zanzan provinces.

Distribution outside Iran: Cyprus, Israel, Greece, Turkey.

44) *Ochetostethus nanus* (Herrich-Schaeffer, 1834)

Cydnus nanus Herrich-Schaeffer, 1834: plate 24 (as new species).
Ochetostethus nanus: Mulsant and Rey 1866: 76 (new combination).

Iran records: Modarres Awal 1996a: 127, 1997: 71.

Distribution in Iran: Khorasan province.

Distribution outside Iran: Belgium, France, Portugal (?), Spain.

Comments: This is a doubtful record. The report by Modarres Awal (1996) probably refers to one of the other species of *Ochetostethus*. This would also be the case for all records from North Africa and Central or Eastern Europe (Lis 2006: 144).

45) *Ochetostethus opacus* (Scholtz, 1847)

Cydnus opacus Scholtz, 1847: 158 (as new species).
Ochetostethus opacus: Kerzhner 1976: 36 (new combination).

Iran records: Hoberlandt 1995: 191; Kerzhner 1976: 36 (without exact locality); Linnavuori 2007: 89; Lis 1999: 226, 2006: 144; Magnien 2006: 515 (without exact locality); Modarres Awal 1996b: 107, 1997: 71.

Distribution in Iran: Ardabil, Gilan and Tehran provinces.

Distribution outside Iran: Afghanistan, Albania, Armenia, Austria, Azerbaijan, Bosnia Herzegovina, Bulgaria, Canary Islands, China (North), Croatia, Cyprus, Czech Republic, Finland, Georgia, Germany, Greece, Hungary, Iraq, Israel, Italy, Kazakhstan, Kirgizia, Latvia, Lebanon, Liechtenstein, Lithuania, Macedonia, Moldavia, Norway, Poland, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Switzerland, Syria, Tadzhikistan, Turkey, Ukraine, Uzbekistan.

46) *Ochetostethus sahlbergi* Wagner, 1952

Ochetostethus sahlbergi Wagner, 1952: 42 (as new species).

Iran records: Hoberlandt 1995: 190.

Additional data: West Azerbaijan, Ourmich (1370m), 1♂, 3♀♀, August 2003.

Distribution in Iran: Tehran and West Azerbaijan provinces.

Distribution outside Iran: Afghanistan (?), Egypt, Israel, Jordan, Lebanon, Syria, Turkey.

47) *Ochetostethus tarsalis* Mulsant & Rey, 1852

Cydnus tarsalis Mulsant & Rey, 1852: 79 (as new species).

Ochetostethus tarsalis: Lethierry & Severin 1893: 80 (new combination).

Iran records: Hoberlandt 1995: 190.

Distribution in Iran: Fars and Tehran provinces.

Distribution outside Iran: Algeria, Canary Islands, France, Italy, Libya, Morocco, Saudi Arabia, Spain, Tunisia.

Genus *Sehirus* Amyot & Serville, 1843**48) *Sehirus cypriacus* Dohrn, 1860**

Sehirus cypriacus Dohrn, 1860: 101 (as new species).

Material examined: West Azerbaijan province, Naghadeh (1364m), 1♀, June 2002.

New record for Iran.

Distribution outside Iran: Cyprus, Israel, Jordan, Syria, Turkey.

49) *Sehirus dissimilis* Horváth, 1919

Sehirus dissimilis Horváth, 1919: 267 (as new species).

Material examined: West Azerbaijan province, Oshnavieh (1454m), 1♂, 2♀♀, June 2002. **New record for Iran.**

Distribution outside Iran: Turkey.

50) *Sehirus luctuosus* Mulsant & Rey, 1866

?*Cimex niger spinipes* De Geer, 1773: 269 [unavailable non binominal name; the synonymy with *S. luctuosus* by Reuter (1888); the synonymy with *Cydnus aterrimus* (Forster, 1771) by Amyot, 1845 seems doubtful since Reuter (1888) did examine De Geer's types (Lis 2006 *contra* 1999)].

Sehirus luctuosus Mulsant and Rey 1866: 52 (new combination).

Material examined: East Azerbaijan province, Arasbaran (826m), 2♂♂, 4♀♀, July 2005. **New record for Iran.**

Distribution outside Iran: Albania, Algeria, Armenia, Austria, Azerbaidjan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Croatia, Czech Republic, Den-

mark, Estonia, Finland, France, Georgia, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Kazakhstan, Kirgizia, Latvia, Lithuania, Luxembourg, Macedonia, Moldavia, Mongolia, Netherlands, Norway, Poland, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tadzhikistan, Turkey, Ukraine.

51) *Sehirus morio* (Linnaeus, 1761)

Cimex morio Linnaeus, 1761: 250 (as new species).

Sehirus morio: Amyot and Serville 1843: 96 (new combination).

Iran records: Modarres Awal 1987: 19, 1997: 71; Linnavuori 2007: 89.

Distribution in Iran: Ardabil and East Azerbaijan provinces.

Distribution outside Iran: Albania, Algeria, Armenia, Austria, Azerbaidjan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, Canary Islands, Croatia, Cyprus, Czech Republic, Denmark, France, Georgia, Germany, Greece, Hungary, Italy, Kazakhstan, Kirgizia, Latvia (?), Libya, Lithuania, Luxembourg, Macedonia, Malta, Moldavia, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Spain, Sweden, Switzerland, Tadzhikistan, Tunisia, Turkey, Turkmenistan, Ukraine, Uzbekistan.

52) *Sehirus ovatus* (Herrich-Schaeffer, 1840)

Cydnus ovatus Herrich-Schaeffer, 1840: 96 (as new species).

Sehirus ovatus: Fieber 1861: 367 (new combination).

Material examined: Ardabil province, Germi (764m), 1♂, 3♀♀, September 2004.

New Record for Iran.

Distribution outside Iran: Armenia, Austria, Azerbaijan, Bulgaria, Croatia, Czech Republic, Georgia, Greece, Hungary, Israel, Italy, Kazakhstan, Moldavia, Romania, Russia (Central and South European Territory), Slovakia, Syria, Turkey, Ukraine.

53) *Sehirus parens* Mulsant & Rey, 1866

Sehirus parens Mulsant and Rey, 1866: 52 (as new species).

Material examined: Khorasan province, Birjand (1434m), 2♀♀, April 2003. **New Record for Iran.**

Distribution outside Iran: Afghanistan, Azerbaijan, China (Xinjiang), Czech Republic, Hungary, Kazakhstan, Kirgizia, Romania, Russia (South European Territory, West and East Siberia), Slovakia, Syria, Tadzhikistan, Ukraine.

54) *Sehirus planiceps* Horváth, 1895

Sehirus planiceps Horváth, 1895: 128 (as new species; in key).

Material examined: Mazandaran province, Galogah (82m), 1♂, 1♀, October 2001.

New Record for Iran.

Distribution outside Iran: Caucasus: Georgia and Russia.

55) *Sehirus robustus* Horváth, 1895

Sehirus robustus Horváth, 1895: 129, 130 (as new species; in key).

Iran records: Hoberlandt 1995: 191; Lis 1999: 228, 2006: 146; Wagner 1968: 438.

Distribution in Iran: Gorgan and Mazandaran provinces.

Distribution outside Iran: Armenia, Azerbaijan, Georgia, Iraq, Turkey.

Genus *Tritomegas* Amyot and Serville, 1843

56) *Tritomegas bicolor* (Linnaeus, 1758)

Cimex bicolor Linnaeus, 1758: 446 (as new species).

Tritomegas bicolor: Amyot & Serville 1843: 98 (new combination).

Iran record: Linnavuori 2007: 90.

Additional data: Ardabil province, Pars-Abad (110m), 3♀♀, September 2004.

Distribution in Iran: Ardabil and Gilan provinces.

Distribution outside Iran: Algeria, Armenia, Austria, Azerbaidjan, Belgium, Bosnia Herzegovina, Bulgaria, Byelorussia, China (Liaoning), Croatia, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Great Britain, Greece, Hungary, Israel, Italy, Kazakhstan, Kirgizia, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Moldavia, Mongolia, Morocco, Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Turkey, Ukraine, Uzbekistan.

57) *Tritomegas delagrangei* (Puton, 1888)

Sehirus bicolor var. *delagrangei* Puton, 1888: 256 (as new var.).

Sehirus delagrangei: Horváth 1901: 471 (upgrading to species rank).

Tritomegas delagrangei: Hoberlandt 1956: 212 (new combination).

Material examined: East Azarbaijan province, Maragheh (1495m), 1♂, June 1999.

New record for Iran.

Distribution outside Iran: Azerbaidjan, Israel, Lebanon, Syria, Turkey.

58) *Tritomegas sexmaculatus* Rambur, 1839

Cydnus sexmaculatus Rambur, 1839: 110 (as new species).

Canthophorus (*Tritomegas*) *sexmaculatus*: Mulsant and Rey 1866: 55 (new combination).

Iran records: Hassanzadeh et al. 2009: 529; Linnavuori 2007: 90; Lis 1999: 229, 2006: 147; Modarres Awal 1996a: 128, 1997: 71.

Distribution in Iran: Khorasan and Tehran provinces.

Distribution outside Iran: Albania, Armenia, Austria, Azerbaidjan, Bosnia Herzegovina, Bulgaria, Croatia, Czech Republic, France, Georgia, Germany, Greece, Hungary, Italy, Liechtenstein, Macedonia, Moldavia, Netherlands, Poland, Portugal, Romania, Russia (Central and South European Territory), Serbia and Montenegro, Slovakia, Slovenia, Spain, Switzerland, Turkey, Ukraine.

Discussion

Fifty-eight species of burrower bugs are reported from Iran in the present checklist: one Amnestinae, one Cephalocteinae, and fifty-six Cydninae (three Amaurocorini, two Cydnini, twenty-five Geotomini and twenty-six Sehirini), i.e. about 9% of the World fauna. Of those, fourteen are newly recorded from the country:

- (a) one Cephalocteinae Scaptocorini: *Stibaropus henkei* (Jakovlev, 1874);
- (b) four Cydninae Geotomini: *Byrsinus fossor* (Mulsant & Rey, 1866), *Byrsinus nigroscutellatus* (Montandon, 1900), *Byrsinus penicillatus* Wagner, 1964 and *Geotomus antennatus* Signoret, 1883;
- (c) and nine Cydninae Sehirini: *Canthophorus wagneri* Asanova, 1964, *Crocistethus waltlianus* (Fieber, 1837), *Sehirus cypriacus* Dohrn, 1860, *Sehirus dissimilis* Horváth, 1919, *Sehirus luctuosus* Mulsant & Rey, 1866, *Sehirus ovatus* (Herrich-Schaeffer, 1840), *Sehirus parens* Mulsant & Rey, 1866, *Sehirus planiceps* Horváth, 1895 and *Tritomegas delagrangei* (Puton, 1888).



Figure 1. Map of Iran with boundaries of provinces.

One species is removed of the Iranian faunal list: *Byrsinus minor* Wagner, 1964, an erroneous mention according to Lis (2006: 129). The presence in Iran of *Byrsinus discus* Jakovlev, 1906 needs confirmation.

The number of species probably will increase in the future because Iran is a large, poorly explored, country, incorporating various geographical regions (Fig. 1), climates, and vegetation zones. We are convinced that additional field work will provide numerous new and interesting records.

Acknowledgments

The authors are indebted to late I. M. Kerzhner (Zoological Institute, Russian Academy of Sciences, St-Petersburg, Russia), P. Kment (National Museum of Natural History, Prague, Czech Republic), D. Pluot-Sigwalt (Muséum national d'Histoire naturelle, Paris, France), D. Redei (Hungarian Natural History Museum, Budapest, Hungary), D. Rider (North Dakota State University, Fargo, United States of America), H. Sakenin (Ghaemshahr Islamic Azad University, Mazandaran, Iran), M. Tabari (Iran Rice Research Institute, Mazandaran, Iran) and M. Havaskary (Tehran Islamic Azad University, Iran) for invaluable helps in progress of the project. The research was supported by Shahre Rey Islamic Azad University, Iran. Dr T. Henry (United States National Museum, Washington D.C., United States of America) and two anonymous reviewers provided constructive criticism on the manuscript.

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An illustrated key to powder post beetles (Coleoptera, Bostrichidae) associated with rubberwood in Thailand, with new records and a checklist of species found in Southern Thailand

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Academic editor: Terry Erwin | Received 26 January 2009 | Accepted 24 June 2009 | Published 30 October 2009

Citation: Sittichaya W et al. (2009) An illustrated key to powder post beetles (Coleoptera, Bostrichidae) associated with rubberwood in Thailand, with new records and a checklist of species found in Southern Thailand. ZooKeys 26: 33–51. doi: 10.3897/zookeys.26.88

Abstract

An illustrated key to seventeen species of Bostrichidae recorded in association with rubberwood in Thailand is provided. A checklist is given of nine species infesting rubberwood sawn timber in sawmills in southern Thailand, with information on distribution, host trees and biology. Three species are recorded for the first time from Thailand: *Cephalotoma tonkinea* Lesne, *Lyctoxylon dentatum* (Pascoe), and *Minthea reticulata* Lesne.

Keywords

Bostrichidae, Thailand, rubber wood, *Hevea brasiliensis*, key

Introduction

Rubberwood (*Hevea brasiliensis* Muell. Arg.) is an environmentally friendly wood source, and is an important raw material for wood industries in South and Southeast Asian countries (Edwin and Pillai 2004, Hong 1996, Royal Forest Department of Thailand 2005). It is a non-durable wood, extremely susceptible to staining fungi as

well as insect attack due to its high starch content and low wood extractives (Akhter 2005, CIRAD 2003, Wong et al. 2005). The major insect pests of dried rubberwood sawn timber are powder post beetles belonging to the family Bostrichidae. They are economically important beetles that can extensively damage dried and seasoned wood and wooden artifacts through the boring behavior of both adults and larvae (Akhter 2005, Creffield 1991, Gerberg 1957, Ivie 2002, Peters et al. 2002). In this paper we have followed the classification of the most recently published catalogue of the Bostrichidae (Borowski and Węgrzynowicz 2007). Adults and larvae of most subfamilies of Bostrichidae both bore into and feed on the wood. One exception is the members of the subfamily Lyctinae in which only the larvae are wood feeders (Halperin and Geis 1999, Liu et al. 2008b). In Thailand, Kamnerdratana et al. (1970) reported two powder post beetles, *Sinoxylon anale* Lesne and *S. crassum* Lesne, infesting rubber logs in southern Thailand. Hutacharern and Tubtim (1995) in their checklist of forest insect pests of Thailand, added 10 species associated with *Hevea brasiliensis*: *Apoleon edax* Gorham, *Dinoderus* spp., *Heterobostrychus aequalis* (Waterhouse), *H. pileatus* Lesne, *H. unicornis* (Waterhouse), *Sinoxylon ruficorne* Fähræus, *Xylothrips flavipes* (Illiger), *Lyctus africanus* Lesne, *Lyctus* sp. and *Minthea rugicollis* (Walker). In this paper, we provide an illustrated key to all 17 species of Bostrichidae that have been recorded in association with rubberwood in Thailand. We provide a checklist with notes on distribution and host plants of nine species of bostrichids that infested rubberwood sawn timber in sawmills in southern Thailand, seven of which are newly reported from rubberwood, and three of which are newly recorded from Thailand.

