Checklist

Passalidae (Coleoptera) recorded from the Crocker Range, Sabah, Malaysia

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ABSTRACT. Forty-four species of Passalidae (Coleoptera) are recorded from the Crocker Range and its surrounding areas, in Sabah, North Borneo. Of these, 26 species (51.9%) are endemic to Borneo. Diagnoses and photographs are provided for the species recorded in the present paper.

INTRODUCTION

Passalidae are a pantropical family of Scarabaeoidea, Coleoptera consisting of about 600 species (Schuster & Schuster, 1997). Most species of this family are large (body length 13-55 mm for Bornean species) jet-black beetles living in family groups in log-excavated galleries (Reyes-Castillo & Halffter, 1983; Kon & Johki, 1992b; Kon *et al.*, 1995b; Schuster & Schuster, 1997; Ento *et al.*, 2003). Passalid beetles have often been cited in the entomological literature as subsocial insects (Wheeler, 1923; Wilson, 1971; Matthews & Matthews, 1978; Eickwort, 1981; Schuster & Schuster, 1997); adult passalid beetles tend to their young, prepare shredded wood for the larval diet and assist the larvae to construct pupal cells.

Key words: Diagnosis, distribution, endemic, biodiversity, Borneo

Borneo supports the greatest species richness for Passalidae within the Oriental Region (Hincks & Dibb, 1935, 1958). Up to the present, more than 60 species of Passalidae have been recorded from Borneo (Hincks & Dibb, 1935, 1958; van Doesburg, 1941; Boucher, 1993a, b, 1995; Boucher & Kon, 1998, 1999; Iwase, 1993, 1995a, b, 1996a, b, 1998a, b, c; Johki & Kon, 2003; Johki *et al.*, 2003; Kon & Johki, 1989a, b, 1991, 1992a, 1993; Kon *et al.*, 1993a, b, c, 1995a, c, 2002). In collaboration with Universiti Malaysia Sabah, we have had the opportunity to investigate passalid beetles in Sabah. Here, we report the passalid species recorded from the Crocker Range.

MATERIALS AND METHODS

We make a list of the passalid beetles recorded from the Crocker Range and its surrounding areas (including Tambunan, Keningau, Kimanis and Sipitang) based mainly on the specimens collected by the expeditions to Sabah in 1997, 1999 and 2002. Moreover, we add several species to the list based on the passalid specimens preserved in the collections of the following institutes: the Sabah Museum; the Sabah Parks Museum at Kinabalu National Park; the Muséum National d'Histoire

Naturelle, Paris; the Naturhistorisches Museum Wien; the National Science Museum (Natural History), Tokyo; University of Shiga Prefecture.

Diagnoses and photographs are also provided for the species recorded in the present study. However, no photograph was available for *Ophrygonius planus* Iwase. We adopt the terminology of Gravely (1914) and Reyes-Castillo (1970) for diagnoses and refer to Hincks & Dibb (1935, 1958) and some subsequent authors for distribution.

RESULTS

Key to the passalid genera recorded from the Crocker Range:

1. Anterior margin of head simple, front tibia broad ---------- *Taeniocerus* Kaup
   Anterior margin of head with more than two tubercles, front tibia not broad ------- 2
2. Antenna with 3 lamellae; head symmetrical ---------- *Leptaulax* Kaup
   Antenna with four lamellae or more (usually six); head either symmetrical or asymmetrical ---------- 3
3. Mentum with scars ---------- 5
   Mentum without scars ---------- 4
4. Anterior lower tooth either as large as or smaller than lowest terminal tooth; anterior lower and lowest terminal teeth of right mandible distinct ------- *Ophrygonius* Zang
   Anterior lower tooth larger than lowest terminal tooth; anterior lower and lowest terminal teeth of right mandible either very small or absent ---------- *Aceraius* Kaup
5. Supraoccipital ridge extending laterally beyond posterior end of supraorbital ridge; body length less than 30 mm ---------- *Macrolinus* Kaup
   Supraoccipital ridge not extending laterally beyond posterior end of supraorbital ridge; body length more than 40 mm ---------- *Pelopides* Kuwert

Subfamily Aulacocyclinae
Genus *Taeniocerus* Kaup

Taeniocerus bicanthatus (Percheron)
(Fig. 1)

Passalus bicanthatus Percheron, 1841, Mag. Zool., XI, p. 41.

Diagnosis. Body cylindrical; central tubercle U-shaped in dorsal view; anterior angle of central tubercle pointed in lateral view; side of elytron hairless; body length 26-29 mm.

Specimen examined. 1 ex., Keningau, Sabah, 7-XI-1987, A. Ueda leg.

Distribution. Malay Peninsula, Sumatra, Borneo.

Taeniocerus platypus (Kaup)
(Fig. 2)

Aulacocyclus platypus Kaup, 1868, Coleopt. Hafte, III, p. 5.

Diagnosis. Body cylindrical; central tubercle consisting of a pair of parallel low longitudinal carinae; anterior angle of central tubercle obsolete in lateral view; side of elytron hairless; body length 17-20 mm.

Specimen examined. 1 ex., Gunung Emas, Crocker Range, 12-IX-1997, T. Matsumoto leg.

Distribution. Malay Peninsula, Sumatra, Java, Borneo.

Subfamily Passalinae
Genus *Macrolinus* Kaup

Macrolinus latipennis (Percheron)
(Fig. 3)

Passalus latipennis Percheron, 1841, Mag. Zool. XI, p. 8.

Diagnosis. Antenna with six long and slender lamellae; anterior lower and lowest terminal teeth of right mandible distinct; anterior margin of head symmetrical; frontal area punctate; outer tubercle small; side of elytron hairless; body length 23-26 mm.

Specimen examined. 1 ex., Crocker Range, Sabah, 16-X-1999, K. Mizota leg.

Distribution. Myanmar, Malay Peninsula, Sumatra, Java, Borneo, Philippines.

