

## Negastriinae Studies: Species of the Genus *Arhaphes* Candèze, 1860 (Insecta: Coleoptera: Elateridae)

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**Rainer Schimmel and Dariusz Tarnawski (2012)** Negastriinae studies: species of the genus *Arhaphes* Candèze, 1860 (Insecta: Coleoptera: Elateridae). *Zoological Studies* 51(4): 536-547. Species of the genus *Arhaphes* Candèze, 1860 are revised, 3 new species are described and illustrated, new records of known species of this genus are given, a key to the species of the genus is provided, and new nomenclatural combinations for 10 species are proposed. The new species are *Arhaphes kralli* sp. nov., *A. longicollis* sp. nov., and *A. rugosicollis* sp. nov. New nomenclatural combinations include *A. biguttatus* (Candèze, 1893) comb. nov., *A. erythrurus* (Schwarz, 1902) comb. nov., *A. cyaneus* (Schwarz, 1902) comb. nov., *A. gestroi* (Candèze, 1892) comb. nov., *A. luteipes* (Candèze, 1896) comb. nov., *A. minusculus* (Candèze, 1878) comb. nov., *A. nigriceps* (Candèze, 1880) comb. nov., *A. opacus* (Candèze, 1878) comb. nov., *A. plumbeus* (Schwarz, 1902) comb. nov., and *A. ruficollis* (Candèze, 1892) comb. nov. <http://zoolstud.sinica.edu.tw/Journals/51.4/536.pdf>

**Key words:** Revision, New species, New records, Keys to species, Asia.

The genus *Arhaphes* was established by Candèze (1860) with the type species *A. diptychus* Candèze, 1860 from Ceylon (Sri Lanka). But in the year 1891, Candèze in one of his publications, erroneously used the name *Arrhaphes* for the species he formerly described under the name *Arhaphes*. Some years later, Candèze (1878 1880 1891 1892 1893 1896) and also Schwarz (1902), described further species of *Arhaphes* from the Oriental Region, which were also superseded by Schenkling (1925-1927) in the *Coleopterorum Catalogus* under the incorrect name *Arrhaphes*: *Arr. biguttatus* (Candèze, 1893), *Arr. cyaneus* (Schwarz, 1902), *Arr. erythrurus* (Schwarz, 1902), *Arr. gestroi* (Candèze, 1878), *Arr. luteipes* (Candèze, 1896), *Arr. minusculus* (Candèze, 1878), *Arr. nigriceps* (Candèze, 1880), *Arr. opacus* (Candèze, 1878), *Arr. plumbeus* (Schwarz, 1902), and *Arr. ruficollis* (Candèze, 1892). Further species published in the *Coleopterorum Catalogus*

belonged to the genus *Hemirrhaphes* Candèze, 1878, which was also incorrectly synonymized by Schenkling (1925-1927) with the genus *Arhaphes*: *H. americanus* (Champion, 1825), *H. apicalis* (Schwarz, 1900), *H. bivittatus* Fleutiaux, 1905, *H. ferrugineus* Candèze, 1896, *H. madagascariensis* Fleutiaux, 1899, *H. notabilis* Candèze, 1878, *H. pallidus* Candèze, 1896, and *H. quadriguttatus* (Schwarz, 1898). Again, some years later, Fleutiaux (1930 1934), and more recently, Kishii (1994) published further species of the genus *Arhaphes*: *A. coomani* Fleutiaux, 1930, *A. fulvus* Fleutiaux, 1930, *A. humeralis* Fleutiaux, 1930, *A. takasago* Kishii, 1994, and *A. terminates* Fleutiaux, 1934. Stibick (1971) in his generic classification published significant differential characters, and separated both genera, *Arhaphes* and *Hemirrhaphes* as valid species-groups. Thus, to date, only 15 species of the genus *Arhaphes* are known, and the distribution of the species

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seems to be restricted to the Palaearctic and Oriental Regions. Schimmel and Tarnawski (2011) enumerate 6 species as members of the genus *Hemirrhaphes*: *H. apicalis* Schwarz, 1900, *H. bivittatus* Fleutiaux, 1905, *H. ferrugineus* Candèze, 1896, *H. johorensis* Schimmel and Tarnawski, 2011, *H. laoticus* Schimmel and Tarnawski, 2011, and *H. notabilis* Candèze, 1878. It is argued that species of *Hemirrhaphes* are phylogenetically closer to species of the genus *Zoroachros* than to those of the genus *Arhaphes*, in which they were repeatedly placed by various earlier authors.

Through colleagues and friends, we recently received for study newly collected materials of the subfamily Negastrinae, which had been collected in China, Indonesia, Laos, Malaysia, India, Thailand, and Vietnam. Among this material, we found some new species of the genus *Arhaphes* which we describe and illustrate below. New records of some known species of this genus are given, and keys to the species are provided.

## MATERIALS AND METHODS

The following abbreviations were used in this study: CSV, Collection Schimmel, Vinningen, Germany; CRG, Collection Riese, Genova, Italy; CTW, Collection Tarnawski, Wrocław, Poland; HNMB, Collection Hungarian National Museum, Budapest, Hungary; SMNS, Collection Staatliches Museum für Naturkunde, Stuttgart, Germany; and TICB, Collection Tamin Insect Collection, Brno, Czech Republic.

Examination of the collected material was carried out with a Zeiss Stemi 2000-C binocular scope (Oberkochen, Germany) with a micron insert. Photographs were taken with a Nikon E4500 camera (Tokyo, Japan) with an TV2/3”C 0.63x adaptor to the binocular scope.

The body length of specimens was measured from the apical margin of the frons to the apex of the elytra, and body width was measured along the base angles of the pronotum using the micron insert of the binocular.

The examined specimens were fixed on a white pasteboard. The genitalia of the males were pulled out of the abdomen, cleaned, and fixed beside the body of the specimen using water-soluble transparent glue.