Key to the Species of Bostrichidae Infesting Rubberwood Sawn Timber in Thailand

1. Head directed to the front, fully visible from above 2
- Head covered by pronotum, not visible from above 9
2. Pronotum not flattened, rounded at sides without lateral margins, disc of pronotum tuberculate (Fig. 5). Antenna 10-segmented with elongate 3-segmented club. Larger species, 10 – 21 mm long. (Dysidinae) *Apoleon edax* Gorham
- Pronotum more or less flattened with complete lateral margins, disc not tuberculate (Figs 1–3). Antenna 11-segmented usually with 2-segmented club (Fig. 12f–h), if 3-segmented, segments less elongate (Fig. 12i, j). Smaller species, at most 4 mm long. (Lyctinae) 3
3. Antennal club 2-segmented. Body moderately flattened. Elytral punctures usually seriate. (Figs 1–3) (Lyctini) 4
- Antennal club 3-segmented. Body very strongly flattened. Elytral punctures confused. (Fig. 4) (Trogoxylini) 8
4. Antennal club with terminal antennomere ovoid becoming attenuated towards apex (Fig. 12f) (*Lyctus*) 5

- Antennal club with one or both antennomeres greatly elongated (Fig. 12g, h) **6**
- 5. Pronotum and elytra with short, fine, yellowish hairs, elytra usually brightly shining (Fig. 1) ***Lyctus africanus* Lesne**
- Pronotum and elytra densely covered with long, coarse, curved hairs, not brightly shining (Fig. 2) ***Lyctus tomentosus* Reitter**
- 6. Antennal club with both segments elongate, subequal in length, segments of funicle without semierect, scale-like setae (Fig. 12h); elytra with short, thick, semierect setae, not arranged in regular rows (Fig. 3c)
..... ***Lyctoxylon dentatum* (Pascoe)**
- Antennal club with only terminal segment elongate, segments of funicle with semierect, scale-like setae (Fig. 12g); elytra with regular rows of wide, flattened, erect, scale-like setae. (*Minthea*) **7**
- 7. Thoracic fovea deeply and distinctly reticulate; lateral margin of pronotum distinctly toothed and with from 7 to 12 stiff narrow scale-like setae (Fig. 3a) ***Minthea reticulata* Lesne**
- Thoracic fovea punctate, not distinctly reticulate; lateral margin of pronotum rather smooth and with from 13 to 19 broad scale-like setae (Fig. 3b)
..... ***Minthea rugicollis* (Walker)**
- 8. Body strongly shining. Punctures on pronotum and elytra less dense, separated by much more than their own diameter. Pronotum with oblique, elongate rugulosities at sides near posterior angles (Fig. 4a). Antenna (Fig. 12i)
..... ***Lyctoderma coomani* Lesne**
- Body dull or weakly shining. Pronotum and elytra very densely punctured, the punctures separated by less than their own diameter. Pronotum without oblique rugulosities near posterior angles (Fig. 4b). Antenna (Fig. 12j)
..... ***Cephalotoma tonkinea* Lesne**
- 9. Pronotum rounded anteriorly without larger hooks or teeth at anterior angles. Protibia with 1 apical spine; first tarsomere subequal to second. (Dinoderinae). Scutellum transversely rectangular; pronotum with an obvious pair of foveae near base (Fig. 6) ***Dinoderus minutus* (Fabricius)**
- Pronotum flattened anteriorly often with hooks or teeth near the anterior angles (Figs 7–8). Protibia with 2 apical spines; first tarsomere very much shorter than the second. (Bostrichinae) **10**
- 10. Intercoxal process of first abdominal ventrite forming a vertical lamina (Fig. 10b). Metepisternum narrowed posteriorly so that metepimeron nearly touches metasternum (Xyloperthini) **11**
- Intercoxal process of first abdominal ventrite broader and with a ventral face (Fig. 7d). Metepisternum more broadly truncate behind with metepimeron widely separated from metasternum **12**
- 11. Antenna 10-segmented, all segments of antennal club longer than wide (Fig. 12c). Anterolateral part of pronotum and basal part of pronotal disk smooth, shining without puncturation. Elytral declivity with three pairs of costae at

- the margins, coarsely punctured above, more finely below. (Fig. 11).....
 ***Xylothrips flavipes* (Illiger)**
- Antenna 9-segmented, first and second segments of antennal club transverse (Fig. 12d). Anterolateral part of pronotum and basal part of pronotal disk punctured. Elytral declivity without costae, strongly punctured throughout. (Fig. 10)..... ***Xylopsocus capucinus* (Fabricius)**
12. Segments of antennal club flabellate (Fig. 12e). Mandibles short, blunt, truncate at apices which meet in midline. (Sinoxylini: *Sinoxylon*)..... **13**
- Segments of antennal club not flabellate (Fig. 12b). Mandibles long, pointed at apices, almost always crossing in mid-line. (Bostrichini: *Heterobostrychus*)..... **15**
13. Teeth on elytral declivity contiguous, inserted on sutural interstriae, laterally compressed, triangular, with pointed tips, a prominent costa present on the lateral margin of the declivity at the same level, and another weaker costa more apically and laterally (Fig. 9c). Larger species, 7–9 mm long.....
 ***Sinoxylon crassum* Lesne**
- Teeth on elytral declivity not contiguous, inserted lateral to sutural interstriae, lateral margin of declivity without costae. Smaller species, up to 6 mm long **14**
14. Elytral disc angularly separated from declivity; elytral margins carinate below, costate above, not rounded; submarginal carina along lateral margin of elytra curving dorsally at its posterior end to join carina forming lower margin of elytral declivity. Punctures of elytral disc increasing in size posteriorly, very coarse at upper margin of declivity. (Fig. 9a, d)
 ***Sinoxylon anale* Lesne**
- Elytral disc curving gradually into declivity; declivital margins rounded; submarginal carina along lateral margin of elytra continues to run parallel to elytral margin to reach suture. Punctures of elytral disc not greatly increasing in size towards declivity. (Fig. 9b, e) ***Sinoxylon unidentatum* (F.)**
15. Posterior angles of pronotum lobed and projecting. Posterior part of pronotum with large, deep punctures. Male with two tubercles on elytral declivity, the outer forming an elongate costa, the inner forming a strong, pointed tooth directed inwardly and upwardly (Fig. 7c); frons without a nearly impunctate shining area in middle. Female without strong tubercles on elytral declivity, emargination between anterior angles of pronotum broad, extending about three quarters of distance between eyes; frons without a tuft of hairs. (Fig. 7) ***Heterobostrychus aequalis* (Waterhouse)**
- Posterior angles of pronotum rounded, at most slightly projecting. Posterior part of pronotum without large, deep punctures. Male frons with a shining almost impunctate area in middle. Female frons with a tuft of hairs; emargination between anterior angles of pronotum narrower **16**
16. Pronotum as wide as long. Male with inner tooth on elytral declivity pointed in lateral view (Fig. 8f); frons distinctly gibbous in lateral view; hooks on anterior angles of pronotum smaller than in female (Fig. 8c, d). Female with

- hairs of frontal tuft shorter and sparser on upper part of frons, a dense tuft on the tubercle just above the epistoma; anterior angles of pronotum separated by about one-quarter of distance between eyes *Heterobostrychus unicornis* Waterhouse
- Pronotum longer than wide. Male with inner tooth on elytral declivity stouter, bluntly tipped in lateral view, directed inwardly but not upwardly (Fig. 8e); clypeus not gibbous in lateral view, in same plane as frons; hooks on anterior angles of pronotum larger than in female (Figs 8a, b, 10). Female with hairs of frontal tuft longer and denser, lacking a pilose tubercle just above epistoma; anterior angles of pronotum separated by about one-third of distance between eyes *Heterobostrychus pileatus* Lesne

Checklist of species associated with rubberwood in southern Thailand

In the checklist, a dagger (†) indicates a species newly recorded from Thailand, an asterisk (*) indicates a dominant pest species of rubberwood sawn timber in southern Thailand. Records of the Thai provinces in which species have been collected include unpublished data from specimens in the collections of R. A. Beaver and W.



Figure 1. *Lyctus africanus* Lesne, 1907. Dorsal view **a** lateral view of head **b** and frontal view of head **c**.

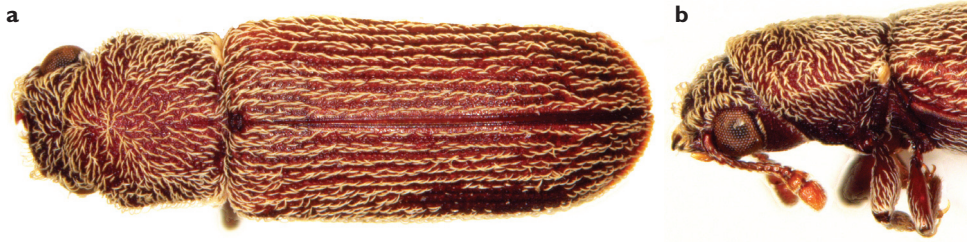


Figure 2. *Lyctus tomentosus* Reitter, 1878. Dorsal view **a**, lateral view of head and pronotum **b**.

Sittichaya. For the species newly recorded from Thailand, the number of specimens that were collected by the senior author is given in parentheses after the locality data. Detailed locality data is given only for species that are newly recorded in Thailand. Figures in parentheses included in the new records indicate the number of specimens collected. It should be noted that there is little information available on the biology of most of the xylophagous species of Bostrichidae (Liu et al. 2008b). We have thought it useful to briefly summarise what is known about the host trees and biology of the species listed here.

Subfamily Bostrichinae: Tribe Bostrichini

Heterobostrychus aequalis (Waterhouse)*

Fig. 7

Distribution. Very widely distributed in the Oriental region, from India and China to the Indonesian archipelago and New Guinea. Introduced into Africa (including Madagascar), Australia, Europe, Hawai'i, Mariana Is., New Caledonia, New Zealand, North America, South Africa and Venezuela, and established in some of these countries (Binda and Joly 1991, Borowski and Węgrzynowicz 2007, Chûjo 1958, Majka 2007, Starr and Starr 2003). Recorded in Thailand from the provinces of Chantaburi, Chiangmai, Chonburi, Chumporn, Krabi, Nakhon Ratchasima, Phang Nga, Rayong, Samut Songkhram, Satun, Songkla and Trang.

Host Plants. Polyphagous attacking almost any woody plant in suitable condition. Recorded in Thailand from *Bambusa arundinacea*, *Bombax anceps*, *Cassia fistula*, *Cedrela angustifolia*, *C. odorata*, *Dendrocalamus strictus*, *Dipterocarpus tuberculatus*, *Koompassia malaccensis*, *Lagerstroemia calyculata*, *Parashorea stellata*, *Pterocarpus macrorarpus*, *Toona ciliata*, *T. sureni* (Hutacharern and Tubtim 1995). Previously recorded from *Hevea brasiliensis* by Hussein (1981) in Malaysia, and Mathew (1982) in India.

Biology. The biology of the species is discussed by Beeson and Bhatia (1937), Ho (1995a) and Woodruff and Fasulo (2006). The species breeds not only in logs, but in planks, furniture and plywood. However, it is confined to wood containing starch, and the heartwood is not usually affected. In India it has an annual life cycle. Figures given by Ho (1995a) suggest that two generations a year may occur in Malaysia.

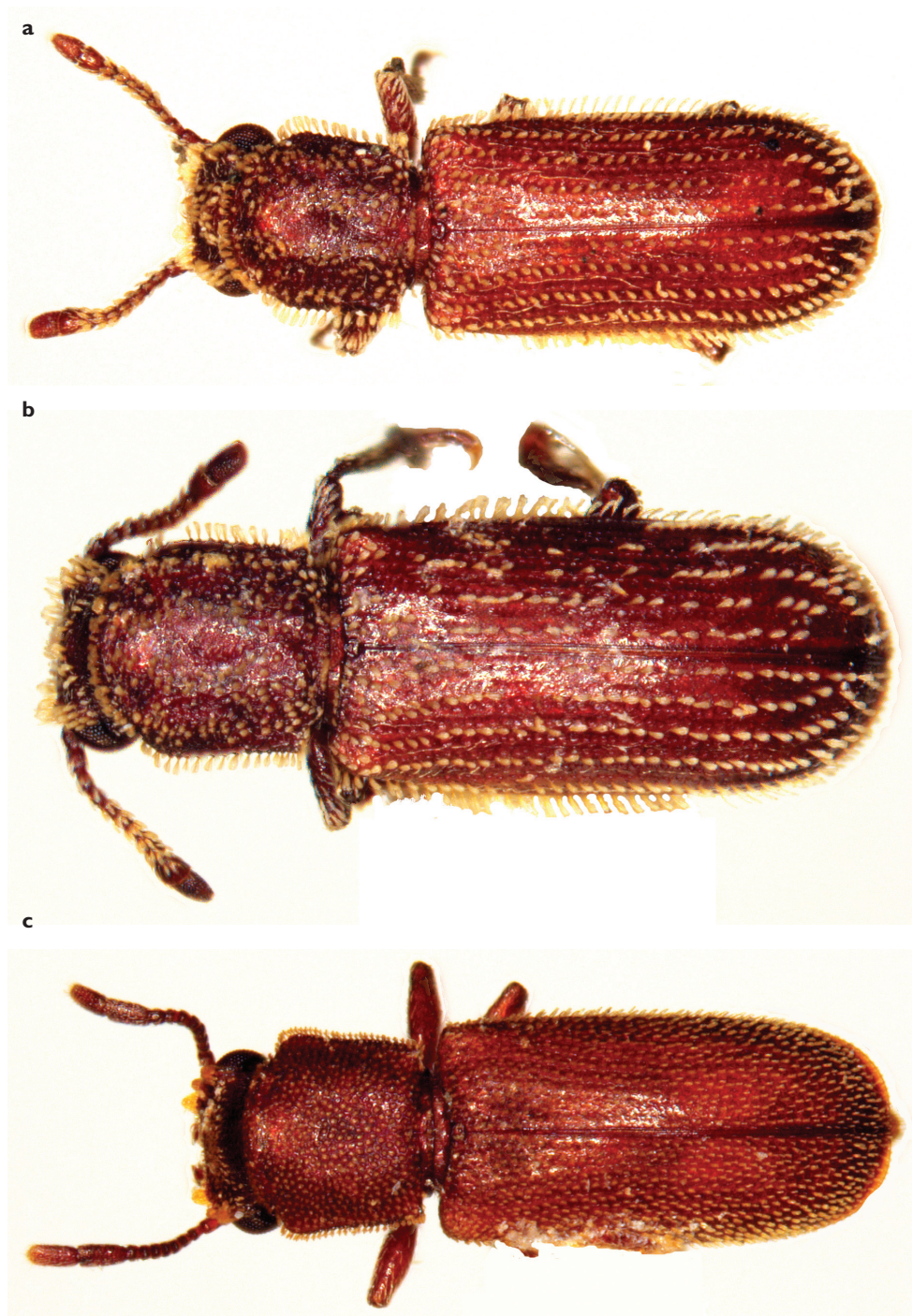


Figure 3. Dorsal views of *Minthea reticulata* Lesne, 1931 **a** *Minthea rugicollis* (Walker, 1858) **b** and *Lyctoxylon dentatum* (Pascoe, 1866) **c**.