Genus *Ophrygonius* Zang

Ophrygonius aequidens (Gravely)
(Fig. 4)

Aceraius aequidens Gravely, 1914, Mem. Ind. Mus., III, p. 240.

Diagnosis. Antenna with six long lamellae; lamella of fifth antennal segment distinct; anterior lower and lowest terminal teeth of right mandible distinct; upper margin of left mandible swollen prior to upper tooth; left outer tubercle longer than the right one; central area of metasternum hairy in anterior portion close to mesocoxae; tenth and ninth ribs of elytron hairy; eighth and seventh with a few hairs; body length 27-32 mm.

Specimens examined. 9 exs., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 14-IX-1997, M. Kon leg.

Distribution. Borneo.

Ophrygonius emas (Iwase)
(Fig. 5)

Aceraius emas Iwase, 1998, Elytra, Tokyo 26, p. 131.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible distinct; left outer tubercle almost as large as the right one; ridge separating between intermediate and lateral areas of metasternum obtuse; third to sixth visible abdominal sternites hairy in lateral portion; body length 32 mm.

Specimen examined. 1 male (holotype in the collection of the Naturhistorisches Museum Wien), Gunung Emas, Crocker Range, Sabah, 16~27-IV-1993, Jenis leg.

Distribution. Borneo.

Ophrygonius hirtimarginalis (Iwase)
(Fig. 6)

Aceraius hirtimarginalis Iwase, 1993, Elytra, Tokyo 21, p. 272.

Diagnosis. Antenna with six long lamellae; anterior lower and lowest terminal teeth of right mandible distinct; left outer tubercle longer than the right one; tenth to eighth ribs of elytron hairy throughout; body length 33-35 mm.

Specimens examined. 2 exs., Crocker Range, Sabah, 1981.

Distribution. Borneo.

Ophrygonius koni Boucher
(Fig. 7)

Ophrygonius koni Boucher, 1995, Ann. Soc. entomol. Fr. (N. S.), 31, p. 52.

Diagnosis. Antenna with six long lamellae; anterior lower and lowest terminal teeth of right mandible distinct; upper margin of left mandible swollen prior to upper tooth; outer tubercles symmetrical, triangular; side of elytron hairless; body flat; body length 38-40 mm.

Specimen examined. 1 female, Crocker Range near Keningau, Sabah, V~VI-1994.

Distribution. Borneo.

Ophrygonius planus Iwase

Ophrygonius planus Iwase, 1995, Elytra, Tokyo 23, p. 66.

Diagnosis. Antenna with four lamellae; anterior margin of labrum with weak prominence in the middle; anterior lower and lowest terminal teeth of right mandible distinct; left outer tubercle slightly longer than the right one; pronotum with distinct median sulcus, strongly punctate in antero-lateral corner; side of elytron hairless; lateral grooves of elytron with oblong punctures; body length 26 mm.

Specimen examined. 1 male (holotype in the collection of the National Science Museum (Natural History), Tokyo), Crocker Range near Keningau, Sabah, V~VI-1994.

Distribution. Borneo.

Ophrygonius pseudaequidens Boucher
(Fig. 8)

Ophrygonius pseudaequidens Boucher, 1995, Ann. Soc. entomol. Fr. (N. S.), 31, p. 50.

Diagnosis. Antenna with three moderately long and two short lamellae; fifth antennal segment with small swelling; anterior lower and lowest terminal teeth of right mandible distinct; upper margin of left mandible swollen prior to upper tooth; left outer tubercle much longer than the right one; central area of metasternum with

a few hairs in anterior portion close to mesocoxae; tenth and ninth ribs of metasternum densely hairy in anterior portion, more sparsely in posterior portion; body length 32 mm.

Specimen examined. 1 ex., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 14-IX-1997, M. Kon leg.

Distribution. Borneo.

Ophrygonius singapurae Gravely
(Fig. 9)

Ophrygonius singapurae Gravely, 1914, Mem. Ind. Mus., III, p. 226.

Diagnosis. Antenna with six long and slender lamellae; anterior lower and lowest terminal teeth of right mandible distinct; left outer tubercle longer than the right one; supraoccipital ridge extending outward beyond posterior end of supraorbital ridge; side of elytron hairless; body flat; body length 29-32 mm.

Specimen examined. 1 ex., Crocker Range, Kimanis Road, 1000 m in altitude, Sabah, 21-III-1981.

Distribution. Laos, Thailand, Malay Peninsula, Borneo.

Genus *Aceraius* Kaup

Aceraius borneanus Kaup
(Fig. 10)

Aceraius borneanus Kaup, 1871, Berl. Ent. Zeitschr., XV (suppl.), p. 52.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible absent; upper margin of left mandible with convexity behind upper tooth; anterior angle of head rounded; left outer tubercle longer than the right one; seventh and eighth ribs of elytron sparsely hairy along whole length; ninth and tenth ribs densely hairy in anterior portion, more sparsely in posterior portion; upper distal portion of fifth tarsomere not projecting in all legs; body length 26-29 mm.

Specimens examined. 2 exs., Gunung Emas, Crocker Range, Sabah, 29-VIII-1983.

Distribution. Malay Peninsula, Sumatra, Java, Borneo.

Aceraius boucheri Kon, Araya et Johki
(Fig. 11)

Aceraius boucheri Kon, Araya et Johki, 1993, Jpn. J. Entomol. 61, p. 712.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head angular though not so prominent forwards; left outer tubercle larger than the right one; ninth rib of elytron hairy in anterior portion, more sparsely in posterior portion; upper distal portion of fifth tarsomere projecting like hood in all legs; body length 38-40 mm.

Specimens examined. 1 ex., Gunung Emas, 1200 m in altitude, Crocker Range, Sabah, 29-IX-1997, M. Kon leg.; 3 exs., Telecom Tower, 1600 m in altitude, Crocker Range, Sabah, 27-VIII-2002.

Distribution. Borneo.