## TAXONOMY

### Genus *Arhaphes* Candèze, 1860 (Figs. 1-6)

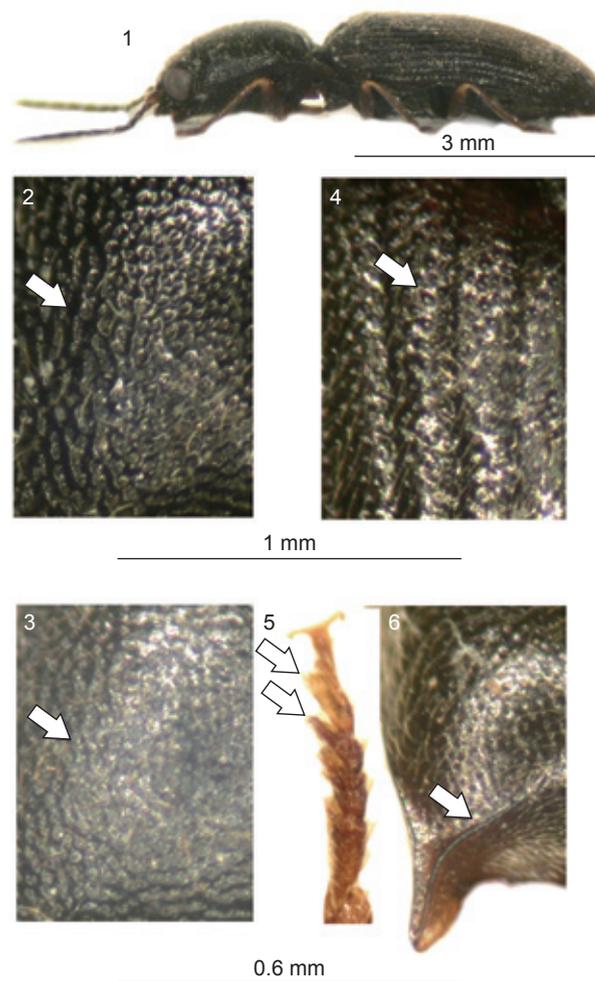
*Arhaphes* Candèze 1860: 52.

*Arrhaphes* (Candèze, 1860), Candèze 1891: 120, Stibick 1971: 389-390, Suzuki 1999: 94-95.

*Type species*: *Arhaphes diptychus* Candèze 1860: 99.

*Distribution*: China, Himalayas, India, Indonesia, Laos, Malaysia, Taiwan, Thailand, and Vietnam.

*Differential diagnosis*: Small species 3.5-6.5 mm long; body subparallel and cylindrical (Fig. 1), pronotum and elytra conspicuously and



**Figs. 1-6.** Characters of *Arhaphes* spp. 1. Habitus (lateral view); 2, 3. wrinkled interstices of punctures on pronotum (dorsal view); 4. pustulate surface of base of elytra (dorsal view); 5. hind-tarsus with lobed 3rd and 4th antennomere (lateral view); 6. carina of left posterior angles of pronotum (dorsal view).

regularly vaulted, matte and pilose; black, blackish, or brownish, with or without yellowish tint; antennae and legs black, sometimes 1st antennomere lighter, reddish-brown, brownish, or yellowish; integument rugose; pubescence yellowish-brown; prosternal suture almost perfectly obliterated, only apically opened; body regularly cylindrical and vaulted; carina of pronotal posterior angles well-separated from lateral margin, and bent mesiad shortly after beginning of basal angles (Fig. 6); apices of basal angles semispherical; punctures on pronotum dense, umbilical, interstices reduced to small, sometimes costiform wrinkles (Figs. 2, 3); elytra with very dense and umbilical punctures and fine longitudinal striae, interstices transversely rugose, basal part of elytra pustulate (Fig. 4); 3rd and 4th tarsomeres apically lobed, tarsomeres and lobes up to claws of decreasing length (Fig. 5); claws simple.

**Remarks:** Stibick (1971) mentioned in his generic key to the Negastrinae about the differential diagnosis of *Arhaphes*: "All segments of tarsae simple... *Arhaphes*". This is not the case, and the 3rd and 4th tarsomeres of all species of the genus *Arhaphes* are distinctly lobed. Schwarz (1900: 89) had previously mentioned that "Diese Gattung (*Arhaphes*) hat nicht, wie Candèze (Monogr. des Elat. III, p. 98) angibt, "tarses simple" sondern ebenso wie die Gattung *Hemirraphes* Cand. (Elat. nouv. II., p. 32) "tarsorum articulus tertio et quarto lobatus". *Hemirraphes* Cand. ist also einfach synonym mit *Arhaphes* Cand., was auch schon Champion in der Biolog. Centr.-Am. III, p. 413 nachgewiesen hat. ["This genus (*Arhaphes*) does not have, as mentioned by Candèze (Monogr. des Elat. III, p. 98), "tarses simple", but the same as the genus *Hemirraphes* Cand. (Elat. nouv. II., p. 32), "tarsorum articulus tertio et quarto lobatus. *Hemirraphes* Cand." Therefore, it is simply a synonym of *Arhaphes* Cand., which was already proved by Champion in Biolog. Centr.-Am. III, p. 413"]. However, even though the 3rd and 4th tarsomeres of *Arhaphes* and *Hemirraphes* are lobed, species of the 2 genera do not belong to a common natural species-group, as there are many further differential characters: all species of the genus *Arhaphes* have a subparallel, cylindrical, and distinctly vaulted body, short legs, and the base of pronotum which is slightly less constricted to subparallel; all species of the genus *Hemirraphes* have flat bodies, long legs, and a conspicuously constricted pronotal base.

**Species of the genus *Arhaphes* from the  
Palaeartic Region  
(including species from China and the  
Himalayas)**

***Arhaphes longicollis* sp. nov.**

(Figs. 7-9)

**Type locality:** China: Yunnan Province (Prov.), Lijiang.

**Material examined:** Holotype ♂ (CSV): China: N Yunnan, Lijiang, 2600 m, 30 June- 2 July 1990, leg. L. et M. Bocák.

**Paratype** ♀ (CSV): Same data as for holotype, leg. L. et M. Bocák.

**Etymology:** The name of the new species refers to the long pronotum.

**Diagnosis:** Holotype ♂: Subparallel, cylindrical, pronotum and elytra conspicuously and regularly vaulted, matte and pilose; black, 1st antennomere, legs, and apices of pronotal basal angles dark reddish-brown; integument rugose, base of elytra micro-punctured; pubescence yellowish-brown; dimensions: 4.81 mm long, 1.84 mm wide.

**Description: Head:** With very dense, circular, and umbilical punctures, interstices reduced to small, shiny wrinkles; pubescence fine, short, and directed from base to apex and to lateral sides; eyes semispherical, slightly prominent; frons semicircular, declivous from center to apex, with complete and prominent, conspicuously shiny boundary carina; antennae elongated, moniliform from 3rd antennomere on, extending posterior to angles of pronotum by length of last antennomere; 2nd antennomere subcylindrical, slightly longer than wide apically, 3rd antennomere twice as long as wide apically, following antennomere of almost same length, last antennomere oblong-elliptic, subapically beveled.