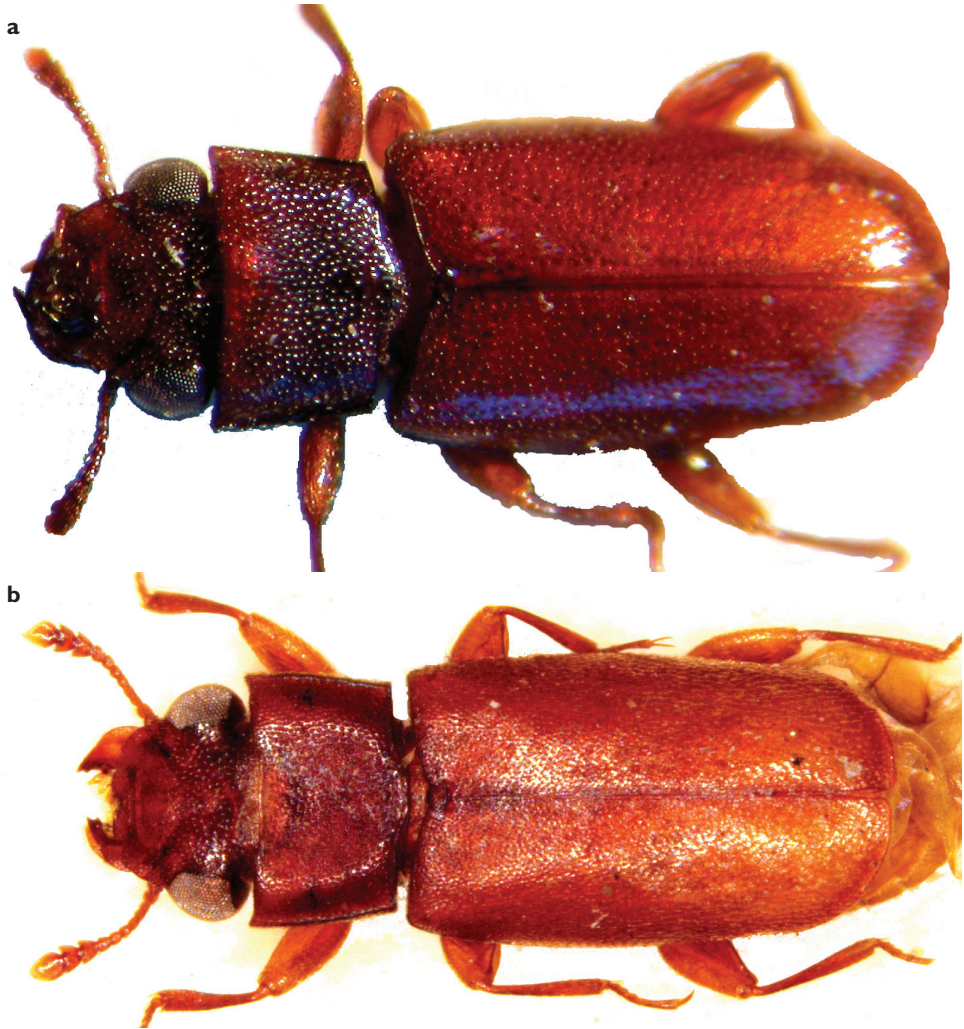


Figure 4. Dorsal views of *Lyctoderma coomani* Lesne, 1932 **a** *Cephalotoma tonkinea* Lesne, 1932 **b**.

Tribe Sinoxylini

Sinoxylon anale Lesne*

Fig. 9a, d

Distribution. An Oriental species that has become almost cosmopolitan as a result of transport by man in infested timber. Recorded in Thailand from the provinces of Chaiyaphum, Chantaburi, Chiangmai, Chonburi, Chumporn, Krabi, Nakhon Ratchasima, Nakhon Sri Thammarat, Petchaburi, Phattalung, Phang Nga, Phetchabun, Ratchaburi, Rayong, Songkla, Samut Songkram, Satun, Surat Thani, Surin and Trang.

Hosts. Polyphagous attacking almost any woody plant in suitable condition. Recorded in Thailand from: *Acacia mangium*, *A. auriculiformis*, *Leucaena diversifolia*,



Figure 5. *Apoleon edax* Gorham, 1885. Dorsal view **a** lateral view of head **b**.

L.leucocephala, *L.diversifolia* (Hutacharern and Choldumrongkul 1989), *Areca catechu*, *Albizia lebbekoides*, *Anogeissus acuminata*, *Casuarina equisetifolia*, *C. junghuhniana*, *Dalbergia sissoo*, *D. cochinchinensis*, *Dendrocalamus strictus*, *Koompassia malaccensis*, *Pterocarpus macrocarpus*, *Terminalia chebula* (Hutacharern and Tubtim 1995). Previously recorded from *Hevea brasiliensis* in Thailand by Kamnerdratana et al. (1970), and by Hussein (1981) in Malaysia.

Biology. The biology of the species is discussed by Beeson and Bhatia (1937) and Liu et al. (2008b). The life cycle may take only three months, but can extend over a period of years. The average life cycle in rubber wood is 84 days at room temperature ($27.30 \pm 0.67^{\circ}\text{C}$) (W. Sittichaya unpublished). The larval galleries do not normally penetrate the heartwood. The adults sometimes bore into living shoots to feed or hibernate, and may cause damage to young saplings. However, they do not breed there.

Sinoxylon unidentatum (F.) †*

Fig. 9b, c

Distribution. An Oriental species that has become almost cosmopolitan as a result of transport by man in infested timber. The species has usually been recorded under the name of its synonym, *Sinoxylon conigerum* Gerstaecker (Borowski and Węgrzynowicz 2007). Recorded in Thailand from the provinces: Chiangmai, Chonburi, Chumporn, Rayong, Samut Songkram, Satun, Songkla, Phattalung, Nakorn Sri Thammarat, Surat Thani, Phang Nga, Krabi and Trang

Hosts. Apparently polyphagous attacking almost any woody plant in suitable condition. No hosts appear to have been recorded in Thailand. Previously recorded from *Hevea brasiliensis* in Malaysia by Tomimura (1993). *Hevea brasiliensis* is given as a major host by CAB International (2004).

Biology. The biology of the species appears not to have been studied in detail, but is likely to resemble that of other species of *Sinoxylon* (Beeson and Bhatia 1937, Liu et al. 2008b). A summary of what is known is given in CAB International (2004 as *S. conigerum*). Tomimura (1993) showed that the adults and larvae reduced the starch content of rubber wood, but not the levels of holocellulose and lignin.



Figure 6. *Dinoderus minutus* (Fabricius, 1775). Dorsal view **a** and lateral view **b**.

Tribe Xyloperthini

Xylopsocus capucinus (F.)

Fig. 10

Distribution. throughout South and Southeast Asia from India to the Indonesian archipelago, New Guinea, New Caledonia, and the Melanesian islands; Introduced into Africa, South America, USA Recorded in Thailand from the provinces Chaiyaphum, Chiangmai, Krabi, Nakorn Sri Thammarat, Phattalung, Phang Nga, Satun, Songkla, Surat Thani and Trang.

Hosts. Apparently polyphagous attacking almost any woody plant in suitable condition. Previously recorded from *Hevea brasiliensis* in Malaysia by Miller (1934) and Hussein (1981). No hosts appear to have been recorded previously in Thailand.

Biology. Beeson and Bhatia (1937) note that in northern India, the adults emerge mainly between May and November, with a annual life cycle, that may be extended for a further one or occasionally two years. Woodruff et al. (2005) give further information from the published literature. The biology of the closely related species, *Xylopsocus bicuspis* Lesne is described by Liu et al. (2008a).

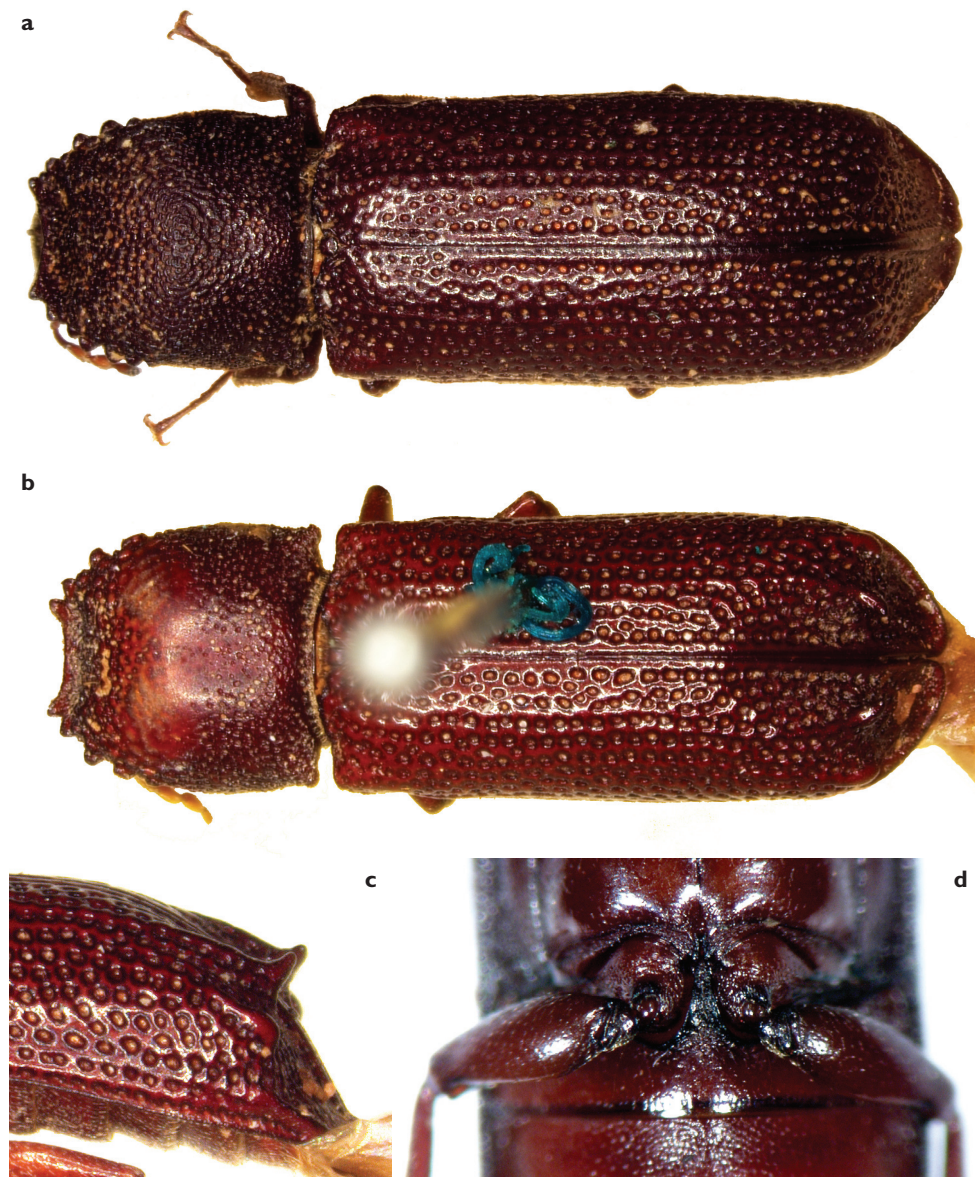


Figure 7. *Heterobostrychus aequalis* (Waterhouse, 1884). Dorsal view of female **a** and male **b** lateral view of male elytral declivity **c** intercoxal process of the first abdominal ventrite **d**.

***Xylotrips flavipes* (Illiger)**

Fig. 11

Distribution. Madagascar and the Indian Ocean islands; Arabian peninsula; throughout South and Southeast Asia from India to the Indonesian archipelago. (Replaced in Australia, New Zealand, New Guinea and the Pacific islands by the closely relat-

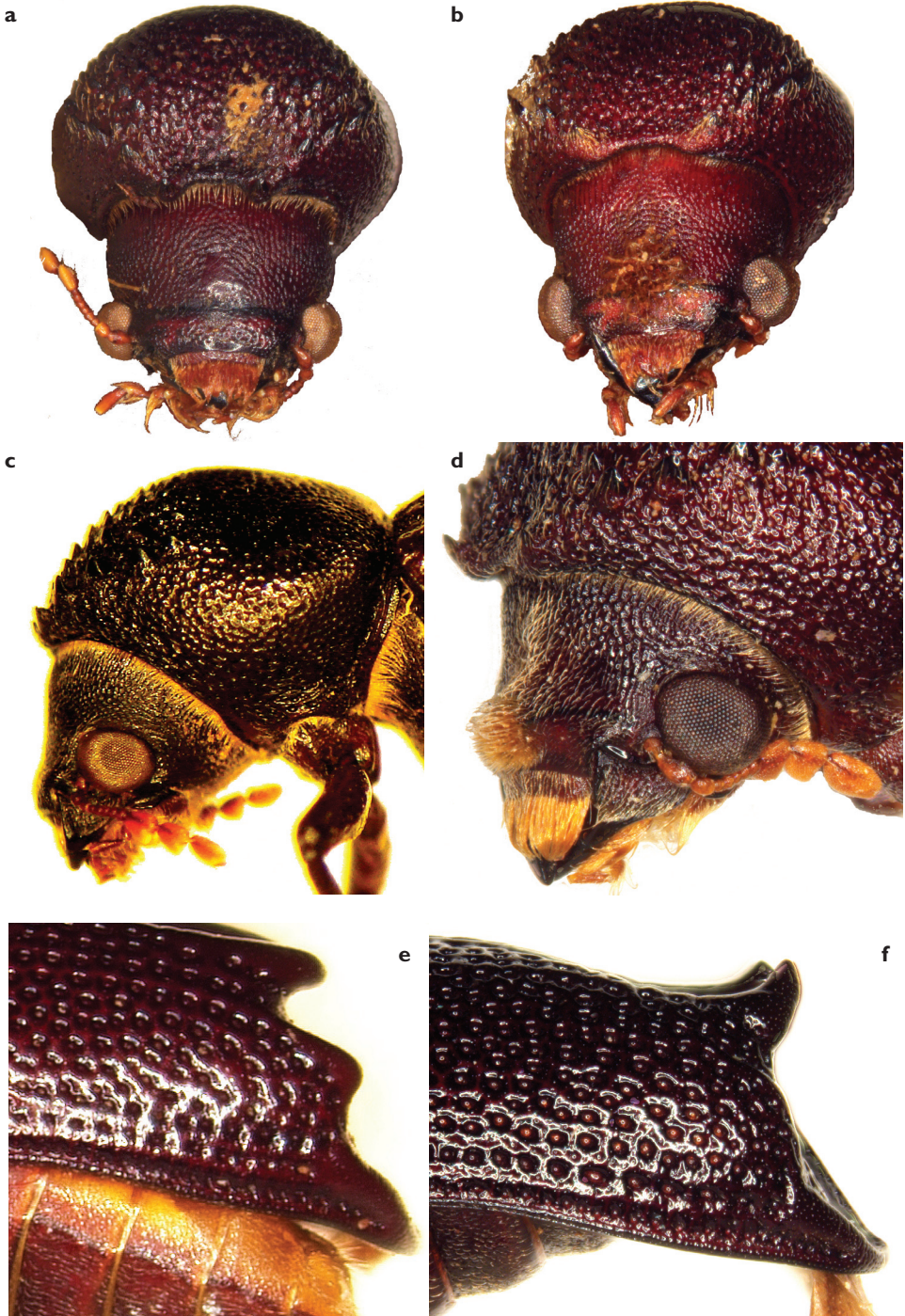


Figure 8. Head and pronotum of *Heterobostrychus pileatus* Lesne, 1899 (frontal view, **a**-male, **b**-female), and *Heterobostrychus unicornis* (Waterhouse, 1879) (**c**-male, frontal view; **d**-female, lateral view). Lateral view of male elytral declivity (**e**-*H. pileatus*, **f**-*H. unicornis*).