Aceraius grandis (Burmeister)
(Fig. 12)

Passalus grandis Burmeister, 1847, Handb. Ent., V, p. 463.

Diagnosis. Antenna with six moderately long lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head strongly prominent forwards; left outer tubercle larger than the right one; ninth and tenth ribs of elytron densely hairy in anterior portion, hairless in posterior portion; seventh and eighth ribs very sparsely hairy in anterior portion, hairless in posterior portion; body length 45-55 mm.

Specimens examined. 2 exs., Gunung Emas, 900 m in altitude, Crocker Range, Sabah, 29-IX-1997, M. Kon leg.

Distribution. Eastern Himalayas, Myanmar, Indochina, Formosa, Malay Peninsula, Sumatra, Java, Borneo, Philippines.

Aceraius hikidai Kon, Ueda et Johki
(Fig. 13)

Aceraius hikidai Kon, Ueda et Johki, 1993, Elytra, Tokyo 21, p. 276.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head

a few hairs in anterior portion close to mesocoxae; tenth and ninth ribs of metasternum densely hairy in anterior portion, more sparsely in posterior portion; body length 32 mm.

Specimen examined. 1 ex., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 14-IX-1997, M. Kon leg.

Distribution. Borneo.

Ophrygonius singapurae Gravely
(Fig. 9)

Ophrygonius singapurae Gravely, 1914, Mem. Ind. Mus., III, p. 226.

Diagnosis. Antenna with six long and slender lamellae; anterior lower and lowest terminal teeth of right mandible distinct; left outer tubercle longer than the right one; supraoccipital ridge extending outward beyond posterior end of supraorbital ridge; side of elytron hairless; body flat; body length 29-32 mm.

Specimen examined. 1 ex., Crocker Range, Kimanis Road, 1000 m in altitude, Sabah, 21-III-1981.

Distribution. Laos, Thailand, Malay Peninsula, Borneo.

Genus *Aceraius* Kaup

Aceraius borneanus Kaup
(Fig. 10)

Aceraius borneanus Kaup, 1871, Berl. Ent. Zeitschr., XV (suppl.), p. 52.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible absent; upper margin of left mandible with convexity behind upper tooth; anterior angle of head rounded; left outer tubercle longer than the right one; seventh and eighth ribs of elytron sparsely hairy along whole length; ninth and tenth ribs densely hairy in anterior portion, more sparsely in posterior portion; upper distal portion of fifth tarsomere not projecting in all legs; body length 26-29 mm.

Specimens examined. 2 exs., Gunung Emas, Crocker Range, Sabah, 29-VIII-1983.

Distribution. Malay Peninsula, Sumatra, Java, Borneo.

Aceraius boucheri Kon, Araya et Johki
(Fig. 11)

Aceraius boucheri Kon, Araya et Johki, 1993, Jpn. J. Entomol. 61, p. 712.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head angular though not so prominent forwards; left outer tubercle larger than the right one; ninth rib of elytron hairy in anterior portion, more sparsely in posterior portion; upper distal portion of fifth tarsomere projecting like hood in all legs; body length 38-40 mm.

Specimens examined. 1 ex., Gunung Emas, 1200 m in altitude, Crocker Range, Sabah, 29-IX-1997, M. Kon leg.; 3 exs., Telecom Tower, 1600 m in altitude, Crocker Range, Sabah, 27-VIII-2002.

Distribution. Borneo.

Aceraius grandis (Burmeister)
(Fig. 12)

Passalus grandis Burmeister, 1847, Handb. Ent., V, p. 463.

Diagnosis. Antenna with six moderately long lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head strongly prominent forwards; left outer tubercle larger than the right one; ninth and tenth ribs of elytron densely hairy in anterior portion, hairless in posterior portion; seventh and eighth ribs very sparsely hairy in anterior portion, hairless in posterior portion; body length 45-55 mm.

Specimens examined. 2 exs., Gunung Emas, 900 m in altitude, Crocker Range, Sabah, 29-IX-1997, M. Kon leg.

Distribution. Eastern Himalayas, Myanmar, Indochina, Formosa, Malay Peninsula, Sumatra, Java, Borneo, Philippines.

Aceraius hikidai Kon, Ueda et Johki
(Fig. 13)

Aceraius hikidai Kon, Ueda et Johki, 1993, Elytra, Tokyo 21, p. 276.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head

rounded; left outer tubercle larger than the right one; central area of metasternum punctate in anterior portion close to mesocoxae; tenth rib of elytron hairy in anterior portion; seventh rib sparsely, ninth rib a little more densely hairy along whole length; upper distal portion of fifth tarsomere not projecting in all legs; body length 29-32 mm.

Specimens examined. 2 exs., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 14-IX-1997, M. Kon leg.; 6 exs., ditto, 19-IX-1997, M. Kon leg.; 20 exs., ditto, 20-IX-1997, M. Kon leg.; 12 exs., ditto, 25-IX-1997, M. Kon leg.; 3 exs., ditto, 29-IX-1997, M. Kon leg.; 1 ex., Telecom Tower, 1600 m in altitude, Crocker Range, Sabah, 27-VIII-2002.

Distribution. Borneo.

Aceraius illegalis Kuwert
(Fig. 14)

Acerajus illegalis Kuwert, 1891, Deutsche Ent. Zeitschr., 1891, p. 163.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head prominent forwards; left outer tubercle larger than the right one; tenth rib of elytron densely hairy in anterior portion, hairless in posterior portion; ninth rib densely hairy in anterior portion, more sparsely in posterior portion; upper distal portion of fifth tarsomere not projecting in all legs; body length 43-45 mm.

Specimens examined. 1 ex., Kimanis, Sabah, 9-IV.

Distribution. Malay Peninsula, Borneo.

Aceraius jenisi Iwase
(Fig. 15)

Aceraius jenisi Iwase, 1998, Elytra, Tokyo 26, p. 133.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle larger than the right one; tenth and eithth ribs of elytron hairless; ninth and seventh sparsely hairy throughout; upper distal portion of fifth tarsomere projecting like hood in all legs; body length 31 mm.