**Pronotum:** Subcylindrical, conspicuously longer along median line than wide posteriorly (length: width ratio of 1.40: 1.21), conspicuously and regularly vaulted throughout entire length, nearly subparallel laterally, just slightly constricted sub-basally, and with precipitous slope posteriorly; posterior angles of pronotum straight, very slightly divergent apically, with rough and prominent carina, well-separated from lateral margin, and bent mesiad shortly after beginning of basal angles; apices of basal angles semispherical; pronotum without fovea or mold; punctures on entire pronotum very dense, circular and umbilical, interstices reduced to small, shiny, sometimes

costiform wrinkles; pubescence very fine, scarcely visible, declivous stellate from center to lateral sides of pronotum.

**Scutellum:** Subtriangular, declivous anteriorly, perpendicular apically, conspicuously vaulted medially; punctures dense and umbilical, interstices conspicuously costiform; pubescence fine, scarcely visible, declivous from base to apex.

**Elytra:** Cylindrical, just after apical 1/3 narrowing to apex; apices arcuate, without inner tooth; base of elytra slightly wider than of pronotum and conspicuously depressed at scutellum, shoulders prominent (winged species); elytra with very dense and umbilical punctures and fine longitudinal striae, interstices transversely rugose, basal part of elytra pustulate; pubescence fine, short and scarcely declivous from base to apex and to lateral sides.

**Pro-, meso-, and metathorax:** With sparse and fine punctures, interstices flat, semi-matte and micro-punctured; pubescence short and declivous; pro-episternum lacking punctures, shiny.

**Legs:** Elongated, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with barely visible, fine pubescence, and fine ornamentation, 3rd tarsomeres short, 4th tarsomeres conspicuously lamellate, tibia covered with semi-protruding bristly thorns.

**Aedeagus:** Oval, trilobate, median lobe widened and subparallel, extending apices of paramere conspicuous and pointed apically; parameres moderately falcate and pointed apically.

Female (paratype) with shorter antennae, not reaching apices of posterior angles of pronotum by length of last antennomere.

**Differential diagnosis:** *Arhaphes longicollis* is similar to *A. plumbeus*, but can be easily distinguished from this species by the longer pronotum, unicolored dark reddish-brown legs, shorter pubescence, and the form of the aedeagus.

**Distribution:** China: Yunnan Prov.

***Arhaphes minusculus* (Candèze, 1878) comb. nov.**

*Arhaphes minusculus* Candèze 1878: 33.

**Type locality:** Himalayas.

**Material examined:** India: Sikkim, Deehiling, 29 Apr. 1985, 1 specimen, leg. Ch. J. Rai; India: Darjeeling, Gangea Thora, 1000 m, 25 Apr. 1986, 1 specimen, leg. B. Bhakta.

**Remarks:** The species is also known from Thailand and Laos.

**Distribution:** Himalayas (type locality); India: Sikkim, Darjeeling.

***Arhaphes opacus* (Candèze, 1878) comb. nov.**

*Arhaphes opacus* Candèze 1878: 33.

**Type locality:** Himalayas.

**Material examined:** India: Sikkim, Khech-eopan Lake, 21-26 June 2003, 1 specimen, leg. E. Kučera; same locality but 15-22 June 2006, 1800 m, 1 specimen, leg. E. Kučera; Deehiling, 1200 m, 29 Apr. 1985, 3 specimens, leg. Ch. J. Rai; Darjeeling, 3rd mi. Gumbha, 2500 m, 21 May 1986, 1 specimen, leg. Ch. J. Rai.

**Distribution:** Himalayas (type locality); India: Sikkim, Darjeeling.

***Arhaphes ruficollis* (Candèze, 1892) comb. nov.**  
(Fig. 10)

*Hemirrhaphes ruficollis* Candèze 1892: 491.

**Type locality:** India: Bengal (Chota Nagpore).

**Material examined:** India: Meghalaya, Darugiri, Garo, 450 m, 19 May 1976, 1 specimen, leg. Wittmer et Baroni.

**Distribution:** India: Bengal, Meghalaya.

**Key to species of the genus *Arhaphes* from the Palaearctic Region**

1. Pronotum red, elytra black, legs yellow .....  
..... *A. ruficollis* (Candèze, 1892)
- Pronotum and elytra black, legs yellow or reddish-brown ....  
..... 2
2. Legs yellow, pronotal posterior angles subparallel .....  
..... *A. minusculus* (Candèze, 1878)
- Legs reddish-brown ..... 3
3. Pronotal punctures umbilical with interstices reduced to small, flat wrinkles; 3rd antennomere 1.5-times as long as 2nd antennomere ..... *A. opacus* (Candèze, 1878)
- Pronotal punctures umbilical with interstices forming costiform wrinkles; 3rd antennomere twice as long as 2nd antennomere ..... *A. longicollis* sp. nov.

**Species of the genus *Arhaphes* from the Indian and Sri Lankan Subregion  
(including species from India and Sri Lanka)**

***Arhaphes diptychus* Candèze, 1860**

*Arhaphes diptychus* Candèze 1860: 99.

*Arhaphes diptychus* (Candèze, 1860), Candèze 1891.

**Type locality:** Sri Lanka.

**Material examined:** Sri Lanka: Kandy, 1-18

Apr. 1991, 600 m, 2 specimens, leg. J. Kolibac.  
*Distribution*: Sri Lanka.

***Arhaphes luteipes* (Candèze, 1896)**

*Arhaphes luteipes* Candèze 1896: 54.  
*Arhaphes luteipes* (Candèze, 1896), Stibick 1971: 390.

*Type locality*: India: Karnataka, Mysore.

*Material examined*: Thailand: Loei Prov., Phu Kradung, 1000 m, 16-18 May 1999, 1 specimen, leg. D. Hauck.

*Remarks*: See remarks for *A. gestroi*. The species is also known from Thailand.

*Distribution*: India: Karnataka Prov.

**Key to species of the genus *Arhaphes* from the Indian and Sri Lankan Subregion**

1. Pronotal punctures sparse and simple, interstices 1x their diameter; pronotal posterior angles conspicuously divergent ..... *A. diptychus* Candèze, 1860
- Pronotal punctures dense and umbilical, interstices reduced to small wrinkles; pronotal posterior angles slightly divergent ..... *A. luteipes* (Candèze, 1896)

**Species of the genus *Arhaphes* from the Indo-Chinese Subregion (including species from Laos, Taiwan, Thailand, and Vietnam)**

***Arhaphes coomani* Fleutiaux, 1930**

*Arhaphes coomani* Fleutiaux 1930: 639.