Figure 9. Dorsal view of *Sinoxylon anale* Lesne, 1897 **a** and *Sinoxylon unidentatum* (Fabricius, 1801) **b** Lateral view of *S. anale* **d** and *S. unidentatum* **e**. Elytral declivity of *Sinoxylon crassum* Lesne, 1897 **c**.

ed species, *Xylothrips religiosus* (Boisduval)). Introduced into Europe, USA Recorded from Thailand in the provinces Chaiyaphum, Chantaburi, Chiangmai, Krabi, Nakhon Ratchasima, Nakhon Sri Thammarat, Phang Nga, Phetchabun, Rayong, Songkla, Surat Thani, Satun and Trang.

Hosts. As with almost all bostrichids, this is a polyphagous species. Previously recorded from *Hevea brasiliensis* in Malaysia by Hussein (1981). In Thailand recorded from *Dipterocarpus* sp., *Hopea odorata*, *Mangifera indica* (Kamnerdratana et al. 1970) and *Choerospondias axillaris* (Hutacharern and Tabtim 1995).

Biology. Beeson and Bhatia (1937) note that the species completes two generations a year in northern India, and occasionally a third generation. The minimum life cycle is about three months. They found peak emergence occurred in April.

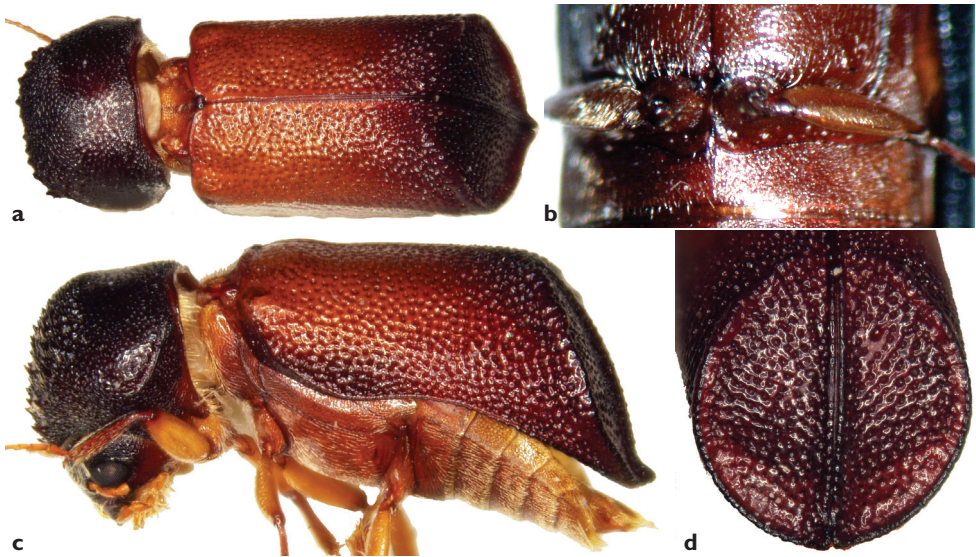


Figure 10. *Xylopsocus capucinus* (Fabricius, 1781). Dorsal view **a** lateral view **c** intercoxal process of the first abdominal ventrite **b** and elytral declivity **d**.

Subfamily Dinoderinae

Dinoderus minutus (L.)

Fig. 6

Distribution. Cosmopolitan. The species is perhaps of Oriental origin but has been transported around the world and has established itself throughout tropical and sub-tropical regions, especially where bamboo is grown. It is frequently intercepted in the temperate zone. Recorded in Thailand from the provinces Chantaburi, Chiangmai, Chonburi, Chumporn, Krabi, Nakhon Sri Thammarat, Phattalung, Phang Nga, Phetchabun, Phitsanulok, Rayong, Samut Songkram, Songkla, Surat Thani and Trang.

Hosts. The species breeds primarily in bamboos (e.g. *Bambusa*, *Dendrocalamus*, *Phyllostachys*). It occasionally makes tunnels in the wood of trees, but rarely breeds there. In Thailand, the species is recorded from *Bambusa arundinacea*, *Dendrocalamus giganteus*, *D. hamiltonii*, *D. strictus*, *Gigantochloa nigrociliata*, *Thyrsostachys oliveri* (Hutacharern and Tabtim 1995). All of these species are bamboos. There appear to be no previous records from *Hevea brasiliensis*.

Biology. Observations made by the first author show that the species was breeding in rubberwood (W. Sittichaya unpublished). Numerous young adults were obtained from rubberwood logs kept in breeding cages, and from dissected logs. Studies of the biology of this and related species of *Dinoderus* are described by Lesne (1924), Beeson and Bhatia (1937) and Liu et al. (2008b). The length of the life cycle depends on temperature. In the tropics, breeding continues throughout the year, and there can be six to seven generations in a year, but usually there are two to four.



Figure 11. *Xylothrips flavipes* (Illiger, 1801). Dorsal view **a** and lateral view **b**.

Subfamily Lyctinae: Tribe Lyctini

***Lyctoxylon dentatum* (Pascoe) †**

Fig. 3c

Distribution. Japan, Taiwan, Vietnam, Malay Peninsula, Java, Philippines (Borowski and Węgrzynowicz 2007, Liu et al. 2006, Walker 2008a); introduced to Europe, Panama, USA (including Hawai'i), East Africa (Starr and Starr 2003, Borowski and Węgrzynowicz 2007), and Canada (Majka 2007), and intercepted in England (Gerberg 1957), Germany (Geis 1995), Italy (Ratti and Rampini 1977), and the Netherlands (Brakman 1966). Not previously recorded from Thailand.

New records. Thailand: Krabi prov., Khlong Thom distr., 07.XI.2007 (3); Nakhon Sri Thammarat prov., Chawang distr. 08.VII.2007 (5); Cha-uaat distr. 08.VII.2007 (1); Phang Nga prov., Thapput distr., 17.VII.2007 (10), 08.VII.2007 (7), 06.III.2008 (11); Phattalung prov., Khao Chaison distr., 07.III.2008 (11); Satun prov., Khuan Kalong distr., 07.VII.2007 (5); Songkla prov., Chana distr., 03.III.2008 (3); Suratthani prov., Ban Na Doem distr., 05.III.2008 (12); Trang prov., Muang distr., 06.XI.2008 (1) (all coll. W. Sittichaya).



Figure 12. Bostrichid antennae. Upper row from left to right: **a** *Dinoderus minutus* (Fabricius) **b** *Heterobostrychus aequalis* (Waterhouse) **c** *Xylothrips flavipes* (Illiger) **d** *Xylopsocus capucinus* (Fabricius) **e** *Sinoxylon anale* Lesne; lower row from left to right: **f** *Lyctus tomentosus* Reitter **g** *Minthea reticulata* Lesne **h** *Lyctoxylon dentatum* (Pascoe) **i** *Lyctoderma coomani* Lesne **j** *Cephalotoma tonkinea* Lesne

Hosts. None recorded. There are no previous records of an association of the species with *Hevea brasiliensis*.

Biology. Observations by the first author (W. Sittichaya, unpublished) show that the species prefers to attack breeding material with a very low moisture content. The infestation density in rubberwood can be very high with reinfestation of previously attacked material by new generations. The lifecycle in rubber wood in southern Thailand lasts approximately 3–4 months.

Minthea reticulata Lesne †*

Fig. 3a

Distribution. Australia, Indonesia, Malaysia, New Guinea, Philippines, Taiwan, Vietnam; introduced to Great Britain, USA (including Hawai'i). Not previously recorded from Thailand.

New Records. Thailand, Krabi prov., Muang distr., 16.VII.2007 (5); Nakhon Sri Thammarat prov., Cha-uat distr., 08.VII.2007 (2); Thung Song distr.,

08.VII.2007 (4); Thung Yai distr., 08.VII.2007 (2); Phang Nga prov., Thap Put distr., 17.VII.2007 (6); Muang distr., 17.VII.2007 (2); Phattalung prov., Khao Chaison distr., 09.XI.2007 (1); Satun prov., Khuan Kalong distr., 7.VII.2007 (7) (all coll. W. Sittichaya).

Hosts. Previously recorded from *Dyera costulata*, *Gonystylus* spp, *Hevea brasiliensis*, *Dillenia* spp. (Ho 1995b).

Biology. The biology of the species does not seem to have been studied in detail, but is assumed to be similar to *Minthea rugicollis* (Walker) and other Lyctini (Beeson and Bhatia 1937, Lesne 1924, Liu et al. 2008b). Only the larvae are xylophagous. The life cycle takes 2–6 months depending on the starch and moisture content of the wood as well as temperature. The average life span of adults is 77 days (Ho 1995b).

Tribe Trogoxylini

Cephalotoma tonkinea Lesne †

Fig. 4b

Distribution. Previously recorded only from Vietnam (Lesne 1932). New to Thailand.

New records. Thailand, Krabi prov., Muang distr., 07.VII.2007 (5); Nakhon Sri Thammarat prov., Chawang distr., 25.VII.2007 (4) (all coll. W.Sittichaya).

Hosts. None recorded. The species was obtained from debarked logs of *Hevea brasiliensis*.

Biology. Adults were captured from logs infested by *Heterobostrychus aequalis*, *Sinoxylon anale* and *S.unidentatum*. Only 2 – 3 specimens were obtained from each infested log. Observations by Lesne (1932) on species of the closely related genus *Lyctoderma*, indicate that the adult lives in the adult gallery of larger bostrichids, where its small size and strongly flattened form enable it to slip beneath the larger beetle and avoid being crushed against the walls of the gallery. The adult feeds on small particles of wood in the gallery of the larger species. It can thus be classed as a commensal of other bostrichids. The larvae are presumed to be xylophagous.

Acknowledgements

We are most grateful to the sawmills used in the survey for the permission to access the rubber wood. Thanks also go to Dr. Hab. Jerzy Borowski, Department of Forest Protection and Ecology, Faculty of Forestry, Warsaw Agricultural University, Poland for identification of certain bostrichid specimens. This work was financially supported by the Prince of Songkla University Research Fund.

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New microhylid frogs from the Muller Range, Papua New Guinea

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Academic editor: *Hans-Dieter Sues* | Received 25 August 2009 | Accepted 16 October 2009 | Published 30 October 2009

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Citation: Kraus F, Allison A (2009) New microhylid frogs from the Muller Range, Papua New Guinea. *ZooKeys* 26: 53–76. doi: 10.3897/zookeys.26.258

Abstract

We describe, from the Muller Range of New Guinea, three new species of microhylid frogs, one each in the genera *Albericus*, *Cophixalus*, and *Oreophryne*. The new *Albericus* is unique in its combination of having an infrequent peeping call, oblique lores, wide snout and finger discs, and distinct tympanum. The new *Cophixalus* is distinguished by its combination of finger discs larger than toe discs, third toe longer than fifth, distinct tympanum, curved scapular ridges, dark postocular stripe, dark W-shaped mark above the shoulders, and having a call consisting of a rapid series of 6–9 musical peeps. The *Oreophryne* is unique in its combination of having a cartilaginous connection of the procoracoid to the scapula, no webbing between the toes, fifth toe longer than third, short snout, dark face, and call consisting of an extended multi-note chuckle or cackle. Each species was either common or abundant. The new *Cophixalus* shows a predilection for caves, although it is not restricted to them. Many frogs occurring in the central highlands of New Guinea are wide-ranging across much of this high-elevational region, but others are of restricted distribution. The species described herein are likely members of the latter group, although it remains to be determined whether each will prove endemic to the Muller Range.

Keywords

Albericus, *Cophixalus*, *Oreophryne*, new species, cave, New Guinea, Southern Highlands

Introduction

The herpetofauna of the central highlands of Papua New Guinea is relatively well known due to the pioneering studies of Tyler (1961, 1962, 1963a, b, 1968), Menzies (1976, 1987, 1993, 1999), Zweifel (1958, 1962, 1972), and others. However, two semi-isolated ranges straddling the upper Strickland River at the southwestern end of the central highlands remain poorly known: the Blucher Range and the Muller Range (sometimes known as the Muller Plateau).

The Muller Range is composed largely of limestone that has heavily weathered into megadolines (James 2006) and is riddled with caves, including Atea Kanada, the largest cave complex in the Southern Hemisphere. The underlying rocks are part of thick marine sequences that began forming in the late Oligocene on a subsiding shelf at the northern edge of the Australian Craton. Subsidence stopped by the early Pliocene and was followed in the late Pliocene by uplift and erosion in association with emplacement of the Star Mountain Intrusives (Francis 1980, James 2006).

Much of the Muller Range forms a plateau at roughly 2600 m elevation, with several peaks above 3600 m, including Mt. Karoma, which at 3623 m is the highest mountain in the area. The surrounding region is mostly isolated from adjacent ranges by highland valleys at elevations of 1200–1400 m.

Only six species of amphibians and reptiles, all widespread montane forms, are currently known from the Muller Range (Smith 1980). These include two species of skinks, *Papuascincus stanleyanaus* (Boulenger) and *Lobulia elegans* (Boulenger); an unidentified snake that was seen but not captured; a hylid frog, *Litoria angiana* (Boulenger); and two species of microhylid frogs, *Callulops wilhelmanus* (Loveridge) and *Cophixalus cryptotympanum* Zweifel.

In April 2009 biologists from a joint Bishop Museum/PNG National Museum expedition spent 20 days surveying the herpetofauna at elevations of approximately 1700–2200 m in the vicinity of Mt. Itukua of the Muller Range. These collections included three new species of microhylid frogs, which we describe herein.