Specimen examined. 1 male (holotype in the collection of the Naturhistorisches Museum Wien), Gunung Emas, Crocker Range, Sabah, 16~27-IV-1993, Jenis leg.

Distribution. Borneo.

Aceraius katsurae Iwase
(Fig. 16)

Aceraius katsurae Iwase, 1995, Elytra, Tokyo 23, p. 63.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle larger than the right one; tenth rib of elytron densely hairy in anterior portion, hairless in posterior portion; ninth and seventh hairy throughout; upper distal portion of fifth tarsomere projecting like hood in all legs; body length 39-43 mm.

Specimen examined. 1 male (holotype in the collection of the National Science Museum (Natural History), Tokyo), Crocker Range near Keningau, Sabah, VI~VII-1994.

Distribution. Borneo.

Aceraius kikutai Kon, Johki et Boucher
(Fig. 17)

Aceraius kikutai Kon, Johki et Boucher, 1993, Jpn. J. Entomol. 63, p. 54.

Diagnosis. Antenna with three moderately long and three short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle larger than the right one; inner angle of left outer tubercle pointed inwards; ridge separating intermediate and lateral areas of metasternum distinct; tenth rib of elytron densely hairy in anterior portion, hairless in posterior portion; ninth densely hary in anterior portion, more sparsely in posterior portion; seventh sparsely hairy throughout; upper portion of distal end of fifth tarsomere weakly projected in middle and hind legs; body length 43-47 mm.

Specimen examined. 1 male (holotype in the collection of the Muséum National d'Histoire Naturelle, Paris), Keningau-Kimanis Road pk 26, 1300 m in altitude, Sabah, VIII-1991, J. Haxaire leg.

Distribution. Borneo.

Aceraius kinabalensis Kon et Johki
(Fig. 18)

Aceraius kinabalensis Kon et Johki, 1989, Jpn. J. Ent., 57, p. 533.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle larger than the right one; right outer tubercle distinct, obliquely truncated; supraorbital ridge not curved inward in anterior portion; tenth and eighth ribs of elytron hairless; seventh very sparsely, ninth a little more densely punctate throughout; upper distal portion of fifth tarsomere not projecting in all legs; body length 52-54 mm.

Specimens examined. 2 exs., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 19-IX-1997, M. Kon leg.; 1 ex., ditto, 20-IX-1997, M. Kon leg.; 6 exs., ditto, 25-IX-1997, M. Kon leg.; 12 exs., Telecom Tower, 1600 m in altitude, Crocker Range, Sabah, 27-VIII-2002.

Distribution. Borneo.

Aceraius kuwerti Zang
(Fig. 19)

Aceraius kuwerti Zang, 1903, Insekten-Borse., XX, p. 339.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle much larger than the right one; right outer tubercle represented as a weak swelling; supraorbital ridge curved inward in anterior portion; tenth and eighth ribs of elytron impunctate and hairless; seventh very sparsely, ninth a little more densely punctate throughout; body length 50-54 mm.

Specimens examined. 5 exs., Gunung Emas, 900 m in altitude, Crocker Range, Sabah, 29-IX-1997, M. Kon leg.; 3 exs., Telecom Tower, 1600 m in altitude, Crocker Range, Sabah, 27-VIII-2002.

Distribution. Borneo.

Aceraius laevicollis (Illiger)
(Fig. 20)

Passalus laevicollis Illiger in Wiedem, 1800, Archiv Zool., I, p. 103.

Diagnosis. Antenna with six moderately long lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head prominent forwards; left outer tubercle larger than the right one; tenth and ninth ribs of elytron densely hairy in anterior portion, hairless in posterior portion; upper distal portion of fifth tarsomere not projecting in all legs; body length 30-35 mm.

Specimens examined. 4 exs., Gunung Emas, 900 m in altitude, Crocker Range, Sabah, 29-IX-1997, M. Kon leg.

Distribution. Malay Peninsula, Sumatra, Java, Borneo, Philippines.

Aceraius laevimargo Zang
(Fig. 21)

Aceraeus laevimargo Zang, 1905, Deutsche Ent. Zeitschr., 1905, p. 244.

Diagnosis. Antenna with six long and slender lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle broad, larger than the right one; right outer tubercle triangular; tenth and eighth ribs of elytron hairless; ninth and seventh sparsely hairy throughout; upper distal portion of fifth tarsomere not projecting in all legs; body length 36-38 mm.

Specimens examined. 2 exs., Kimanis Road, Crocker Range, Sabah, 18-VIII-1983.

Distribution. Borneo.

Aceraius lamellatus Gravely
(Fig. 22)

Aceraius lamellatus Gravely, 1918, Mem. Ind. Mus., III, p. 89.

Diagnosis. Antenna with six long and slender lamellae; anterior lower and lowest terminal teeth of right mandible absent; anterior

angle of head rounded; left outer tubercle larger than the right one; mesosternum hairy in central portion; tenth and ninth ribs of elytron hairy throughout; upper distal portion of fifth tarsomere not projecting in all legs; body length 21-23 mm.

Specimen examined. 1 ex., Crocker Range, Sabah, 1981.

Distribution. Malay Peninsula, Sumatra, Borneo, Sulawesi.

Aceraius laniger Zang
(Fig. 23)

Aceraius laniger Zang, 1905, Deutsche Ent. Zeitschr., 1905, p. 191.

Diagnosis. Antenna with three moderately long and three short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle larger than the right one; inner angle of left outer tubercle rounded; ridge separating intermediate and lateral areas of metasternum blunt; tenth rib of elytron densely hairy in anterior portion, hairless in posterior portion; ninth and seventh hairy throughout; upper portion of distal end of fifth tarsomere projected like hood in middle and hind legs; length 48-54 mm.