*Type locality*: Vietnam: Tonkin, Hoa-Binh.

*Material examined*: Laos: Hua Phan Prov., Fuleoi, Ban Sokok, 23-26 May 2003, 1 specimen, leg. D. Hauck; Thailand: Loi Prov., Rua NP (National Park), 1199 m, 6-9 May 1999, 1 specimen, leg. D. Hauck; same province but Phu Kradung, 1000 m, 16-18 May 1999, 12 specimens, leg. D. Hauck.

*Remarks*: The above data are the 1st for *A. coomani* from Thailand and Laos.

*Distribution*: Vietnam: Tonkin; Thailand: Loi Prov.; Laos: Hua Phan Prov.

***Arhaphes erythrurus* (Schwarz, 1902) comb. nov.**

*Arhaphes erythrurus* Schwarz 1902: 256.

*Type locality*: Indonesia: Sumatra.

*Material examined*: Thailand: Nan Prov., Bo Klua, 700 m, 1999, 6 specimens, leg. D. Hauck.

*Remarks*: The above data are the 1st for *A. erythrurus* from Thailand. The species is also known from Indonesia.

*Distribution*: Thailand: Nan Prov.

***Arhaphes fulvus* Fleutiaux, 1930**

*Arhaphes fulvus* Fleutiaux 1930: 637.

*Type locality*: Vietnam: Tonkin, Lam.

*Material examined*: Thailand: Chiang-Mai Prov., Doi Mae Ya, 1300 m, 14 May 1993, 1 specimen, leg. V. Kuban.

*Remarks*: The above data are the 1st for *A. fulvus* from Thailand.

*Distribution*: Vietnam: Tonkin; Thailand: Chiang-Mai Prov.

***Arhaphes gestroi* (Candèze, 1878) comb. nov. (Fig. 11)**

*Arhaphes gestroi* Candèze 1878: 131.

*Arhaphes gestroi* (Candèze, 1878), Stibick 1971: 390.

*Type locality*: Indonesia: Java.

*Material examined*: Thailand: Nan Prov., Doi Mts., Phukua, 22-24 June 1999, 2 specimens, leg. D. Hauck; Loei Prov., Phu Kradung, 1000 m, 16-18 May 1999, 1 specimen, leg. D. Hauck; Mae Hong Son Prov., Soppong, 600 m, 28 May 2006, 1 specimen, leg. D. Hauck; Chiang Dao Prov., 1000 m, 17-24 May 1991, 1 specimen, leg. V. Kuban.

*Remarks*: Stibick (1971) in his generic classification of the Negastrinae did not explicitly place *A. gestroi* as a new nomenclatural combination, but used this combination when considering species that appertained to the genus *Arhaphes*. The above data are the 1st of the species from Thailand. The species is also known from Java.

*Distribution*: Thailand: Nan Prov., Loei Prov., Mae Hong Son Prov., Chiang Dao Prov.; Indonesia: Java.

***Arhaphes humeralis* Fleutiaux, 1930**

*Arhaphes humeralis* Fleutiaux 1930: 638.

*Type locality*: Vietnam: Tonkin, Hoa Binh.

*Material examined*: Thailand: Nan Prov., Bo Klua, 700 m, (1999?), 1 specimen, leg. D. Hauck.

*Remarks*: The above data are the 1st of the species *A. humeralis* from Thailand.

*Distribution*: Vietnam: Tonkin; Thailand: Nan Prov.

***Arhaphes krali* sp. nov.**

(Figs. 12-14)

*Type locality*: Thailand: Lansang NP.*Material examined*: Holotype ♂ (CSV): Thailand: Lansang NP, 500 m, 18-24 Apr. 1991, leg. D. Kral.*Etymology*: The name of the new species refers to the collector of the type, Prof. Dr. D. Kral, Prague, Czech Republic.*Diagnosis*: Holotype ♂: Subparallel, cylindrical, pronotum and elytra conspicuously and regularly vaulted, matte and pilose; blackish-brown, 1st 2 antennomere, legs, and prosternum light yellowish-red; integument rugose, base of elytra micro-punctured; pubescence yellowish-brown; dimensions: 5.42 mm long, 1.64 mm wide.*Description*: *Head*: With very dense, circular, and umbilical punctures, interstices reduced to small, shiny wrinkles; pubescence fine, short, and directed from base to apex and to lateral sides; eyes semispherical, slightly prominent; frons semicircular, declivous from center to apex, with complete, prominent, conspicuously shiny boundary carina; antennae elongated, moniliform from 3rd antennomere on, just reaching posterior angles of pronotum; 2nd antennomere subcylindrical, slightly longer than wide apically, 3rd antennomere twice as long as wide apically, following antennomere of almost same length, last antennomere oblong-elliptic, subapically beveled.*Pronotum*: Subcylindrical, along median line slightly longer than wide posteriorly (length: width ratio of 1.80: 1.41), conspicuously and regularly vaulted along entire length, nearly subparallel laterally, just slightly constricted sub-basally, with precipitous slope posteriorly; posterior angles of pronotum straight, very slightly divergent apically, with rough and prominent carina, well-separated from lateral margin, and bent mesiad shortly after beginning of basal angles; apices of basal angles semispherical; pronotum without fovea or mold; punctures on entire pronotum very dense, circular, and umbilical, interstices reduced, small, shiny, sometimes with costiform wrinkles; pubescence very fine, scarcely visible, declivous stellate from center to lateral sides of pronotum.*Scutellum*: subtriangular, declivous anteriorly, perpendicular apically, conspicuously vaulted medially; punctures dense and umbilical, interstices conspicuously costiform; pubescence fine, scarcely visible, declivous from base to apex.*Elytra*: Cylindrical, just after apical 1/3 narrowing to apex; apices arcuate, without inner

tooth; base of elytra slightly wider than that of pronotum and conspicuously depressed at scutellum, shoulders prominent (winged species); elytra with very dense, umbilical punctures and fine longitudinal striae, interstices transversely rugose, basal part of elytra pustulate; pubescence fine, short, and scarcely declivous from base to apex and to lateral sides.