Materials and methods

All measurements were made with digital calipers or an optical micrometer to the nearest 0.1 mm, with the exception that disc widths were measured to the nearest 0.01 mm. Measurements, terminology, and abbreviations follow Zweifel (1985) and Kraus and Allison (2006): body length from snout–vent (SV); tibia length from heel to outer surface of flexed knee (TL); horizontal diameter of eye (EY); distance from anterior corner of eye to center of naris (EN); internarial distance, between centers of external nares (IN); distance from anterior corner of eye to tip of snout (SN); head width at widest point, typically at the level of the tympana (HW); head length, from tip of snout to posterior margin of tympanum (HL); horizontal tympanum diameter (TY); hand length, from proximal edge of palm to tip of 3rd finger (HandL); arm length,

from elbow to tip of 3rd finger (ArmL); width of the third finger disc (3rd F); width of the fourth toe disc (4th T).

We recorded calls in the field using a Sennheiser ME66 microphone and a Marantz 660 audio recorder. Call structure was analyzed using the computer program Avisoft-SASLab Pro(v4.34), available from Avisoft Bioacoustics (<http://www.avisoft.com/>).

We confirmed by dissection generic assignment of the frogs using the presence of an eleutherognathine jaw, presence/absence of clavicles and procoracoids, origin of *M. depressor mandibulae*, and position of *M. acromiohumeralis* (Burton 1990; Burton and Zweifel 1995; Menzies and Tyler 1977; Parker 1934; Zweifel and Parker 1989). Comparisons to congeners relied on direct comparison to museum material (listed in Kraus and Allison [2005a, 2005b, 2009, in press], with additional specimens noted in Appendix) and to information from Roux (1910), Parker (1934), Zweifel (1962, 1979, 2003), Menzies (1999), Richards and Iskandar (2000), Günther et al. (2001), Hiaso (2002), Günther (2003a, b, 2006), Zweifel et al. (2003, 2005), and Richards and Oliver (2007).

Type specimens are deposited in the Bernice P. Bishop Museum, Honolulu (BPBM) and Papua New Guinea National Museum and Art Gallery, Port Moresby (PNGNM). Unless otherwise noted, all latitude and longitude coordinates use the Australian Geodetic Datum, 1966 (AGD 66).

***Albericus murritus* sp. n.**

urn:lsid:zoobank.org:act:C1F51397-8A1C-404B-AAF5-2B68F46C6A53

Fig. 1A

Holotype. BPBM 33657 (field tag FK 13097), collected by F. Kraus, S of Tumbutu River, Muller Range, 5.6567028°S, 142.6342342°E, 1700 m, Southern Highlands Province, Papua New Guinea, 2 April 2009.

Paratypes (n = 31). BPBM 33636–40, Kunida, Muller Range, 5.6431159°S, 142.6342342°E, 1700 m, 21–22 March 2009; BPBM 33641, E slope Mt. Itukua, Muller Range, 5.66954°S, 142.62334°E, 2177 m, 27 March 2009; BPBM 33642–53, Tumbutu River below Mt. Paramo, 5.6503623°S, 142.63963°E, 31 March 2009; BPBM 33654–56, same data as BPBM 33642–53 except collected 1 April 2009; BPBM 33658, PNGNM 24095–96, same data as holotype; BPBM 33659, PNGNM 24093–94, Mt. Paramo, 5.64545°S, 142.63904°E, 1777 m, 2 April 2009; BPBM 33660–63, same data as BPBM 33642–53 except collected 2 April 2009.

Diagnosis. A small species (adult SV = 14.6–18.3 mm) distinguished by its combination of oblique lores, distinct tympanum, relatively broad snout (IN/SV = 0.081–0.096, mean 0.086), relatively wide finger discs (3rdF/SV = 0.059–0.081), and advertisement call consisting of a single peep uttered in a continuous series.

Comparisons with other species. The new species differs from all congeners except *A. swanhildae* Menzies and *A. exclamitans* Kraus and Allison in having a call



Figure 1. Photos in life of **A** paratype of *Albericus murrutus* sp. n. (BPBM 33656) **B** paratype of *Cophixalus caverniphilus* sp. n. (BPBM 33711) **C** paratype of *Oreophryne anamiattoi* sp. n. (BPBM 33764), and **D** paratype of *Oreophryne anamiattoi* sp. n. (BPBM 33765).

consisting of a peep; all other *Albericus* have calls consisting of a single honk/buzz or a series of clicks. From *A. swanhildae* the new species differs in its larger size (SV = 13.6–15.4 mm in *A. swanhildae*), oblique (vs. vertical) lores, wider finger discs (3rdF/SV = 0.055–0.061 in *A. swanhildae*), and in having a single broad dark band across the center of each shank (vs. three narrow dark bars across each shank in *A. swanhildae*). From *A. exclamitans* the new species differs in having the tympanum evident (vs. hidden) in males and in having the call consist of an infrequently produced single peep (vs. rapid burst of 3–48 peeps in *A. exclamitans*). *Albericus murrutus* is also slightly smaller than *A. exclamitans* (male SV = 14.6–18.3 mm, female SV = 15.0–18.3 mm in *A. murrutus* vs. 15.3–20.7 and 18.0–22.0 in *A. exclamitans*) and has a somewhat broader snout (IN/SV = 0.074–0.085, mean 0.079 in *A. exclamitans*).

Description of holotype. Adult male. Head relatively wide (HW/SV = 0.38), with oblique and shallowly concave loreal region; canthus rostralis broadly rounded; nostrils small, crescent-shaped, much closer to tip of snout than to eyes; distance from external naris to eye larger than internarial distance (EN/IN = 1.14, IN/SV = 0.083, EN/SV = 0.095); snout bluntly rounded when viewed from above, truncate when viewed from side; eyes moderately large (EY/SV = 0.13), eyelid approximately 2/3 width of interorbital distance; tympanum indistinct, partially hidden by surrounding skin. Dorsum pustulose on body and limbs; supratympanic fold absent

but row of dorsal pustules occupy that area; ventral surfaces coarsely granular. Fingers unwebbed, bearing discs with terminal grooves; relative lengths $3 > 4 > 2 > 1$. Finger discs approximately twice widths of penultimate phalanges. Subarticular tubercles not well developed; metacarpal tubercles absent. Toes unwebbed, bearing discs with terminal grooves; relative lengths $4 > 5 > 3 > 2 > 1$. Toe discs smaller than those of fingers ($3rdF/4thT = 1.24$), approximately 1.5 times width of penultimate phalanges. Subarticular tubercles low; metatarsal tubercles lacking. Hind legs rather short ($TL/SV = 0.40$); arms rather long ($ArmL/SV = 0.54$).

In preservative, dorsal ground color an irregular mix of yellow-tan and brown, with the former predominating dorsolaterally and the latter mid-dorsally; parts of both fields suffused with russet. Irregular black flecks and markings scattered throughout, concentrated above shoulders, on rear of head, and above tympana. Traces of a short, lighter, yellow-brown bar on each scapula; similar-colored interocular bar and vestiges of lumbar ocelli. Sides dark gray flecked with black and light blue-gray. Face yellow-tan flecked with black and russet. Legs yellow-tan with one broad, dark, centrally placed band on each thigh and shank. Rear of thighs dark brown with narrow yellow-tan band proximally. Venter dirty light gray evenly and densely peppered with dark gray; palmar and plantar surfaces same. Front margin of mandible russet. Iris black flecked with silver.

Variation. Mensural variation for the type series is shown in Table 1. There is no obvious sexual dimorphism in morphometric features, although there is slight evidence that females may average larger in body size. However, this difference is slight considering the normal pattern of larger female size in most Papuan frogs.

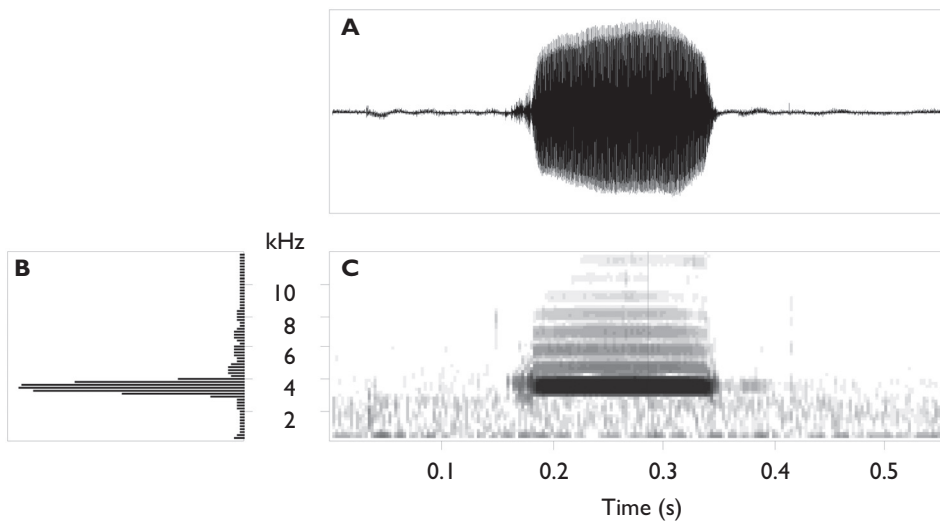
Most specimens appear dark brown in preservative (darker than the holotype), with a few contrasting light-brown streaks or lines scattered on dorsum. These typically involve a single short line on each scapula, an interocular bar, and often traces of lumbar ocelli. Lighter specimens are similar but show more clearly the variable mottling seen in the holotype. Density of dark ventral stippling varies from sparse to dense, making the overall appearance of the venter vary from light gray to black. Both ventral extremes appear in frogs with both light and dark dorsa, but venters of frogs that are lighter dorsally average somewhat paler than those of dark frogs.

Color in life. BPBM 33636: "Dorsum dark tan with irregular black blotches and tiny white or tan dots on some warts; fairly warty. Orange-brown interocular bar, supra-scapular marks, and on arms and heels. Venter charcoal gray with tiny light-gray punctations. Light-tan patch from eye to rictus. Iris brown." BPBM 33637 was yellow-brown with cream and black markings, venter densely punctated with light gray, and iris tan.

Call. This species begins calling at dusk and calls in highest numbers during the first few hours of darkness. The call consists of a single "peep" note uttered in a continuous series with occasional breaks (Fig 2). We recorded calls of two individuals, BPBM 33641 and BPBM 33657 (Table 2). The notes had a mean duration of 0.151 s (range 0.093–0.213). The inter-note interval for BPBM 33641 ranged from 4.1–9.0 s ($n = 20$), except for two instances of 31.6 and 35.9 s. Many species of *Albericus* produce calls in groups separated by periods of silence (A. Allison, pers. obs.), and our brief recording suggests that this is occurring in BPBM 33641.

Table 1. Mensural data for type series of *Albericus murrinus* sp. n. Data include only adult animals.

Character	Males (n = 17)		Females (n = 6)	
	Mean	range	mean	range
SV (mm)	16.6	14.6–18.3	17.2	15.0–18.3
TL/SV	0.40	0.37–0.44	0.42	0.37–0.45
EN/SV	0.097	0.089–0.106	0.098	0.093–0.107
IN/SV	0.086	0.081–0.096	0.087	0.081–0.093
SN/SV	0.15	0.14–0.16	0.15	0.15–0.16
TY/SV	0.057	0.051–0.065	0.064	0.060–0.068
EY/SV	0.12	0.11–0.13	0.13	0.12–0.13
HW/SV	0.38	0.36–0.40	0.39	0.38–0.39
HL/SV	0.32	0.29–0.35	0.33	0.32–0.34
HandL/SV	0.28	0.25–0.30	0.28	0.27–0.30
ArmL/SV	0.54	0.51–0.58	0.56	0.52–0.59
3rdF/SV	0.068	0.059–0.080	0.074	0.067–0.081
4thT/SV	0.054	0.047–0.062	0.059	0.054–0.064
EN/IN	1.14	1.06–1.23	1.14	1.07–1.21
3rd F/4th T	1.26	1.06–1.58	1.26	1.14–1.32
HL/HW	0.85	0.81–0.90	0.85	0.82–0.89

**Figure 2.** **A** Waveform, **B** power spectrum, and **C** spectrogram of call “T” of *Albericus murrinus* sp. n. (BPBM 33641) recorded on E slope Mt. Itukua, Muller Range, Southern Highlands Province, Papua New Guinea on 27 March 2009 at 2020 h. Air temperature 14.7 °C.

The call of BPBM 33657 was similar. The interval between the 36 notes in our recorded sequence ranged from 2.7–6.5 s, except in four instances that ranged in duration from 11.4–57.8 s. Again, the interval sequence suggests that the calls are produced in groups separated by periods of silence (Fig. 3).

Table 2. Call statistics of *Albericus murritus* sp. n. recorded by Fred Kraus on E slope Mt. Itukua, Muller Range, Southern Highlands Province, Papua New Guinea. BPBM 33641 was recorded on 27 March 2009 at 2020 h, BPBM 33657 on 2 April 2009 at 2215 h. Air temperatures were 14.7 and 18.8 °C, respectively.

Specimen	Number	Note duration (s)		Internote duration (s)		Dominant frequency (Hz)	
		Mean	Range	Mean	Range	Mean	Range
BPBM 33641	20	0.1720	0.1119–0.2126	8.5395	4.1081–35.8882	3460	3420–3510
BPBM 33657	36	0.1393	0.0934–0.1811	6.4229	2.7302–57.7857	3560	3180–3650

The call note is unpulsed (Fig. 2A) and finely tuned, with a mean dominant frequency of 3520 Hz (range 3180–3650) and a well-developed harmonic structure (Fig. 2B–C).

Etymology. The name is a masculine Latin adjective meaning “to squeak like a mouse”.

Range. Known only from the vicinity of the type locality on the northeastern slopes of the Muller Range, Southern Highlands Province, Papua New Guinea (Fig. 4).

Ecological notes. Animals were found while calling perched in exposed locations on leaves or twigs of vegetation 1–3 m above the ground. They inhabited primary and secondary rainforest ranging from 1700–2180 m elevation, as well as cleared areas around villages. Syntopic microhylids include *Albericus darlingtoni* (Loveridge), *Callulops wilhelmanus*, *Choerophryne burtoni* Richards, Dahl, and Hiaso, *Hylophorbus richardsi* Günther, *Oreophryne notata* Zweifel, *Xenorhina parkerorum* Zweifel, and the two species described below.

Cophixalus caverniphilus sp. n.

urn:lsid:zoobank.org:act:90795C42-34A3-4D52-B299-4025E0389CA3

Fig. 1B

Holotype. BPBM 33748 (field tag FK 13180), collected by F. Kraus and D. Gibson, Mt. Paramo, Muller Range, 5.64728°S, 142.63941°E, 1718 m, Southern Highlands Province, Papua New Guinea, 5 April 2009.

Paratypes (n = 48). BPBM 33707, E slope Mt. Itukua, Muller Range, 5.66954°S, 142.62334°E, 2177 m, 20 March 2009; BPBM 33708–40, PNGNM 24101–07, Mt. Paramo, Muller Range, 5.64791°S, 142.63663°E, 1780 m, 22 March 2009; BPBM 33741–43, Kunida, 5.64°S, 142.63°E, 1700–1800 m, 23 March 2009; BPBM 33744–46, same data as BPBM 33707, except collected 30 March 2009; BPBM 33747, same data as holotype except collected 4 April 2009.

