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# **Description of two new genera of Macronychini:** ***Aulacosolus* and *Nesonychus*** **(Coleoptera: Elmidae)**

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## **Abstract**

Two new riffle beetle genera, *Aulacosolus* gen.n. and *Nesonychus* gen.n., and eight new species, *Aulacosolus bharatensis* sp.n., *A. carinatus* sp.n., *A. tenuior* sp.n. (type species of *Aulacosolus*), *A. spinosus* sp.n., *A. scida* sp.n., *A. tarsalis* sp.n., *Nesonychus kodadai* sp.n. (type species of *Nesonychus*) and *N. gibbulus* sp.n. are described from the Oriental Realm. The new genera belong to the Macronychini.

**Key words:** Coleoptera, Elmidae, Macronychini, taxonomy, new genera, new species, Oriental Realm, Asia

## **Introduction**

Two new genera of Macronychini from the Oriental Realm are described in this paper. The two genera are closely related to *Indosolus* BOLLOW, *Loxostirus* JÄCH & KODADA and *Graphosolus* JÄCH & KODADA. *Indosolus* was briefly redescribed by JÄCH & BOUKAL (1995) whereas *Loxostirus* and *Graphosolus* were described recently (see JÄCH & KODADA 1996a, 1996b).

## **Acronyms:**

BML	The Natural History Museum, London [formerly: British Museum (Natural History)]
CBB	Coll. Boukal, České Budějovice
CSN	Coll. Satô, Nagoya
CKB	Coll. Kodada, Bratislava
NMW	Naturhistorisches Museum, Wien

## ***Aulacosolus* gen.n.**

Type species: *Aulacosolus tenuior* sp.n.

**DESCRIPTION:** Habitus (Figs. 1 - 3). Body form obovate to subparallel; surface sparsely covered with yellowish, short, adpressed or semi-erect hairs; plastron distribution: dorsal surface of head (except labrum; anterior margin of clypeus and occipital region), hypomera (except posterior fifth and anterior margin), lateral parts of prosternum, elytra between 7th interval and lateral margin, epipleura, lateral parts of meso-, metasternum and coxae, femora, tibiae, lateral parts of abdominal sternites.

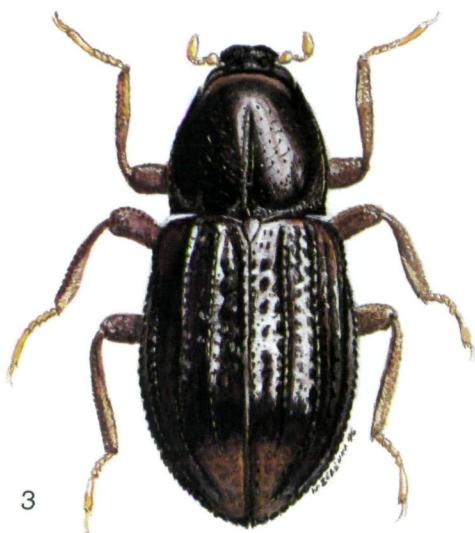
Head partly retractable; clypeus slightly shorter and distinctly wider than labrum; fronto-clypeal suture faintly impressed, more or less straight; anterior angles of frons very slightly upturned posterior to antennal insertions; eyes (Figs. 35, 36) well developed, with at least 50 facets; antennae (Figs. 7, 35 - 37) eight-segmented, segments 3 - 7 small, segment 8 large and oval; mandibles (Fig. 8) with two apical teeth, anterior margin deeply excised, prostheca large and apically densely spinose; labium (Figs. 6, 38), labial palpi two-segmented, ligula wide, umbrella-shaped.



1



2



3



4

Figs. 1 - 4: Habitus of 1) *Aulacosolus tenuior*, 2) *A. bharatensis*, 3) *A. carinatus*, 4) *Nesonychus kodadai*.

Pronotum (Fig. 39) wider than long (length/width ratio = ca. 0.8), widest usually near basal 0.3; slightly constricted towards base, more distinctly constricted towards apex; lateral margin more or less smooth, finely rimmed, never distinctly crenulate, not explanate; posterior angles rectangular, anterior angles acuminate produced anteriorly; disc more or less regularly convex, with a distinct median groove reaching from base to about apical 0.25, parallel-sided or gradually narrowing from base towards anterior end; sublateral carinae absent or very faint; sublateral grooves usually very shallow.