*Pro-, meso-, and metathorax*: With sparse and fine punctures, interstices flat, semi-matte and micro-punctured; pubescence short and declivous; pro-episternum lacking punctures, shiny.*Legs*: Elongated, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with barely visible, fine pubescence, and fine ornamentation, 3rd tarsomeres short, 4th tarsomeres conspicuously lamellate, tibia covered with semi-protruding bristly thorns.*Aedeagus*: Oval, trilobate, median lobe widened and subparallel, extending apices of paramere conspicuously and pointed apically; parameres subparallel and pointed apically.*Differential diagnosis*: *Arhaphes krali* is similar to *A. ruficollis*, but can be easily distinguished from this species by the shorter body, light yellowish-red pronotum, and form of the aedeagus.*Distribution*: Thailand: Lansang NP.***Arhaphes luteipes* (Candèze, 1896)***Arhaphes luteipes* Candèze 1896: 54.*Arhaphes luteipes* (Candèze, 1896), Stibick 1971: 390.*Type locality*: India: Mysore.*Material examined*: Thailand: Loei Prov., Phu Kradung, 1000 m, 16-18 May 1999, 1 specimen, leg. D. Hauck.*Remarks*: See remarks for *A. gestroi*. The above data are the 1st for the species from Thailand. The species is also known from India.*Distribution*: Thailand: Loei Prov., Mae Hong Son Prov.***Arhaphes minusculus* (Candèze, 1878) comb. nov.***Arhaphes minusculus* Candèze 1878: 33.*Type locality*: Himalayas.*Material examined*: India: Sikkim, Deehiling, 29 Apr. 1985, 1 specimen, leg. Ch. J. Rai; Darjeeling, Gangea Thora, 1000 m, 25 Apr. 1986, 1 specimen, leg. B. Bhakta; Thailand: Nan Prov., Doi Mts., Phukua, 22-24 June 1999, 13 specimens,

leg. D. Hauck; same province but Bo Khua, 700 m (1999?), 1 specimen, leg. D. Hauck; Mae Hong Son Prov., Soppong, 1350 m, 10-13 May 1993, 2 specimens, leg. V. Kuban; same locality but 1500 m, 23-27 May 1999, 17 specimens, leg. D. Hauck; Laos: Hua Phan Prov., Fuleoi, Ban Sakok, 23-26 May 2003, 1 specimen, leg. D. Hauck.

**Remarks:** The above data are the 1st for the species from Thailand and Laos. The species is also known from the Himalayas.

**Distribution:** Thailand: Nan Prov., Mae Hong Son Prov.; Laos: Hua Phan Prov.

***Arrhaphes plumbeus* (Schwarz, 1902) comb. nov.**  
(Fig. 15)

*Arrhaphes plumbeus* Schwarz 1902: 257.

**Type locality:** Sumatra: Soekaranda, Lian-gagas, Indrapoera.

**Material examined:** Thailand: Loei Prov., Phu Kradung, 1000 m, 16-18 May 1999, 3 specimens, leg. D. Hauck; Mae Hong Son Prov., Soppong, 600 m, 28 May-2 June 1989, 1 specimen, leg. D. Hauck.

**Remarks:** The above data are the 1st for the species from Thailand. The species is also known from Sumatra.

**Distribution:** Thailand: Loei Prov., Mae Hong Son Prov.; Indonesia: Sumatra.

***Arrhaphes rugosicollis* sp. nov.**  
(Figs. 16-18)

**Type locality:** Laos: Hua Phan Prov.

**Material examined:** Holotype ♂ (CRG): Laos: Hua Phan Prov., Ban Suluei, Phu Phan Mts., 1500-2000 m, 26 Apr.-11 May 2001, leg. D. Hauck.

Paratypes 7 ♂♂, 3 ♀♀ (CRG, CSV): same data as for holotype, leg. D. Hauck.

**Etymology:** The name of the new species refers to the pronotal punctures.

**Diagnosis:** Holotype ♂: Subparallel, cylindrical, pronotum and elytra conspicuously and regularly vaulted, matte and pilose; black, 1st and 2nd antennomere, legs, apices of pronotal basal angles, and prosternal apophysis dark reddish-brown; integument rugose, base of elytra micro-punctured; pubescence yellowish-brown; dimensions: 3.43 mm long, 1.25 mm wide.

**Description:** **Head:** With very dense, circular and umbilical punctures, interstices reduced to small, shiny wrinkles; pubescence fine, short,

and directed from base to apex and to lateral sides; eyes semispherical, slightly prominent; frons semicircular, declivous from center to apex, with complete, prominent, conspicuously shiny boundary carina; antennae elongated, moniliform from 3rd antennomere on, extending beyond posterior angles of pronotum by length of last 2 antennomere; 2nd antennomere subcylindrical, slightly longer than wide apically, 3rd antennomere twice as long as wide apically, following antennomere of almost same length, last antennomere oblong-elliptic, subapically beveled.

**Pronotum:** Subcylindrical, along median line slightly longer than wide posteriorly (length: width ratio of 1.06: 1.01), conspicuously and regularly vaulted throughout entire length, slightly bent laterally, constricted sub-basally, and with precipitous slope posteriorly; posterior angles of pronotum straight, slightly divergent apically, with rough and prominent carina, well-separated from lateral margin, and bent mesiad shortly after beginning of basal angles; apices of basal angles semispherical; pronotum without fovea or mold; punctures on entire pronotum very dense, circular, and umbilical, interstices reduced to small, shiny, costiform wrinkles; pubescence very fine, scarcely visible, declivous stellate from center to lateral sides of pronotum.

**Scutellum:** Subtriangular, declivous anteroinferiorly, perpendicular apically, conspicuously vaulted medially; punctures dense and umbilical, interstices conspicuously costiform; pubescence fine, scarcely visible, declivous from base to apex.

**Elytra:** Cylindrical, just after apical 1/3 narrowing to apex; apices arcuate, without inner tooth; base of elytra slightly wider than that of pronotum and conspicuously depressed at scutellum, shoulders prominent (winged species); elytra with very dense, umbilical punctures and fine longitudinal striae, interstices transversely rugose, basal part of elytra pustulate; pubescence fine, short and scarcely declivous from base to apex and to lateral sides.

**Pro-, meso-, and metathorax:** With sparse and fine punctures, interstices flat, semi-matte and micro-punctured; pubescence short and declivous; pro-episternum lacking punctures, shiny.

**Legs:** Elongated, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with barely visible, fine pubescence, and fine ornamentation, 3rd tarsomeres short, 4th tarsomeres conspicuously lamellate, tibia covered with semi-protruding bristly thorns.