Diagnosis. A moderately large species of *Cophixalus* (adult SV = 25.5–36.7 mm) distinguished by its combination of expanded finger discs larger than toe discs (3rdF/SV = 0.069–0.107, 3rdF/4thT = 1.27–1.70); long legs (TL/SV = 0.50–0.59); third toe distinctly longer than fifth; distinct tympanum; curved scapular ridges; pustulose skin; short, dark postocular stripe; dark W-shaped mark above the shoulders; lacking a dark

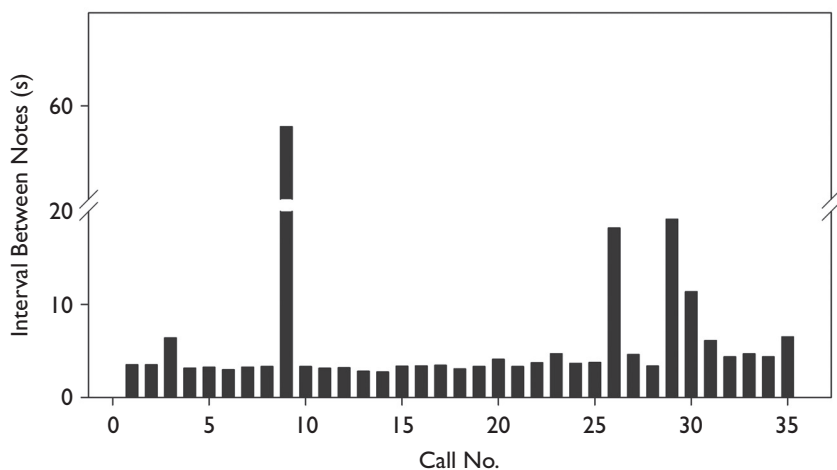


Figure 3. Duration of the interval between call notes in the complete recorded sequence of *Albericus murrinus* sp. n. (BPBM 33657) recorded at Mt. Paramo, Muller Range, Southern Highlands Province, Papua New Guinea on 2 April 2009 at 2215 h. Air temperature 18.8 °C.

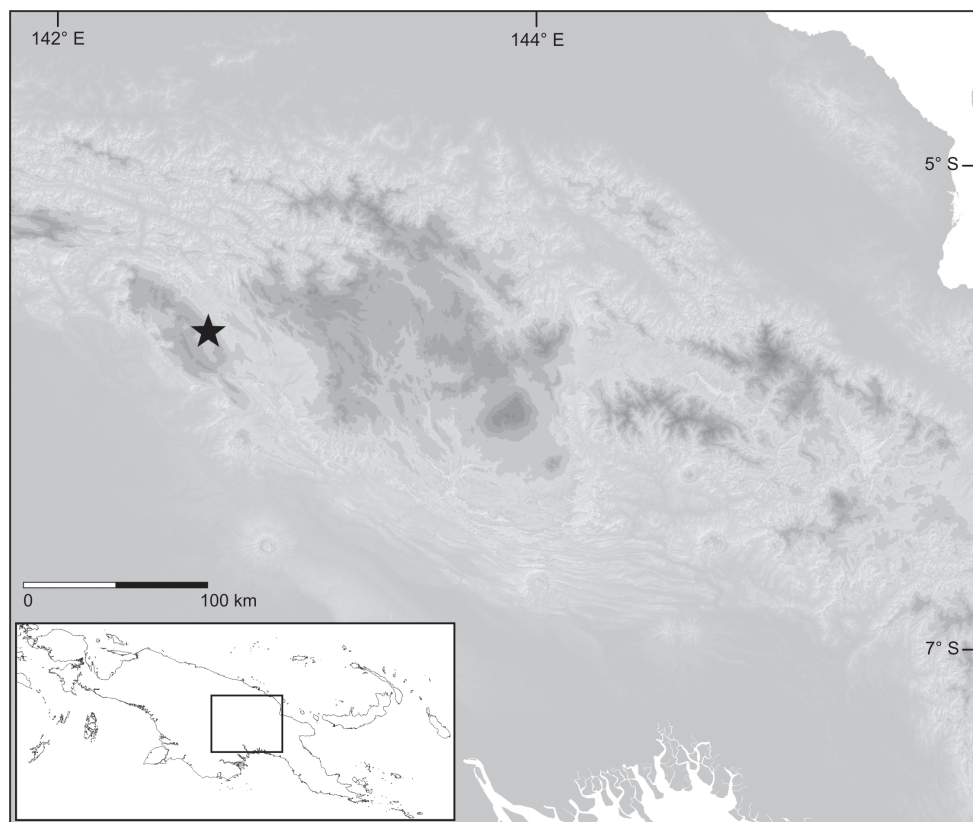


Figure 4. Map showing known distribution of three new species of microhylid frogs from along the eastern slope of Mt. Itukua, Muller Range, Southern Highlands Province, Papua New Guinea (star).

face and yellow spotting on the rear of thighs; and having a call consisting of a rapid series of 6–9 musical peeps.

Comparisons with other species. The new species differs from all congeners except *C. balbus* Günther, *C. bironi* (Méhely), *C. cheesmanae* Parker, *C. cryptotympanum*, *C. nubicola* Zweifel, *C. riparius* Zweifel, and *C. verrucosus* (Boulenger) in its combination of SV > 25 mm, finger discs larger than toe discs, and third toe longer than fifth. It differs from *C. balbus* and *C. bironi* in having (vs. lacking) raised scapular ridges, lacking (vs. having) a triangle of pale coloration on the top of the snout, having a call consisting of only 6–9 peeps (vs. long trains of peeps), and from *C. bironi* in having (vs. lacking) a dark W-shaped mark above the shoulders; from *C. cheesmanae* in having pustulose (vs. smooth) skin and in lacking the dorsolateral ridge and uniformly dark face of that species; from *C. cryptotympanum* in having an exposed (vs. obscure or hidden) tympanum, pustulose (vs. smooth) skin, a dark (vs. light) postocular stripe, and a dark W-shaped mark above the shoulders (absent in *C. cryptotympanum*); from *C. nubicola* in its longer legs (TL/SV = 0.35–0.38 in *C. nubicola*), thighs same color as (vs. conspicuously paler than) dorsum, and dorsum yellow or greenish-yellow with a dark W-shaped mark above the shoulders (vs. reddish-brown with light spots in *C. nubicola*); from *C. riparius* in its smaller size (SV = 40–50 mm in *C. riparius*) and dorsum yellow or greenish-yellow with a dark W-shaped mark above the shoulders (vs. brown with two elongated and irregular dark dorsolateral patches or network in *C. riparius*); and from *C. verrucosus* in having larger finger discs (3rdF/SV = 0.052–0.073, 3rdF/4thT = 0.96–1.26), a dark W-shaped mark above the shoulders (absent in *C. verrucosus*), and rear of thighs yellow dusted with brown (vs. spotted with yellow on dark brown in *C. verrucosus*).

Description of holotype. Adult male with small lateral incision on right side. Head moderately wide (HW/SV = 0.39), with steep, almost vertical, loreal region and slightly inflated lip; canthus rostralis rounded, straight when viewed from above; nostrils directed laterally, much closer to tip of snout than to eyes; internarial distance larger than distance from naris to eye (EN/IN = 0.83, IN/SV = 0.106, EN/SV = 0.088); snout rounded and somewhat projecting when viewed from the side, broadly angulate when viewed from above; eyes moderately large (EY/SV = 0.12); eyelid approximately 2/3 width of interorbital distance; tympanum indistinct and small (TY/SV = 0.049), with a slightly raised annulus anteriorly but covered by ridge of skin dorsally and posteriorly. Skin pustulose dorsally and laterally, with prominent pair of scapular ridges, granulose ventrally. Supratympanic fold present, distinct ventrally but merging with pustulose skin dorsally. Fingers unwebbed, bearing discs with terminal grooves; relative lengths 3>4>2>1; first finger and disc well-developed. Finger discs approximately 3 times widths of penultimate phalanges, except for the first finger disc, which is approximately 2 times width of penultimate phalanx. Subarticular tubercles low; inner metacarpal tubercle weakly developed, outer absent. Toes unwebbed, bearing discs with terminal grooves; relative lengths 4>3>5>2>1. Toe discs smaller than those of fingers (3rdF/4thT = 1.33); approximately twice widths of penultimate phalanges. Subarticular tubercles weakly developed; inner metatarsal

tubercle narrow, elongate, and low; outer lacking. Hind legs moderately long (TL/SV = 0.54).

In preservative, dorsum brown with broken, dark-brown scapular W, and indistinct dark-brown markings scattered throughout. Dark-brown interocular bar, postocular stripe, and loreal stripe. Face light brown with small dark-brown flecks and smudges. Rear of thighs pale straw suffused with brown stippling and having dark-brown blotching distally. Ventral surfaces pale straw yellow heavily stippled with black, this more evenly distributed on chin and throat, and more broken on abdomen and under legs. Few white flecks along margin of mandible and sparsely scattered on throat and chest. Palmar and plantar surfaces brown, latter darker. Iris very dark brown, densely flecked with brass.

Variation. Mensural variation for the type series is shown in Table 3. Sexual dimorphism is slight except that females are of larger size than males. There is relatively little variation in dorsal color pattern. Most specimens are similar to the holotype, but four or five have a slightly lighter ground color, and four are darker; all have the scapular W. Similarly, ventral color pattern varies little. Most specimens are like the holotype, but a few (7 or 8) have darker stippling, which gives a higher contrast to the ventral pattern.

Color in life. BPBM 33708: “Mustard yellow with irregular dark-brown markings; dark-brown suprascapular W and dorsolateral lines which are ridges. Iris bronze punctated with brown. Venter yellow with blue-white punctations.” BPBM 33728 was mustard yellow with black spots dorsally. The yellow color was prominent in all specimens collected.

Call. We heard this species call only in the morning between 0500–0930 h. We obtained good recordings of 16 calls produced by two individuals, BPBM 33747 and 33748 (Table 4). Both calls were similar, so we combined data for analysis. The call

Table 3. Mensural data for type series of *Cophixalus caverniphilus* sp. n. Data include only adult animals.

Character	Males (n = 17)		Females (n = 22)	
	Mean	range	mean	range
SV (mm)	28.1	25.5–30.2	33.2	29.7–36.7
TL/SV	0.53	0.50–0.57	0.52	0.50–0.57
EN/SV	0.087	0.080–0.096	0.086	0.079–0.093
IN/SV	0.101	0.096–0.106	0.098	0.090–0.103
SN/SV	0.15	0.14–0.16	0.14	0.13–0.15
TY/SV	0.045	0.038–0.051	0.050	0.043–0.060
EY/SV	0.13	0.12–0.15	0.13	0.11–0.15
HW/SV	0.38	0.36–0.40	0.37	0.36–0.40
HL/SV	0.33	0.32–0.35	0.33	0.31–0.35
3rdF/SV	0.085	0.073–0.097	0.093	0.075–0.107
4thT/SV	0.059	0.051–0.069	0.063	0.055–0.072
EN/IN	0.86	0.81–0.93	0.88	0.82–0.97
3rd F/4th T	1.44	1.33–1.66	1.49	1.33–1.70
HL/HW	0.87	0.83–0.92	0.88	0.85–0.94

consists of 5–9 (mode = 7) regularly spaced notes delivered at a mean rate of 6.63 notes/s (range 5.65–7.57) with the acoustic impression of bell-like peeping. The mean duration of calls was 1.77 s (range 1.50–2.18). The first note, with one exception, was the longest note in the call, averaging 0.2933 s (range 0.0920–0.3280) (Fig. 5A). If the exception is excluded, the mean duration of the first note increases to 0.3067 (range 0.2818–0.3280). This note also generally had a lower amplitude than that of subsequent notes.

The second note tended to be the second longest in the call, averaging 0.1556 s (range 0.0790–0.1990). Subsequent notes were generally similar, averaging 0.1324 s in duration (range 0.0602–0.1960), but in nine of the 16 calls the last note was the shortest in the call, with a duration ranging from 0.0602–0.1100 s.

There was a slight tendency for pulsing of the first note (Fig. 6A–B). This is more apparent in the second and subsequent notes, particularly in BPBM 33748 (Fig. 6B), in which the first note generally included upwards of 8–9 irregular, often partial pulses. Subsequent notes, particularly in BPBM 33748, generally had at least two components: a short, high-amplitude pulse of ~0.03–0.04 s followed by a longer, lower-amplitude pulse that was generally 0.07 s or more in duration.

Table 4. Call characteristics of *Cophixalus caverniphilus* sp. n. recorded from caves at Mt. Paramo, Muller Range, 1720 m, Southern Highlands Province, Papua New Guinea. BPBM 33747 was recorded at 0930 h, 4 April 2009; BPBM 33748 at 0855 h, 5 April 2009. Air (cave) temperatures were 17.8 and 17.6 °C, respectively.

Specimen	Call	Total notes	Call duration (s)	Notes/s	Mean note duration (s)	Mean internote duration (s)	Dominant frequency (Hz)
BPBM 33747	A	5	INTERFERENCE				2570
"	B	7	INTERFERENCE				2570
"	C	6	1.52	5.65	0.1721	0.0980	2530
"	D	7	1.81	6.06	0.1675	0.1055	2570
"	E	7	1.88	6.53	0.1699	0.1148	2570
"	F	8	2.06	6.84	0.1553	0.1196	2570
"	G	7	1.76	6.56	0.1556	0.1114	2570
"	H	8	2.14	6.28	0.1776	0.1031	2570
"	I	7	1.81	6.51	0.1625	0.1118	2530
"	J	8	1.98	7.24	0.1463	0.1157	2530
BPBM 33748	A	6	1.45	5.71	0.1597	0.0984	2530
"	B	7	1.74	6.22	0.1680	0.0938	2480
"	C	7	1.63	7.41	0.1373	0.1114	2480
"	D	6	1.50	6.09	0.1723	0.0922	2430
"	E	7	1.59	7.11	0.1539	0.0853	2430
"	F	7	1.66	6.96	0.1471	0.1043	2480
"	G	8	1.78	7.57	0.1376	0.0966	2480
"	H	9	2.18	6.60	0.1636	0.0890	2430

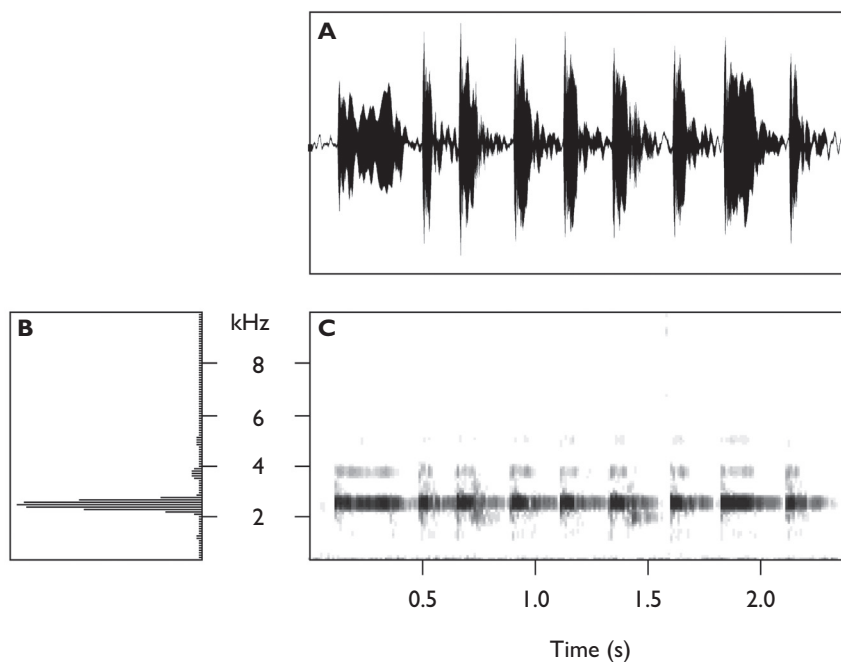


Figure 5. A Waveform, **B** power spectrum, and **C** spectrogram of the complete call of call “H” (Table 4) of *Cophixalus caverniphilus* sp. n. (BPBM 33748) recorded from a cave at Mt. Paramo, Muller Range, 1720 m, Southern Highlands Province, Papua New Guinea at 0830 h, 5 April 2009. Air (cave) temperature 17.6 °C.