Specimens examined. 2 exs., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 14-IX-1997, M. Kon leg.; 3 exs., ditto, 1400 m in altitude, 20-IX-1997, M. Kon leg.; 6 exs., ditto, 1600 m in altitude, 25-IX-1997, M. Kon leg.

Distribution. Borneo.

Aceraius sabanus Kon, Ueda et Johki
(Fig. 24)

Aceraius sabanus Kon, Ueda et Johki, 1995, Jpn. J. sys. Ent. 1, p. 101.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle larger than the right one; tenth rib of elytron densely hairy in anterior portion, hairless in middle portion, with a few hairs in posterior portion; seventh sparsely, ninth a little more densely hairy throughout; upper distal portion of fifth tarsomere not projecting in all legs; body length 35-40 mm.

Specimens examined. 4 exs., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 19-IX-1997, M. Kon leg.; 4 exs., ditto, 20-IX-1997, M. Kon leg.; 1 ex., ditto, 25-IX-1997, M. Kon leg.

Distribution. Borneo.

Aceraius tricornis Zang
(Fig. 25)

Aceraius tricornis Zang, 1903, Insekten-Borse., XX, p. 339.

Diagnosis. Antenna with six short lamellae; anterior lower and lowest terminal teeth of right mandible almost obsolete; anterior angle of head rounded; left outer tubercle long and slender; right outer tubercle completely absent; supraorbital ridge strongly curved inward in anterior portion; tenth and eighth ribs of elytron hairless; seventh very sparsely, ninth a little more densely punctate throughout; upper distal portion of fifth tarsomere not projecting in all legs; body length 51-56 mm.

Specimens examined. 3 exs., Crocker Range, 1500 m in altitude, Sabah, 20-IX-1987.

Distribution. Borneo.

Aceraius wallacei (Kuwert)
(Fig. 26)

Heterochilus wallacei Kuwert, 1898, Nov. Zool., V, p. 334.

Diagnosis. Antenna with six long lamellae; anterior lower and lowest terminal teeth of right mandible distinct; anterior lower tooth strongly divided into upper and lower portions in both mandibles; anterior angle of head not prominent forwards; left outer tubercle larger than the right one; tenth rib of elytron densely hairy in anterior portion close to shoulder; upper distal portion of fifth tarsomere not projecting in all legs; body length 34-38 mm.

Specimen examined. 1 ex., Mondulong, 760 m in altitude, Sipitang, Sabah, 26-VIII-1988, W. Nordin leg.

Distribution. Malay Peninsula, Sumatra, Borneo.

Genus *Pelopides* Kuwert

Pelopides monticulosus (Smith)
(Fig. 27)

Passalus monticulosus Smith, 1852, Nomencl. Coleopt. Ins. Coll. Brit. Mus., VI, p. 6.

Diagnosis. Anterior lower tooth of right mandible absent; right outer tubercle much broader than the left one; mesosternum impunctate; ridge separating between intermediate and lateral areas of metasternum distinct; seventh and sixth grooves of elytron and posterior portion of fifth groove broad, ladder-like; pronotum with slight median groove; body length 44-48 mm.

Specimens examined. 3 exs., Tambunan, Sabah, 15-VIII-1987, H. Ota leg.

Distribution. Thailand, Malay Peninsula, Sumatra, Borneo.

Pelopides symmetricus (Zang)
(Fig. 28)

Parapelopides symmetricus Zang, 1904, Zool. Anz., XXVII, p. 695.

Diagnosis. Anterior lower tooth of right mandible distinct; right outer tubercle slightly broader than left one; mesosternum punctate in lateral portion; ridge separating between intermediate and lateral areas of metasternum obtuse; lateral grooves of elytron simply punctate; body length 42-44 mm.

Specimens examined. 2 exs., Gunung Emas, 1400 m in altitude, Crocker Range, Sabah, 20-IX-1997, M. Kon leg.

Distribution. Borneo.

Genus *Leptaulax* Kaup

Leptaulax acutangularis Iwase
(Fig. 29)

Leptaulax acutangularis Iwase, 1998, Jpn. J. sys. Ent., 4, p. 196.

Diagnosis. Parietal ridge reaching supraorbital ridge; eye not projecting laterally beyond canthus; hypostomal process without longitudinal groove; mesosternum with some punctures; central area of metasternum with punctures; humerus hairless; lateral grooves of elytron with oblong punctures; ventral side black; body length 15-16 mm.

Specimens examined. 1 male (holotype in the collection of the National Science Museum (Natural History), Tokyo), Crocker Range, Sabah, VIII-1994; 1 ex., Gunung Emas, 1600 m in altitude, Crocker Range, Sabah, 19-IX-1997, M. Kon leg.; 1 ex., ditto, 20-IX-1997, M. Kon leg.

Distribution. Borneo.

Leptaulax arayai Johki et Kon
(Fig. 30)

Leptaulax arayai Johki et Kon, 2003, Elytra, 31, p. 144.

Diagnosis. Parietal ridge reaching supraorbital ridge; eye not projecting laterally beyond canthus; hypostomal process without longitudinal groove; pronotum reddish-brown even in mature individuals with black elytra; lateral grooves of elytron with transverse punctures; humerus hairless; body length 17-19 mm.

Specimens examined. 2 exs., Crocker Range, 1600 m in altitude, Sabah, 27-VIII-2002, M. Kon leg.

Distribution. Borneo.

Leptaulax bicolor (Fabricius)
(Fig. 31)

Passalus bicolor Fabricius, 1801, Syst. Eleuth., II, p. 256.

Diagnosis. Parietal ridge reaching supraorbital ridge; eye projecting laterally beyond canthus; hypostomal process without longitudinal groove; lateral grooves of elytron simply punctate; humerus hairless; upper surface of middle and hind tibiae smooth; body length 12-22 mm.