**Aedeagus:** Oval, trilobate, median lobe

widened and subparallel, extending apices of paramere conspicuously and pointed apically; parameres moderately falcate and pointed apically.

Female (paratype) with shorter antennae, not reaching apices of posterior angles of pronotum by length of last antennomere.

*Differential diagnosis:* *Arrhaphes rugosicollis* is similar to *A. gestroi*, but can be easily distinguished from this species by the shorter body, dark reddish-brown legs, and form of the aedeagus.

*Distribution:* Laos: Hua Panh Prov.

#### ***Arrhaphes takasago* Kishii, 1994**

*Arrhaphes takasago* Kishii 1994: 188-190, Suzuki 1999: 95.

*Type locality:* Taiwan: Nantou County (Co.).

*Remarks:* No new material known.

*Distribution:* Taiwan: Nantou Co.

#### **Key to species of the genus *Arrhaphes* from the Indo-Chinese Subregion**

1. Pronotum light yellowish-red ..... *A. krali* sp. nov.
- Pronotum black, blackish, or brownish ..... 2
2. Pronotum brownish, posterior angles yellowish .....  
..... *A. fulvus* Fleutiaux, 1930
- Pronotum black or blackish ..... 3
3. Pronotum unicolored black ..... 4
- Pronotum black, posterior angles reddish or yellowish ..... 5
4. Smaller species approximately 3.7 mm long; pronotum medially as long as wide basally .....  
..... *A. minusculus* (Candèze, 1878)
- Larger species approximately 5.3 mm long; pronotum medially conspicuously longer than wide basally .....  
..... *A. plumbeus* (Schwarz, 1902)
5. Elytra unicolored black ..... 6
- Elytra bicolored: black with yellow or brownish tint ..... 9
6. Larger species approximately 5.3 mm long; legs and 1st 2 antennomere yellowish ..... *A. luteipes* (Candèze, 1896)
- Smaller species approximately 3.5-4.2 mm long; legs and 1st 2 antennomere brownish ..... 7
7. Pronotum basally slightly constricted; pronotal punctures dense, interstices reduced to small, costiform wrinkles on entire surface ..... *A. rugosicollis* sp. nov.
- Pronotum sub-basally distinctly constricted ..... 8
8. Pronotal punctures dense, interstices reduced to small, basally costiform wrinkles ..... *A. gestroi* (Candèze, 1878)
- Pronotal punctures sparse, interstices 1x their diameter .....  
..... *A. takasago* Kishii, 1994
9. Elytra with reddish tint apically .....  
..... *A. erythrurus* (Schwarz, 1902)
- Elytra with tint basally or medially ..... 10
10. Elytra with yellowish, subcircular tint basally on each side of base; antennae just reaching posterior angles of pronotum .....  
..... *A. humeralis* Fleutiaux, 1930
- Elytra with irregular yellowish tint basally and medially; antennae extending beyond posterior angles of pronotum for length of last 2 antennomeres .....  
..... *A. coomani* Fleutiaux, 1930

#### **Species of the genus *Arrhaphes* from the Malaysian Subregion**

##### ***Arrhaphes biguttatus* (Candèze, 1893) comb. nov.**

*Arrhaphes biguttatus* Candèze 1893: 44.

*Type locality:* Malaysia: Perak.

*Material examined:* Malaysia: Kelantan, 60 km NE of Tanah Rata, Tanah Kerajaan, 1000 m, 12-30 Apr. 2007, 1 specimen, leg. P. Čechovský; same locality but 3-19 Feb. 2005, 1 specimen, leg. P. Čechovský; Pahang, Cameron Highland, Tanah Rata, 2-9 Apr. 1997, 2 specimens, leg. D. Hauck; Indonesia: Sumatra, Sibayak, 1450-1900 m, 19-23 Feb. 1991, 1 specimen, leg. Bocák et Bocáková.

*Remarks:* The above data are the 1st for *A. biguttatus* from Indonesia.

*Distribution:* Malaysia: Kelantan, Pahang; Indonesia: Sumatra.

##### ***Arrhaphes cyaneus* (Schwarz, 1902) comb. nov.**

*Arrhaphes cyaneus* Schwarz 1902: 256.

*Type locality:* Indonesia: Sumatra.

*Remarks:* Since the description of the species no further material has been collected.

*Distribution:* Indonesia: Sumatra.

##### ***Arrhaphes erythrurus* (Schwarz, 1902) comb. nov.**

*Arrhaphes erythrurus* Schwarz 1902: 258.

*Type locality:* Indonesia: Sumatra.

*Remarks:* The species is also known from Thailand.

*Distribution:* Indonesia: Sumatra; Thailand.

##### ***Arrhaphes gestroi* (Candèze, 1878) comb. nov.**

*Arrhaphes gestroi* Candèze 1878: 131.

*Arrhaphes gestroi* (Candèze, 1878), Stibick 1971: 390.

*Type locality:* Indonesia: Java.

*Remarks:* The species is also known from Thailand.

*Distribution:* Indonesia: Java; Thailand.

##### ***Arrhaphes nigriceps* (Candèze, 1880) comb. nov.**

*Arrhaphes nigriceps* Candèze 1880: 194.