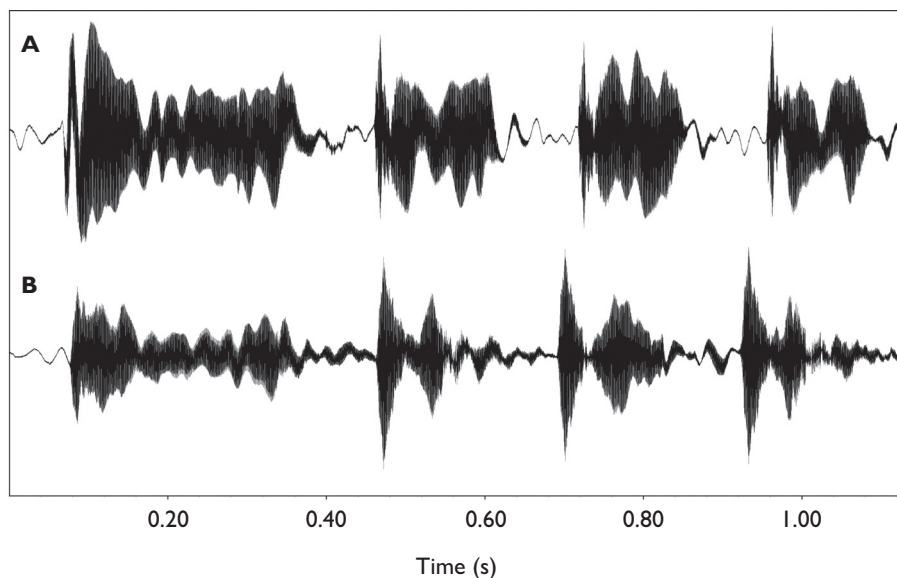


Figure 6. A Waveforms of the first four notes of the call of *Cophixalus caverniphilus* sp. n. Call “J” of BPBM 33747 **B** Call “D” produced by BPBM 33748. See Table 4 for details.

Mean interval between notes was 0.1033 s (range 0.0380–0.1360) with no obvious tendency for the interval to lengthen or shorten over the course of the call. Notes are finely tuned, with a mean dominant frequency of 2510 Hz (range 2430–2570) (Fig. 5B), only weakly developed harmonic structure, and little or no change in note frequency over the duration of the call (Fig. 5C).

Etymology. The name is a masculine latinized compound adjective formed from the Latin “caverna”, meaning “cave” or “grotto”, and the Greek “philia”, meaning “fondness”.

Range. Known only from the vicinity of the type locality on the northeastern slopes of the Muller Range, Southern Highlands Province, Papua New Guinea (Fig. 4).

Ecological notes. Animals inhabit primary and secondary rainforest but were also common around largely cleared village areas. We found only one animal in primary rainforest, but they were common in highly disturbed areas around villages. In the latter areas, animals were abundant inside caves comprised of a hard, slick clay surface, but they were also common in grassy and lightly treed areas outside of caves. Within caves they could be found active on or calling from both horizontal and vertical surfaces or within horizontal or vertical cracks during the day. They were not limited to the mouths of the caves but were found well back into the caves in areas having little, if any, light.

In the caves, calling occurred in waves, with silence predominating, but then followed by a one- or two-minute spate of calling. Some animals were calling from deep, inaccessible fissures at least 20 m from the mouth of the cave. During our observations, calling in caves occurred during the morning (until at least 0900 h); however, it is possible the frogs call throughout the day in such circumstances. Outside of caves, calling occurred primarily on wet mornings following night-time rain, with calling beginning at approximately 0500 h, diminishing after daylight (~0600 h), but continuing until at least 0930 h. One animal found calling during this time was perched approximately 1 m above the ground on *Dicranopteris linearis*. We never heard these frogs calling in the evening or night-time until the hour before dawn.

Syntopic microhylids include *Albericus darlingtoni*, *A. murritus*, *Callulops wilhelmanus*, *Choerophryne burtoni*, *Hylophorbus richardsi*, *Oreophryne notata*, *Xenorhina parkerorum*, and the species described below.

When disturbed, this frog plays dead, often lying on its back and refusing to move. However, unlike *Albericus darlingtoni*, they do not roll into a tight ball, but lie limply. One of us (FK) initially thought several animals in a collection bag were dead because of this habit, but they become active once righted and left undisturbed for a few moments.

Remarks. A distinctive aspect of the vocalization of this species is that it delivers a series of 8–10 calls at frequent, regular intervals (every 1.6 s for BPBM 33747 and every 2.3 s for BPBM 33748) (Fig. 7), with each series punctuated by a short period of silence of approximately the same duration. Other species of New Guinean *Cophixalus* that produce multi-note calls generally deliver them at irregular, much lengthier intervals. For example, the upper montane species, *Cophixalus sphagnicola* Zweifel and Allison, which has a call of 15–27 peeps, generally calls every 30–60 s (Zweifel and Allison 1982).

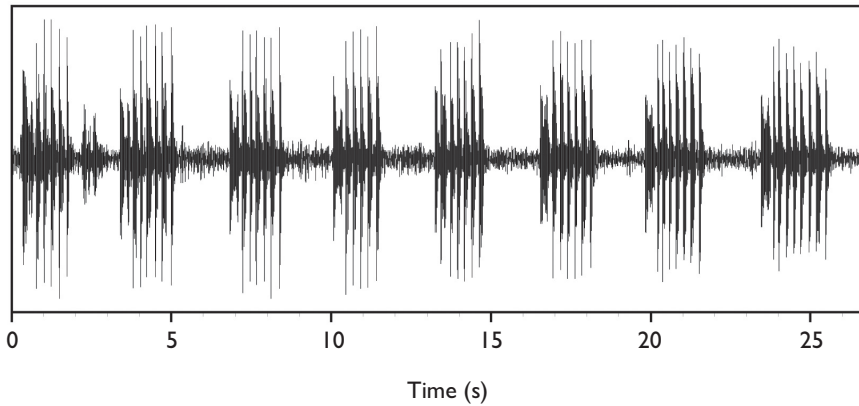


Figure 7. Wave form of all eight calls **A–H** recorded from *Cophixalus caverniphilus* sp. n. (BPBM 33748). See Table 4 for details.

This same behavior is seen in four recently described species of *Cophixalus* (Kraus and Allison, 2009). The holotype of *Cophixalus kethuk* (BPBM 20203) from Rossel Island in Milne Bay Province produced a call of 12–13 notes that sounded similar to “a marble falling and quickly coming to rest on a hard surface” (Kraus and Allison 2009). It called on average every 13 s (range 9–18 s, $n = 5$). *Cophixalus phaeobalius*, from 1520 m in the Bowutu Mts in Morobe Province, produces a call of 4–7 peeps. We recorded a paratype (BPBM 26194) that called at fairly regular intervals of 32–43 s (mean 37, $n = 4$). A morphologically similar species, *C. tomaiodactylus*, has a call consisting of 2–13 rapid peeps. Two paratypes (BPBM 23720, 26183) from middle to high elevations in the Bowutu Mts called irregularly every 23–74 s (mean 48, $n = 27$). A third species from the Bowutu Mts, *C. linnaeus*, produces a long call consisting of 21–48 peeps. Calling frequency of the holotype (BPBM 31836) and two paratypes (BPBM 31337–38) ranged from 87–595 s (mean 186, $n = 16$).

***Oreophryne anamiatoi* sp. n.**

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Fig. 1C, D

Holotype. BPBM 33768 (field tag FK 12882), collected by F. Kraus and J. Anamiato, E slope Mt. Itukua, Muller Range, 5.66954° S, 142.62334° E, 2177 m, Southern Highlands Province, Papua New Guinea, 27 March 2009.

Paratypes (n = 20). BPBM 33763, same data as holotype except collected 17 March; BPBM 33764, same data as holotype except collected 22 March; PNGNM 24097, same data as holotype except collected 25 March; BPBM 33765–66, same data as holotype except collected 26 March; BPBM 33767, same data as holotype; BPBM

33769–71, same data as holotype except collected 28 March; PNGNM 24098, same data as holotype except collected 29 March; BPBM 33772, same data as holotype except collected 30 March; PNGNM 24099, same data as holotype except collected 31 March; BPBM 33773–79, PNGNM 24100, Mt. Paramo, Muller Range, 5.64509° S, 142.63618° E, 1874 m, 3 April 2009.

Diagnosis. A medium-sized species of *Oreophryne* (adult SV = 23.4–29.7 mm) distinguished by its combination of a cartilaginous connection of the procoracoid to the scapula, no webbing between the toes, fifth toe longer than the third, relatively short snout (EN/SV = 0.073–0.086), dark face, venter with a dense array of dark-brown flecks, and call consisting of an extended multi-note chuckle or cackle.

Comparisons with other species. The new species differs from all Papuan congeners except *O. alticola* Zweifel, Cogger, and Richards, *O. asplenicola* Günther, *O. brevicrus* Zweifel, *O. clamata* Günther, *O. crucifera* (van Kampen), *O. flava* Parker, *O. habbemensis* Zweifel, Cogger, and Richards, *O. idenburgensis* Zweifel, *O. kampeni* Parker, *O. notata*, *O. pseudasplenicola* Günther, and *O. waira* Günther in having (vs. lacking) a procoracoid that reaches the scapula. It differs from *O. crucifera*, *O. idenburgensis*, *O. kampeni*, and *O. waira* in lacking (vs. having) webbing between the toes; and it differs from *O. alticola*, *O. brevicrus*, *O. clamata*, and *O. habbemensis* in having the fifth toe longer than (vs. shorter than or subequal to) the third. *Oreophryne anamiatoi* differs from the remaining species *O. asplenicola*, *O. flava*, *O. notata*, and *O. pseudasplenicola* in its larger size (23.4–29.7 mm vs. maximum of 21 mm in those four species) in having a uniformly dark face, and in its call (call a series of peeps in the other species, but call unknown in *O. flava*); it further differs from *O. asplenicola* and *O. pseudasplenicola* in its shorter snout (EN/SV > 0.086 in those species), from *O. notata* and *O. pseudasplenicola* in lacking (vs. having) an inverted white U on the face, and from *O. flava* in having an abdomen with dark-brown flecking (vs. immaculate yellow-white), and lacking (vs. having) a dark W-shaped mark between the shoulders.

Description of holotype. Adult female with incision on right side. Head wide (HW/SV = 0.40), with steep, slightly concave loreal region. Canthus rostralis rounded, concave when viewed from above. Nostrils directed laterally, closer to tip of snout than to eyes. Internarial distance broader than distance from naris to eye (EN/IN = 0.80, IN/SV = 0.101, EN/SV = 0.081). Snout truncate when viewed from the side, shallowly angulate when viewed from above. Eyes moderately large (EY/SV = 0.11); eyelid approximately two-thirds width of interorbital distance. Tympanum distinct but small (TY/SV = 0.047). Dorsal skin granular with series of weakly raised parallel ridges and scattered small pustules; ventral surfaces coarsely granular. Supratympanic fold narrow. Fingers unwebbed, bearing discs with terminal grooves; relative lengths 3>4>2>1. Finger discs approximately 3 times widths of penultimate phalanges, except for first finger, which is approximately twice width of penultimate phalanx. Subarticular tubercles well developed; inner metacarpal tubercle oval and low; outer rounded and obscure. Toes unwebbed, bearing discs with terminal grooves; relative lengths 4>5>3>2>1. Toe discs smaller than those of fingers (3rdF/4thT = 1.37), approximately twice width of penultimate phalanges. Subarticular tubercles low but

distinct; inner metatarsal tubercle large, oval; outer absent. Hind legs of moderate length (TL/SV = 0.46).

In preservative, dorsum medium brown with small black flecks scattered throughout, these concentrated dorsolaterally, mid-dorsally, and on top of head. Entire face to posterior of jaw angle uniform dark brown. Dark-brown postocular stripe extends along ventral side of supratympanic ridge. Rear and front of thighs uniform medium brown. Tops of wrist, hand, and first three fingers boldly marked with dark brown. Sides darker brown with very pale straw flecks. Venter very pale straw with bold, large, dark-brown flecks, these dense on chin, throat, and under legs, sparse on abdomen. Palmar and plantar surfaces dark brown spotted with very pale straw. Iris dark brown minutely flecked with silver.

Variation. Mensural variation for the type series is shown in Table 5. Sexual dimorphism is slight except that females clearly attain larger size than males and may have slightly narrower snouts (reflected in EN/IN values).

Dorsal ground color varies from light brown to dark brown, and pattern varies from virtually absent to moderately well stippled and streaked with black. Black stippling may be uniformly distributed, or concentrated laterally or dorsolaterally. Two specimens have a narrow tan vertebral stripe margined with black stippling. The dark face and postocular bar are present in all. Venters of all specimens are boldly spotted with dark brown on white, but two specimens have the abdomen clear and a few others have it less spotted than the chin and throat.

Color in life. BPBM 33764 (Fig. 1C): “Dorsum medium brown with a slight russet cast. Face dark brown; short dark-brown postocular dash; and few dark-brown lateral flecks. Rear of thighs brown, slightly darker than dorsum. Venter pale yellow heavily flecked with dark gray. Iris bronze with narrow red rim around pupil. Upper

Table 5. Mensural data for type series of *Oreophryne anamiatoi* sp. n. Data include only adult animals.