Scutellum (Fig. 41) subtriangular. Elytra (Figs. 9, 41, 42) rather short, obovate or subparallel; disc slightly impressed behind base and slightly vaulted along suture before declivity; lateral margin not explanate, distinctly crenulate; distinctly punctate-striate, with 8 rows of punctures between suture and lateral margin; punctures deeply or shallowly impressed; distinct carinae on intervals 3, 5, 7 or 5, 7 or 3, 5, 7, 8; epipleura moderately wide, gradually narrowing towards apex. Hind wings (Fig. 5): venation more or less as in *Indosolus* (see JÄCH & BOUKAL 1995: Fig. 32), fourth anal vein more distinctly Y-shaped. All examined specimens are macropterous.

Prosternum (Fig. 40) produced anteriorly; prosternal process subtriangular, its apex more or less rounded; middle of mesosternum deeply grooved for reception of prosternal process; suture between meso- and metasternum slightly impressed or unimpressed admedially; metasternum usually glabrous, median longitudinal suture shallowly, moderately deeply or very deeply impressed; disc antero-laterally bordered by a shallow impression and a carina; posterior margin of metasternum bordered by a row of coarse punctures.

Legs moderately long; femora with golden setae on inner surface; tibiae with cleaning fringes; claws simple.

Abdomen (Fig. 43) with five ventrites; first ventrite sometimes transversely impressed subbasally, admedian carinae unabbreviated; posterior angles of ventrites III and IV distinctly produced.

Aedeagus (Figs. 16 -23, 25 - 27, 30, 31): Long and slender; fibula absent, corona present, in repose always situated in basal third of aedeagus; ventral sac developed in apical half of the penis; ejaculatory duct laterally bordered by a sclerotized band, ejaculatory duct with distinct sclerotizations; parameres absent; phallobase short or very short, cylindrical.

Ovipositor (Fig. 24): Terminal segment moderately long, slender, more or less straight. Preterminal segment long and slender; distal sclerite distinctly longer than proximal sclerite, mesally pubescent, laterally with a row of short, blunt setae which seem to have diagnostic value. Basal segment about twice as long as preterminal.

Secondary sexual dimorphism: The metasternum and the legs (especially the tarsi) are sexually dimorphic in *Aulacosolus*. However, only two species were found to have a strongly pronounced secondary sexual dimorphism: *Aulacosolus scida* sp.n. and *A. tarsalis* sp.n. There is no obvious secondary sexual dimorphism in *A. bharatensis* sp.n.

**DIFFERENTIAL DIAGNOSIS:** A distinctive genus, which is characterized by the combination of the following characters: 1) pronotal median groove distinct (reaching pronotal base), 2) dorsal surface of head almost entirely covered by plastron, 3) antennae 8-segmented, 4) elytra with 8 rows of punctures, 5) distinct elytral carinae on intervals 3, 5, 7 or 5, 7 or 3, 5, 7, 8.

In *Indosolus*, the pronotal groove (if present) never reaches the pronotal base and there are only 7 distinct rows of punctures (Fig. 10) between suture and lateral elytral margin (the 8th row is at most indicated by a few isolated punctures); in addition, in *Indosolus* the carinae on the first ventrite are never reaching the ventrite's posterior margin.

*Loxostirus*, another related genus (possessing a distinct pronotal median groove), differs in 1) the slanting 5th elytral interval, 2) the presence of distinct sublateral pronotal carinae and 3) the absence of plastron on the clypeus and the middle of the frons.

**DISCUSSION:** Based on the external and aedeagal morphology we can distinguish at least seven species of *Aulacosolus*, six of which are described herein. It can be estimated that numerous additional species will be discovered in future.

**DISTRIBUTION:** Widely distributed in the Oriental Realm (South India, Thailand, Laos, Peninsular Malaysia, Sumatra).

**HABITAT:** This genus seems to prefer rather slowly flowing, shallow streams and rivers.

**ETYMOLOGY:** "Aulax, aulakos" (Greek: groove) and "-solus" (from *Indosolus*). The name refers to the distinctly developed pronotal groove and to the phylogenetic relationship to *Indosolus*.