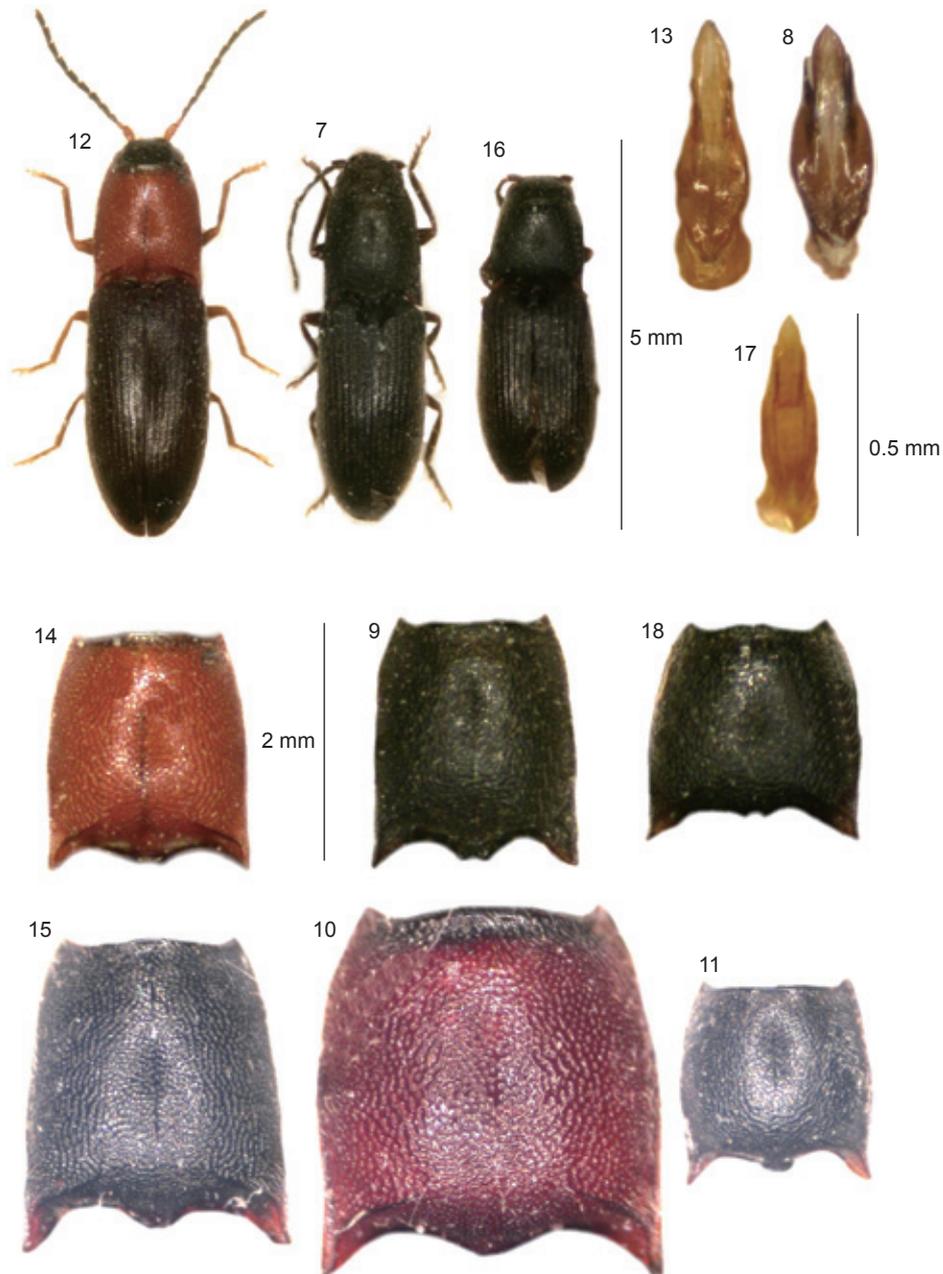
*Type locality:* Sumatra: Mont Singalan.

*Material examined:* Malaysia: Johor, 15 km west of Kota Tinggi, Muntahak Mts., 200 m, 7-13 Mar. 2002, 1 specimen, leg. P. Čechovský; Perak, 40 km SE of Ipho, Banjaran Titi Wangsa, Ringlet, 29 Mar.- 15 Apr. 2004, 12 specimens, leg. P. Čechovský; Pahang, 70 km SW of Kuala Rompin to Endau, Rompin NP, 600 m, 13 May- 2 June

2006, 1 specimen, leg. P. Čechovský; Kelantan, road between Kampong Raja and Gua Musang, Ladang Pandrak, 1400-1700 m, 1-28 Apr. 2006, 5 specimens, leg. P. Čechovský.

*Remarks:* The above data are the 1st for the species from Malaysia.

*Distribution:* Indonesia: Sumatra; Malaysia: Johor, Kelantan, Pahang, Perak.



**Figs. 7-18.** 7-9. *Arhaphes longicollis* sp. nov. 7. Habitus; 8. aedeagus; 9. pronotum. 10. Pronotum of *A. ruficollis* (Candèze, 1892). 11. Pronotum of *A. gestroi* (Candèze, 1878). 12-14. *A. krali* sp. nov. 12. Habitus; 13. aedeagus; 14. pronotum. 15. Pronotum of *A. plumbeus* (Schwarz, 1902). 16-18. *A. rugosicollis* sp. nov. 16. Habitus; 17. aedeagus; 18. pronotum.

***Arhaphes plumbeus* (Schwarz, 1902) comb. nov.**

*Arhaphes plumbeus* Schwarz 1902: 257.

*Type locality:* Sumatra: Indrapoera, Lian-gagas, Soekaranda.

*Material examined:* Thailand: Loei Prov., Phu Kradung, 1000 m, 16-18 May 1999, 3 specimens, leg. D. Hauck; Mae Hong Son Prov., Soppong, 600 m, 28 May-2 June 1989, 1 specimen, leg. D. Hauck.

*Remarks:* The above data are the 1st for the species from Thailand.

*Distribution:* Indonesia: Sumatra; Thailand.

***Arhaphes terminatus* Fleutiaux, 1934**

*Arhaphes terminatus* Fleutiaux 1934: 476.

*Type locality:* Malaysia: Borneo.

*Material examined:* Malaysia: Pahang-district, Cameron Highland, Kampung Kuola Boh. Env., 850-1050 m, 26 Mar.-3 Apr. 2001, 1 specimen, leg. R. Hergovits; Sabha, Crocker Range, Rovie Keninlav, Papar, Feb. 2000, 2 specimens, leg. Snizek; Perak, 30 km SE of Ipoh, 900 m, Cameron Highland, Ringlet, 25 Apr.-5 May 2001, 2 specimens, leg. P. Čechovský.

*Remarks:* The above data are the 1st for the species from Borneo, Malaysia.

*Distribution:* Malaysia: Borneo, Sabah, Pahang, Perak.