Specimens examined. 13 exs., Gunung Emas, 1600 m in altitude, ditto, 14-IX-1997, M. Kon leg.; 1 ex., Crocker Range, Sabah, 23-X-1999, K. Mizota leg.; 3 exs., ditto, 23-X-1999; 2 exs., Telecom Tower, 1600 m in altitude, Crocker Range, Sabah, 27-VIII-2002.

Distribution. India, Sri Lanka, eastern Himalayas, Myanmar, Thailand, Vietnam, Cambodia, Malay Peninsula, Sumatra, Java,

Borneo, Philippines, Sulawesi, Moluccas, New Guinea, Australia.

Leptaulax crockerensis Iwase
(Fig. 32)

Leptaulax crockerensis Iwase, 1998, Ann. Naturhist. Mus. Wien, 100, p. 165.

Diagnosis. Parietal ridge reaching supraorbital ridge; eye not projecting laterally beyond canthus; hypostomal process without longitudinal groove; anterior angle of pronotum slightly pointed forwards; humerus of elytron hairless; lateral grooves of elytron with round punctures; male genitalia without lateral projection; body length 13 mm.

Specimen examined. 1 male (holotype in the collection of the Naturhistorisches Museum Wien), Gunung Emas, Sabah, 16~27-IV-1993, I. Jenis leg.

Distribution. Borneo.

Leptaulax cyclotaenius Kuwert
(Fig. 33)

Leptaulax cyclotaenius Kuwert, 1891, Deutsche Ent. Zeitschr., 1891, p. 188.

Diagnosis. Parietal ridge gradually descending in distal portion; upper surface of head strongly punctate; eye projecting laterally beyond canthus; hypostomal process with longitudinal groove; anterior lower tooth simple; pronotum densely punctate in lateral portion; central area of metasternum with punctures; humerus hairless; lateral grooves of elytron with strongly transverse punctures; humerus hairless; body length 14-18 mm.

Specimens examined. 2 exs., Keningau, Sabah, 12-IV-1978, K. Sohma leg.

Distribution. Eastern Himalayas, Myanmar, Vietnam, Cambodia, Malay Peninsula, Sumatra, Borneo, Sulawesi.

Leptaulax dentatus (Fabricius)
(Fig. 34)

Passalus dentatus Fabricius, 1792, Ent. Syst., I(2), p. 241.

Diagnosis. Parietal ridge abruptly ending in distal end, not reaching supraorbital ridge; upper surface of head with large annular punctures; eye projecting laterally beyond canthus; hypostomal process either without longitudinal groove or with weak depression in anterior portion; anterior lower tooth broad; humerus hairless; lateral grooves of elytron with oblong punctures; body length 22-30 mm.

Specimen examined. 1 ex., Crocker Range, Sabah, 14-X-1999, K. Mizota leg.

Distribution. India, eastern Himalayas, Myanmar, Thailand, Vietnam, Cambodia, China, Formosa, Malay Peninsula, Sumatra, Java, Borneo, Philippines, Sulawesi, Lesser Sundas, Moluccas, New Guinea, Australia.

Leptaulax dentifrons Iwase
(Fig. 35)

Leptaulax dentifrons Iwase, 1996, Jpn. J. sys. Ent., 2, p. 35.

Diagnosis. Parietal ridge abruptly ending in distal end, not reaching supraorbital ridge; eye projecting laterally beyond canthus; hypostomal process with longitudinal groove; anterior lower tooth acute; central area of metasternum without large puncture; humerus hairless; lateral grooves of elytron with oblong punctures; body length 16-17 mm.

Specimen examined. 1 male (holotype in the collection of the National Science Museum (Natural History), Tokyo), Crocker Range, Sabah, V-1994.

Distribution. Malay Peninsula, Borneo.

Leptaulax hidakai Johki, Araya et Kon
(Fig. 36)

Leptaulax hidakai Johki, Araya et Kon, 2003, Elytra, 31, p. 386.

Diagnosis. Parietal ridge abruptly ending in distal end, not reaching supraorbital ridge; upper surface of head with large annular punctures; eye projecting laterally beyond canthus; hypostomal process without longitudinal groove; anterior lower tooth triangular; humerus hairless; lateral grooves of elytron mat throughout, with transverse punctures; upper surface of middle tibiae polished; body length 24-26 mm.

Specimen examined. 1 female, Crocker Range, 1600 m, 27-VIII-1987.

Distribution. Borneo.

Leptaulax humerosus Kuwert
(Fig. 37)

Leptaulax humerosus Kuwert, 1891, Deutsche Ent. Zeitschr., 1891, p. 189.

Diagnosis. Parietal ridge abruptly ending in distal end, not reaching supraorbital ridge; upper surface of head with large annular punctures; eye projecting laterally beyond canthus; hypostomal process without longitudinal groove; anterior lower tooth triagular; humerus hairless; lateral grooves of elytron mat throughout, with transverse punctures; upper surface of middle tibiae mat; body length 16-17 mm.

Specimens examined. 1 ex., Crocker Range, Sabah, 14-X-1999, K. Mizota leg.; 2 exs., ditto, 16-X-1999.

Distribution. Malay Peninsula, Sumatra, Java, Borneo.

Leptaulax jenisi Iwase
(Fig. 38)

Leptaulax jenisi Iwase, 1998, Ann. Naturhist. Mus. Wien, 100, p. 164.

Diagnosis. Parietal ridge reaching supraorbital ridge; eye slightly projecting laterally beyond canthus; hypostomal process without longitudinal groove; mesosternum with a few punctures; central area of metasternum with punctures; humerus with a few hairs; lateral grooves of elytron with oblong punctures; ventral side reddish brown even in mature individuals with back dorsal side; body length 18-19 mm.

Specimens examined. 1 male (holotype in the collection of the Naturhistorisches Museum Wien), Gunung Emas, Sabah, 16~27-IV-1993, I. Jenis leg.; 3 exs., ditto, 1600 m in altitude, Crocker Range, Sabah, 15-IX-1997, M. Kon leg.; 3 exs., ditto, 20-IX-1997, M. Kon leg.