Character	Males (n = 11)		Females (n = 4)	
	mean	range	Mean	range
SV (mm)	25.2	23.4–26.7	29.0	27.4–29.7
TL/SV	0.45	0.43–0.49	0.47	0.45–0.48
EN/SV	0.077	0.073–0.082	0.079	0.075–0.084
IN/SV	0.103	0.100–0.107	0.100	0.098–0.102
SN/SV	0.14	0.13–0.15	0.13	0.13–0.14
TY/SV	0.045	0.039–0.056	0.049	0.047–0.051
EY/SV	0.12	0.11–0.13	0.12	0.11–0.12
HW/SV	0.39	0.38–0.40	0.39	0.38–0.40
HL/SV	0.33	0.32–0.35	0.33	0.32–0.34
3rdF/SV	0.071	0.062–0.083	0.074	0.065–0.082
4thT/SV	0.056	0.050–0.062	0.058	0.055–0.062
EN/IN	0.74	0.72–0.77	0.79	0.75–0.86
3rd F/4th T	1.28	1.20–1.40	1.27	1.18–1.37
HL/HW	0.85	0.81–0.89	0.85	0.82–0.86

arms and tarsi burnt orange.” BPBM 33765 was uniform brown dorsally with a dark face mask and postocular stripe (Fig. 1D); rear and front of thighs, and groin, uniform brown, slightly darker than dorsum; venter dirty cream flecked with gray; iris dark brown. BPBM 33766 had black flecks on sides and venter brighter yellow but with fewer gray flecks and with white chromatophores; BPBM 33767 had the dorsum and rear of thighs burnt orange and venter pale yellow; BPBM 33769 and 33771 had a tan vertebral line. BPBM 33774 had a metallic green sheen on eyelids and top of snout; BPBM 33776 same but less extensive. PNGNM 24097 was light brown with straw yellow on sides, with dark-brown spots dorsally and laterally, denser on sides; face to rictus and short postocular stripe dark brown; rear of thighs brown like dorsum but unspotted; venter pale yellow spotted with dark-gray flecks; iris brown.

Call. Animals called during the first few hours of darkness. We recorded ten calls from two individuals (Table 6). The calls from both were similar, so we combined data from both for analysis.

The call consists of 17–22 pulsed notes (Figs. 8A, 9A). Note duration was similar over the course of the call and averaged 0.0569 s (range 0.0266–0.0681). Inter-note intervals were also similar throughout the call and were similar in duration to the notes, averaging 0.0563 s (range 0.0390–0.0942). Mean call duration was 2.10s (range 1.77–2.33), and notes were delivered at a mean repetition rate of 18.5 notes/s (range 17.3–20.3). Number of pulses/note ranged from 3–11 (Fig. 9A), with a strong tendency to decrease over the course of the call (Fig 10). Modal number of pulses in the first three notes in each call ranged from 10–11, producing a mean rate for those notes of 200.9 pulses/s, while modal number of pulses in the last three notes ranged from 7–9, producing a mean rate for those notes of 146.4 pulses/s (Table 7). Notes are finely tuned, with a mean dominant frequency of 2490

Table 6. Call statistics of *Oreophryne anamiatoi* sp. n. recorded on Mt. Paramo, Muller Range, Southern Highlands Province, Papua New Guinea on 3 April 2009. BPBM 33774 was recorded at 2000 h and BPBM 33775 at 2100 h. Air temperatures were 17.0 and 17.7 °C, respectively.

Specimen	Call	Total notes	Call duration (s)	Notes/s	Mean note duration (s)	Mean internote duration (s)	No. pulses per note	Dominant frequency (Hz)
BPBM 33774	A	19	2.15	17.27	0.0611	0.0551	8–11	2540
“	B	20	2.33	17.86	0.0596	0.0598	8–12	2520
“	C	19	2.14	17.67	0.0596	0.0560	7–11	2520
“	D	19	2.13	18.12	0.0580	0.0569	7–11	2480
“	E	16	1.77	17.75	0.0572	0.0574	4–12	2480
“	F	18	1.96	18.68	0.0564	0.0553	3–11	2480
“	G	17	1.94	17.85	0.0584	0.0592	8–12	2460
BPBM 33775	A	22	2.31	20.29	0.0516	0.0558	6–12	2460
“	B	21	2.21	19.86	0.0532	0.0545	7–10	2460
“	C	20	2.08	19.80	0.0531	0.0536	7–11	2460

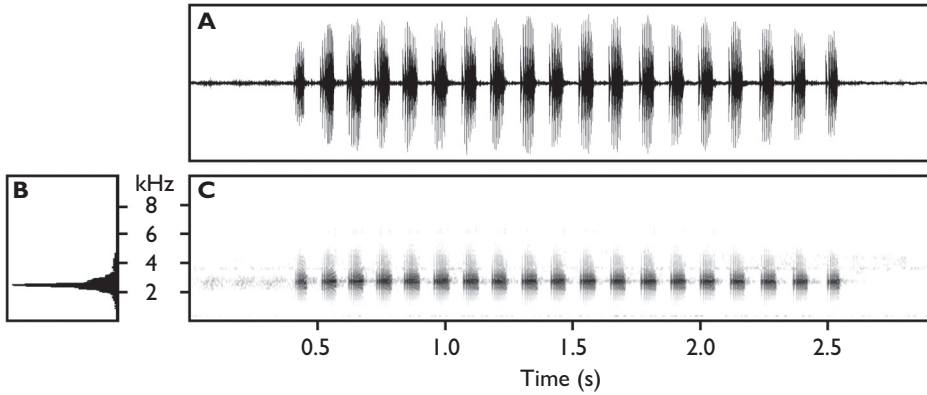


Figure 8. **A** Waveform, **B** power spectrum, and **C** spectrogram of Call “D” of *Oreophryne anamiatoi* sp. n. (BPBM 33774) recorded at Mt. Paramo, Muller Range, Southern Highlands Province, Papua New Guinea on 3 April 2009 at 2000 h. Air temperature 17.7 °C.

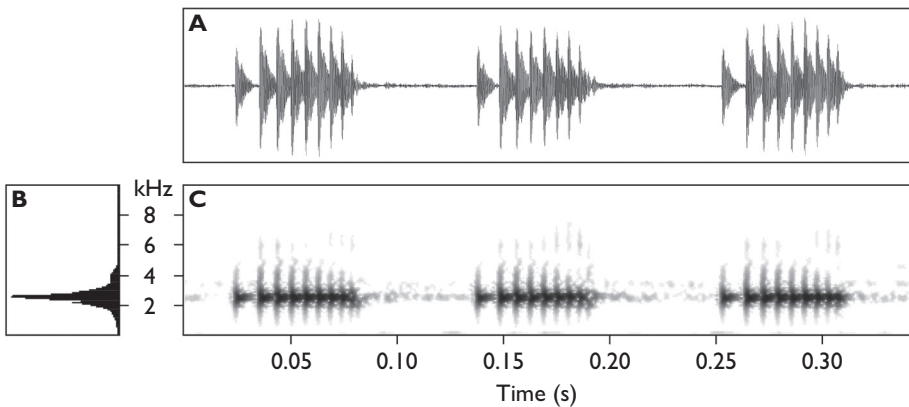


Figure 9. Detail of the middle three notes of call “D” of *Oreophryne anamiatoi* sp. n. (BPBM 33774). **A** Waveform, **B** power spectrum, and **C** spectrogram. Note the pulsing of the notes.

Hz (range 2460–2540) (Fig. 8B–C, 9B–C) and no frequency modulation over the duration of the note.

Etymology. The species is named for Jim Anamiato of the Papua New Guinea National Museum for his considerable assistance on several of our expeditions, including the one during which this frog was discovered.

Range. Known only from the vicinity of the type locality on the northeastern slopes of the Muller Range, Southern Highlands Province, Papua New Guinea (Fig. 4).

Ecological notes. Animals inhabited both primary and secondary rainforest at elevations ranging from 1870–2180 m. Most animals were found in the immediate vicinity of stream banks, but a few were found several meters away in adjacent forest. Males called from dense moss mats on standing or fallen trees from 1–5 m above the ground,

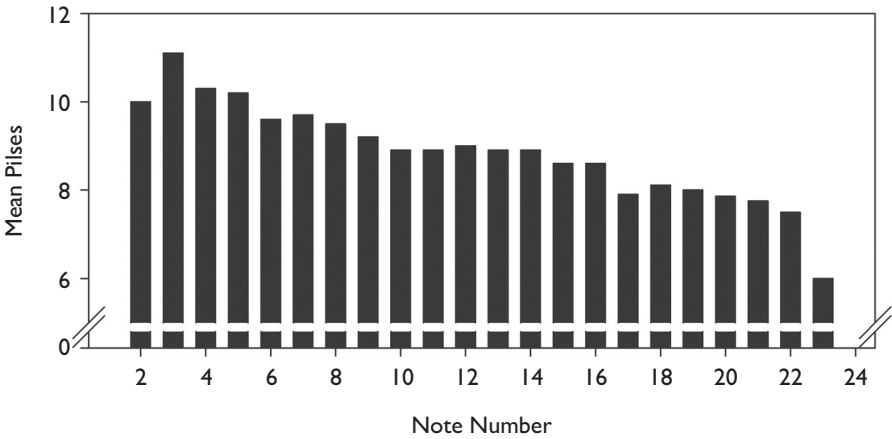


Figure 10. Number of pulses/note of *Oreophryne anamiattoi* sp. n. recorded at Mt. Paramo, Muller Range, Southern Highlands Province, Papua New Guinea on 3 April 2009. BPBM 33774 was recorded at 2000 h and BPBM 33775 at 2100 h. Air temperatures were 17.0 and 17.7 °C, respectively. See Table 7 for additional details.

Table 7. Pulse rates of the calls of *Oreophryne anamiattoi* sp. n. See Table 6 for additional details.

Specimen	Call	Pulses/s	
		First Three Notes	Last Three Notes
BPBM 33774	A	166.5	139.7
"	B	206.5	145.1
"	C	181.3	135.7
"	D	197.2	139.3
"	E	195.6	154.1
"	F	216.0	155.2
"	G	202.1	154.7
BPBM 33775	A	245.9	154.9
"	B	195.5	138.3
"	C	202.4	146.6

but several animals were found perched silently on low (<2 m above ground) vegetation, on *Pandanus* roots or near *Pandanus* trees. Syntopic microhylids include *Albericus darlingtoni*, *A. murritus*, *Callulops wilhelmanus*, *Choerophryne burtoni*, *Cophixalus caverniphilus*, *Hylophorbus richardsi*, *Oreophryne notata*, and *Xenorhina parkerorum*.

Remarks. Several species of *Oreophryne* give loud, rattling calls similar to that of *O. anamiattoi*. These include *Oreophryne clamata*, which gives a call of 10–23 pulsed notes (Günther 2003a); *O. kapisa* Günther, which produces 26–47 pulsed notes (Günther 2003b); and *O. waira*, which produces 6–11 pulsed notes (Günther 2003b).

The call of *Oreophryne anamiatoi* is most similar to that of *O. clamata* but differs from that species in having a slightly longer duration (1.77–2.33 s vs. 0.58–1.41s), a longer mean note duration (57 ms vs. 21 ms), a longer mean internote duration (56 ms vs. 39 ms), and a slightly lower dominant frequency (2460–2540 Hz vs. 2700–3600 Hz). Internote duration is fairly constant in *O. anamiatoi* but tends to lengthen over the course of the call in *O. clamata* (Günther 2003a).

Discussion

With the addition of the three species described herein and other species recently collected by us, there are now at least nine species of microhylid frogs known from the Muller Range. These include four species that are endemic to but relatively widespread in the central highlands of Papua New Guinea (*Albericus darlingtoni*, *Callulops wilhelmanus*, *Oreophryne notata*, *Xenorhina parkerorum*) and two species (*Choerophryne burtoni*, *Hylophorbus richardsi*) that were recently described from uplands approximately 90 km and 60 km, respectively, to the southeast of the Muller Range. In addition, Smith (1980) listed *Cophixalus cryptotympanum* from the Muller Range. This taxon was originally described from Mt. Dayman on the Southeast Peninsula of Papua New Guinea and has been recorded from numerous montane localities throughout much of Papua New Guinea (Menzies 2006). However, the taxonomic status of this species is uncertain, and it is likely that it is a species complex, with the named form known with certainty only from Mt. Dayman. Hence, the record of *C. cryptotympanum* from the Mullers is best treated with caution at present.

A similar distributional pattern characterizes the hylid frogs that we found in the Muller Range. We obtained *Litoria angiana* (Boulenger), *L. arfakiana* (Peters and Doria), *L. darlingtoni* (Loveridge), *L. iris* (Tyler), *L. kumae* Menzies and Tyler, *L. micromembrana* (Tyler), and *L. modica* (Tyler). All of these except *L. kumae* are widespread montane species across Papua New Guinea (*Litoria angiana*, *L. arfakiana*, *L. micromembrana*, *L. modica*), or widespread within the central highlands (*L. darlingtoni*, *L. iris*). Only *L. kumae* is endemic to a small portion of the central highlands, being previously known from the vicinity of Tari, 35 km southeast of our collection site, and a couple of points a short distance south of Tari but still in Southern Highlands Province.

These rather limited details suggest that the frog fauna of the Muller Range is broadly representative of that of the central highlands but with a significant endemic element that appears to be restricted to uplifted limestone regions and adjacent volcanoes of the Southern Highlands. Additional endemic species may be expected in the subalpine and alpine regions (>3000 m) of the Muller Range.

Acknowledgements

We thank Paulus Kei (UPNG) for loan of specimens; Don Cameron for advice on Latin and Greek grammar; Pumehana Imada for specimen processing and documentation; and Brad Evans for preparing the figures. We thank Jim Anamiato, Anulpi Aralu, Tarali Bulu, Dickson Gibson, Gideon Petawi, Phil Shearman, Francis Tatabe, and Makana Yewa for providing logistical or field assistance during the expedition. We thank the PNG National Museum and Art Gallery for providing in-country collaborative assistance and the Department of Environment and Conservation, National Research Institute, and Southern Highlands provincial government for permission to conduct this research. This research was supported by National Science Foundation grants DEB-0103794 and DEB-0743890. This is contribution 2009-011 from the Pacific Biological Survey at the Bishop Museum.

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Appendix

Additional specimens examined

- Albericus exclamitans*: Papua New Guinea: Morobe Province: along Dunch River, NW slope Mt. Shungol, 750–780 m (BPBM 18319, holotype; BPBM 18317–18, 18320–40).
- Albericus swanhildae*: Papua New Guinea: Southern Highlands Province: 16 km NE Mendi, 2400–2500 m (UPNG 5572, holotype; UPNG 5573–74, 5576, 5591–92, paratypes).

Oreophryne idenburgensis: Indonesia: Irian Jaya: Idenburg River, 18 km SW Bernhard Camp, 2150 m (AMNH 49663, holotype; AMNH 49666, paratype).

Oreophryne kampeni: Papua New Guinea: Central Province: Moroka (BMNH 1947.2.12.14, holotype; BMNH 1947.2.12.43–44, paratypes).

Oreophryne notata: Papua New Guinea: Southern Highlands Province: E slope Mt. Itukua, Muller Range, 2170 m (BPBM 33672–706).