**Key to species of the genus *Arhaphes* from the Malayan Subregion**

1. Elytra unicolored blue, pronotum greenish-blue .....  
..... *A. cyaneus* (Schwarz, 1902)
- Elytra and pronotum black, blackish, or brownish, not blue ..... 2
2. Elytra brownish with yellow tint basally, centrally, and apically ..... *A. biguttatus* (Candèze, 1893)
- Elytra black, with or without yellowish tint ..... 3
3. Elytra unicolored black ..... 5
- Elytra bicolored, black with yellowish tint ..... 4
4. Black species, legs, head, and pronotum anteriorly, and elytra apically yellowish-red .....  
..... *A. terminatus* Fleutiaux, 1934
- Black species, legs and elytra apically yellowish-red .....  
..... *A. erythrurus* (Schwarz, 1902)
5. Pronotum black, posterior angles yellowish-red, legs and 1st 2 antennomere yellow ..... *A. gestroi* (Candèze, 1878)
- Pronotum unicolored black ..... 6
6. Larger species, body length approximately 5-5.5 mm; femora black, tibiae and tarsi yellowish-brown .....  
..... *A. plumbeus* (Schwarz, 1902)

- Smaller species, body length approximately 2.5 mm; legs unicolored brownish ..... *A. nigriceps* (Candèze, 1880)

**DISCUSSION**

Some of the above-described species of the genus *Arhaphes* have distributions in the Indo-Chinese and Malayan Subregions (*A. erythrurus*, *A. gestroi*, and *A. plumbeus*), and in the Himalayas and Indo-Chinese Subregion (*A. minusculus*). These distribution patterns are generally not uncommon for the Elateridae, and may be based on spreading mechanisms during the Pleistocene glaciations. Due to drops in sea level during those times, land corridors enabled the species to actively spread from continental Southeast Asia into the Sunda Archipelago. However, the present occurrence of *A. luteipes* in India (Karnataka Prov.) and Thailand (Loei Prov.) is most enigmatic, and seems to be based on allopatry. As the Indian Subcontinent has been isolated zoogeographically for a long time (from the Tertiary to the present), the occurrence of *A. luteipes* in India and Thailand cannot be explained by spreading mechanisms during the Pleistocene Epoch.

Currently, species of the genus *Arhaphes* are included in the subfamily Negastriniinae. Species of some genera of the Negastriniinae live sub-aquatically, under stones and pebbles on river banks which are not usually inundated. The bodies of these species are conspicuously flat, as they have to be able to fit in the small spaces where they live. Furthermore, most of these beetles live as ground-movers, and therefore have longer legs and a conspicuously constricted base to the pronotum. This constriction enables the animal to swing unimpeded with the forelegs while moving. Further species of genera of the Negastriniinae (such as *Quasinusini*) are known as heliotropic, flower visiting, flying insects. Those species have shorter legs, a less-constricted base to the pronotum and a vaulted, aerodynamic body. All species of the genus *Arhaphes* have a subparallel, cylindrical, distinctly vaulted body, short legs, and a base to the pronotum which is less constricted to subparallel (Table 1).

Currently, nothing is known about how the species live, but the above-described external characters and the fully intact wings and flight muscles point to a mode of life as flyers, not ground-movers, and not as beetles which live under stones and pebbles on riverbanks. Also, based on the above-described characters of

the species of the genus *Arhaphes*, a close phylogenetic relationship to *Hemirrhaphes* and further species-groups of the Negastrinae with flat bodies, long legs, and a constricted pronotal base, can be excluded.

The above-described facts and differential characters of the species of the various genera of the Negastrinae led to the supposition that the current subfamily Negastrinae is an artificial construction of species-groups with different phylogenetic ancestors.

Of special interest is the confirmation of the homologous characters of the pustulate basal part of the elytra and the subparallel, cylindrical body of species of the genera *Arhaphes* Candèze, 1860 and *Friedrichiellus* Schimmel, 2004. Both characters are nearly identical in species of the 2 genera. As *Friedrichiellus* belongs to the tribe Megapenthini Gurjeva, 1973, those characters very probably developed in convergence, and may have been developed as similar independent adaptations to environments in which common ancestors of species of *Arhaphes* and of species of *Friedrichiellus* may have lived.

Species of the genus *Arhaphes* Candèze, 1860 were revised. As a result of the revision, 3 new species were described and illustrated, new records of known species of this genus were given, keys to the species of the genus are provided, and new nomenclatural combinations for 10 species

were proposed. The new species are *A. krali* sp. nov., *A. longicollis* sp. nov., and *A. rugosicollis* sp. nov. The new nomenclatural combinations are *A. biguttatus* (Candèze, 1893) comb. nov., *A. erythrurus* (Schwarz, 1902) comb. nov., *A. cyaneus* (Schwarz, 1902) comb. nov., *A. gestroi* (Candèze, 1892) comb. nov., *A. luteipes* (Candèze, 1896) comb. nov., *A. minusculus* (Candèze, 1878) comb. nov., *A. nigriceps* (Candèze, 1880) comb. nov., *A. opacus* (Candèze, 1878) comb. nov., *A. plumbeus* (Schwarz, 1902) comb. nov., and *A. ruficollis* (Candèze, 1892) comb. nov. Species of the genus *Arhaphes* recorded for the 1st time from China include *A. longicollis* sp. nov.; from Laos include *A. coomani* Fleutiaux, 1930 and *A. minusculus* (Candèze, 1878); from Thailand include *A. coomani* (Fleutiaux, 1930), *A. erythrurus* (Schwarz, 1902), *A. fulvus* Fleutiaux, 1930, *A. gestroi* (Candèze, 1878), *A. humeralis* Fleutiaux, 1930, *A. luteipes* (Candèze, 1896), *A. opacus* (Candèze, 1878), *A. minusculus* (Candèze, 1878), and *A. plumbeus* (Schwarz, 1902); from Indonesia include *A. biguttatus* (Candèze, 1893); and from Malaysia include *A. nigriceps* (Candèze, 1880).

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**Table 1.** Overview of the Distributions of Species of the Genus *Arhaphes*

	Palearctic Region	Indian/Sri Lankan Subregion	Indo-Chinese Subregion	Malayan Subregion
<i>Arhaphes biguttatus</i>				Malaysia, Indonesia
<i>A. coomani</i>			Laos, Thailand, Vietnam	
<i>A. cyaneus</i>				Indonesia
<i>A. diptychus</i>		Sri Lanka		
<i>A. erythrurus</i>			Thailand	Indonesia
<i>A. fulvus</i>			Thailand, Vietnam	
<i>A. gestroi</i>			Thailand	Indonesia
<i>A. humeralis</i>			Thailand, Vietnam	
<i>A. krali</i>			Thailand	
<i>A. longicollis</i>	China			
<i>A. luteipes</i>		India	Thailand	
<i>A. minusculus</i>	Himalayas		Thailand	
<i>A. nigriceps</i>				Malaysia, Indonesia
<i>A. plumbeus</i>			Thailand	Indonesia
<i>A. ruficollis</i>	Himalayas			
<i>A. rugosicollis</i>			Laos	
<i>A. takasago</i>			Taiwan	
<i>A. terminatus</i>				Malaysia

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