Distribution. Borneo.

Leptaulax malaccae Kuwert
(Fig. 39)

Leptaulax malaccae Kuwert, 1891, Deutsche Ent. Zeitschr., 1891, p. 188.

Diagnosis. Parietal ridge reaching supraorbital ridge; upper surface of head with several punctures just behind outer tubercle; eye projecting laterally beyond canthus; hypostomal process without longitudinal groove; pronotum densely punctate in lateral portion; humerus hairless; lateral grooves of elytron simply punctate; upper surface of middle and hind tibiae mat; body length 16-18 mm.

Specimens examined. 2 exs., Keningau, Sabah, V-1981.

Distribution. Malay Peninsula, Borneo.

Leptaulax planus (Illiger)
(Fig. 40)

Passalus planus Illiger in Wiedem, 1800, Archiv Zool., I, p. 104.

Diagnosis. Parietal ridge reaching supraorbital ridge; eye projecting laterally beyond canthus; hypostomal process without longitudinal groove; humerus hairless; lateral grooves of elytron simply punctate; abdominal sternite finely and shallowly punctate throughout; body length 12-14 mm.

Specimens examined. 1 ex., Crocker Range, Sabah, 14-X-1999, K. Mizota leg.; 2 exs., ditto, 16-X-1999; 2 exs., ditto, 22-X-1999; 1 ex., ditto, 23-X-1999.

Distribution. Myanmar, Thailand, Malay Peninsula, Sumatra, Java, Borneo, Sulawesi.

Leptaulax sabahensis Iwase
(Fig. 41)

Leptaulax sabahensis Iwase, 1996, Jpn. J. sys. Ent., 2, p. 221.

Diagnosis. Parietal ridge gradually descending in distal portion; upper surface of head strongly punctate; eye projecting laterally beyond canthus; hypostomal process with longitudinal groove; anterior lower tooth bidentate antero-laterally; pronotum densely

punctate in lateral portion; central area of metasternum with punctures; humerus hairless; lateral grooves of elytron with strongly transverse punctures; body length 18-20 mm.

Specimen examined. 1 male (holotype in the collection of the National Science Museum (Natural History), Tokyo), Crocker Range, Sabah, 27-VIII~3-IX-1994.

Distribution. Borneo.

Leptaulax similis Iwase
(Fig. 42)

Leptaulax similis Iwase, 1996, Jpn. J. sys. Ent., 2, p. 229.

Diagnosis. Parietal ridge reaching supraorbital ridge; upper surface of head without punctures just behind outer tubercle; eye projecting laterally beyond canthus; hypostomal process without longitudinal groove; pronotum densely punctate in lateral portion; humerus hairless; lateral grooves of elytron simply punctate; upper surface of middle and hind tibiae mat; body length 20-21 mm.

Specimen examined. 1 male (holotype in the collection of the National Science Museum (Natural History), Tokyo), Crocker Range, Sabah, V~VI-1994.

Distribution. Borneo.

Leptaulax strbai Iwase
(Fig. 43)

Leptaulax strbai Iwase, 1998, Ann. Naturhist. Mus. Wien, 100, p. 167.

Diagnosis. Parietal ridge reaching supraorbital ridge; eye not projecting laterally beyond canthus; hypostomal process without longitudinal groove; anterior angle of pronotum not prominent forwards; humerus of elytron with a few hairs; lateral grooves of elytron with simple punctures; male genitalia with lateral projection; body length 12-12.5 mm.

Specimen examined. 1 male (holotype in the collection of the Naturhistorisches Museum Wien), Gunung Emas, Crocker Range, Sabah, 16~27-IV-1993, Strba & Jenis leg.

Distribution. Borneo.

DISCUSSION

In the present study, 44 species of Passalidae were recorded from the Crocker Range and its surrounding areas. This figure is equivalent to about 70 % of the passalid species known from entire Borneo. Of the 44 species, 26 are endemic to Borneo. Furthermore, the Crocker Range is also the type locality of the following 10 species: *Aceraius kikutai* Kon, Johki et Boucher; *Ophrygonius emas* (Iwase); *O. planus* Iwase; *Leptaulax acutangularis* Iwase; *L. crockerensis* Iwase; *L. dentifrons* Iwase; *L. jenisi* Iwase; *L. sabahensis* Iwase; *L. similis* Iwase; *L. strbai* Iwase.

It has been reported for several Bornean species of Passalidae to have a species-specific altitudinal distribution range (Kon *et al.*, 1995b; Gunsalam & Ueda, 1998). Thus, the high passalid species diversity in the Crocker Range may be attributed in part to the fact that Crocker Range is covered with forests in various altitudes.

The present results suggest that the Crocker Range National Park is likely to be one of the most important areas from the viewpoint of biodiversity conservation in Borneo, because it is expected that the Crocker Range may also harbour high species richness for other forest insect groups besides the Passalidae.

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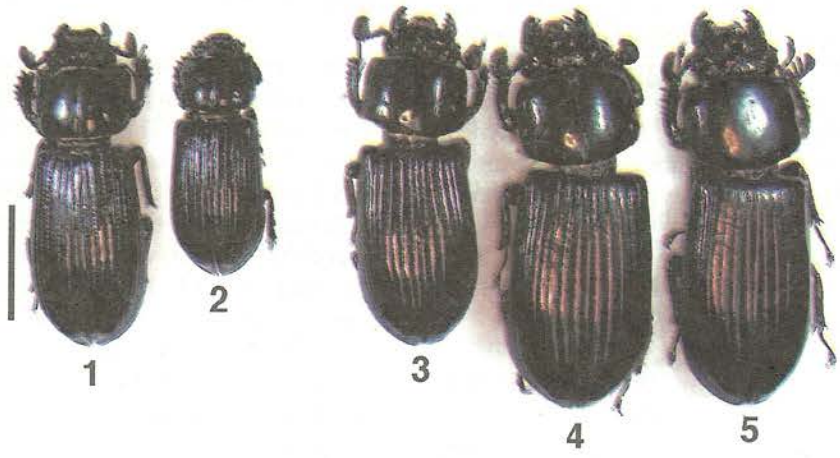
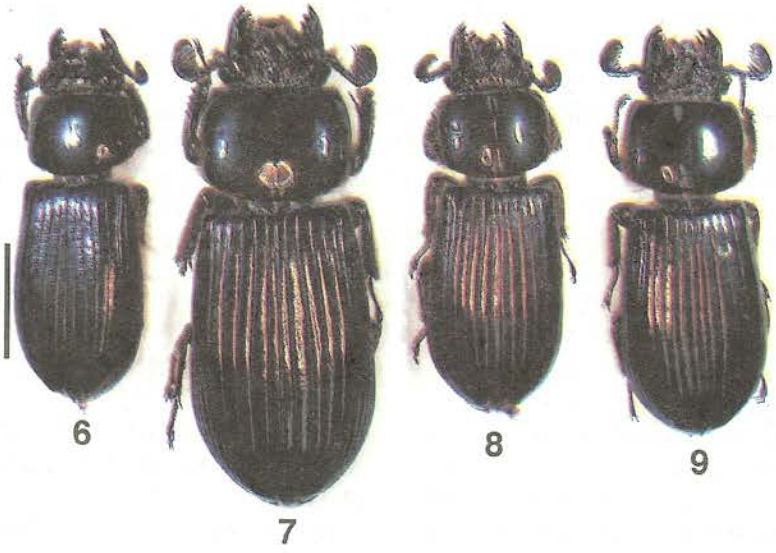
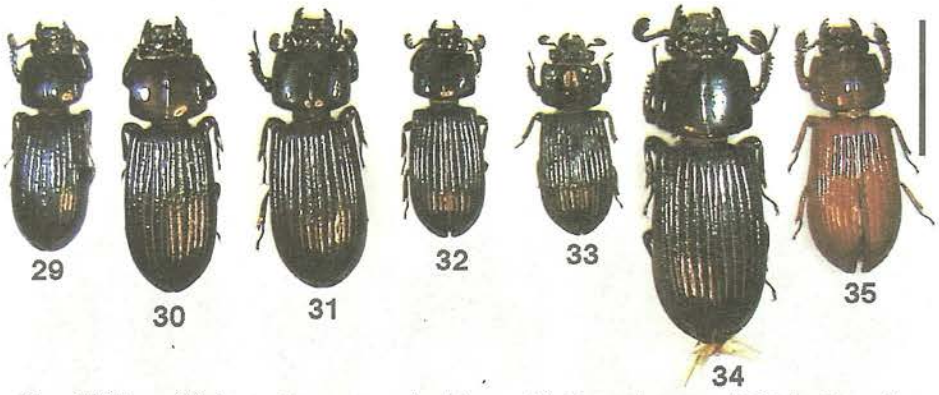


Figs. 1-5. — 1, *Taeniocerus bicanthatus* (Percheron); 2, *Taeniocerus platypus* (Kaup); 3, *Macrolinus latipennis* (Percheron); 4, *Ophrygonius aequidens* (Gravely); 5, *Ophrygonius emas* (Iwase). Scale, 10 mm.

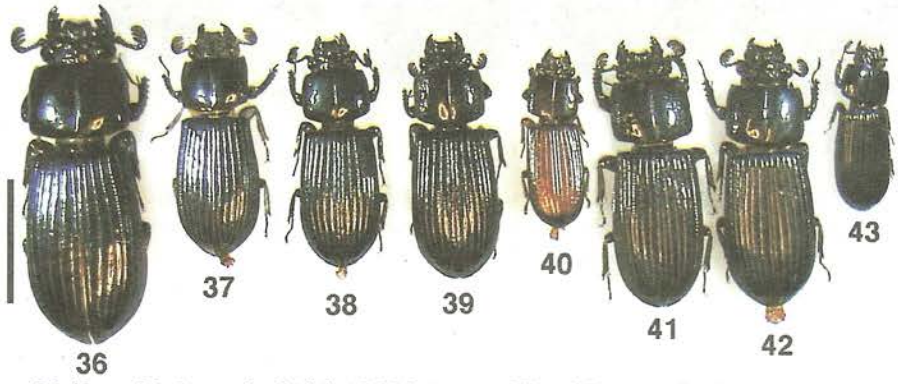


Figs. 6-9. — 6, *Ophrygonius hirtimarginalis* (Iwase); 7, *Ophrygonius koni* Boucher; 8, *Ophrygonius pseudaequidens* Boucher; 9, *Ophrygonius singapurae* Gravely. Scale, 10 mm.

Figs. 23-28. — 23, *Aceraius laniger* Zang; 24, *Aceraius sabanus* Kon, Ueda et Johki; 25, *Aceraius tricornis* Zang; 26, *Aceraius wallacei* (Kuwert); 27, *Pelopides monticulosus* (Smith); 28, *Pelopides symmetricus* (Zang). Scale, 10 mm.



Figs. 29-35. — 29, *Leptaulax acutangularis* Iwase; 30, *Leptaulax arayai* Johki et Kon; 31, *Leptaulax bicolor* (Fabricius); 32, *Leptaulax crocherensis* Iwase; 33, *Leptaulax cyclotaenius* Kuwert; 34, *Leptaulax dentatus* (Fabricius); 35, *Leptaulax dentifrons* Iwase. Scale, 10 mm.



Figs. 36-43. — 36, *Leptaulax hidakai* Johki, Araya et Kon; 37, *Leptaulax humerosus* Kuwert; 38, *Leptaulax jenisi* Iwase; 39, *Leptaulax malaccae* Kuwert; 40, *Leptaulax planus* (Illiger); 41, *Leptaulax sabahensis* Iwase; 42, *Leptaulax similis* Iwase; 43, *Leptaulax strbai* Iwase. Scale, 10 mm.

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