### *Aulacosolus tenuior* sp.n.

**TYPE LOCALITY:** River, ca. 10 m wide, ca. 8 km SW of Khao Yai TAT (Tourism Authority of Thailand) Office, Khao Yai National Park, Thailand.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "THAILAND 16.11. Khao Yai NP leg. Jäch 88 (7)". **Paratypes** (NMW, CBB, CKB, CSN, BML): 66 exs., same label data as holotype; 2 exs.: "THAILAND 14.11. Khao Yai NP leg. Jäch 88 (2)"; 6 exs.: "THAILAND 14.11. Khao Yai NP leg. Jäch 88 (5)"; 2 exs.: "S-LAOS: Prov. Champasak ca. 60km S Pakse 10km S Ban Phatouphone 24.5.1996, 80m leg. Schillhammer (3)".

**DIAGNOSIS:** Length (pronotum + elytra), ca. 1.15 - 1.25 mm; width, ca. 0.50 - 0.55 mm. Habitus (Fig. 1).

Colouration variable: pale brown to black; labrum, mouth parts, antennae, legs and anterior margin of pronotum always yellowish brown or reddish brown; remainder of head always black.

Dorsal surface of head (Figs. 35, 36) mat, impunctate, moderately densely covered with minute granules.

Surface of pronotum (Fig. 39) more or less extensively microreticulate and smooth, sparsely covered with minute granules; microreticulation more distinctly pronounced near lateral margin and along traces of sinuous sublateral grooves; microreticulation partly composed of distinct meshes (especially in basal half); median groove gradually narrowing anteriorly; sublateral carinae absent; sublateral grooves vestigial, but their basis occasionally marked by a minute puncture or impression which is sometimes extended towards scutellum.

Scutellum (Fig. 41) glabrous or microreticulate. Elytra (Figs. 41, 42) almost subparallel, widest near apical 0.3; more or less regularly convex in cross section; striae punctures moderately large, usually well impressed (especially in middle portion); non-carinate intervals rather smooth and glabrous; carinae positioned on intervals 5 and 7; all carinae crenulate; carina of interval 5 almost reaching apex; carina of interval 7 ending near posterior 0.2; occasionally, very faintly developed, subbasal carinae can be observed on intervals 4 and 6; intervals 1 - 4 and 6 each with a few isolated small granules (visible only at a magnification of at least 80x) in basal 0.2; interval 8 very faintly raised from base to level of declivity, but never as strongly carinate as intervals 5 and 7, sparsely crenulate.

Metasternal disc mat.

**Aedeagus** (Figs. 22, 23): Penis about 2.8 times as long as phallobase, gradually tapering toward apex, ca. 5.2 times as long as wide, apex acute; sclerotizations of ejaculatory duct consisting of minute speckles and spinules.

**Ovipositor** (Fig. 24): Lateral setae of distal sclerite of preterminal segment conspicuously large.

**Secondary sexual dimorphism:** Metasternal impressions more distinct in male; ventro-lateral protarsal setae very slightly (hardly noticeably) longer in male.

**DISTRIBUTION:** So far known from Thailand and Laos.

**ETYMOLOGY:** *Tenuior* (Latin: more slender), referring to the fact that the elytra of this species are slightly more slender than in related species.

***Aulacosolus spinosus* sp.n.**

**TYPE LOCALITY:** Stream, ca. 2 m wide, unshaded, slowly flowing, on the road between Kampung Ulu Melaka and Padang Lalang, Langkawi, Kedah, western Malaysia.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "MALAYSIA 13.2.88 LANGKAWI P.Lalang -U.Melaka lg.Madl". **Paratypes** (NMW, CBB): 10 exs., same label data as holotype; 1 ♀: "MALAYSIA 30.1.1992 KEDAH: Langkawi leg. Jäch (16)".

**Additional material examined (NMW, CKB):**

**T H A I L A N D:** 2 exs.: Chiang Dao, 21.V.-4.VI.1995, leg. Snizek; 1 ♀: Nam Nao NP, Petchabun Prov., 24.XI.1995, leg. Zettel.

**I N D O N E S I A:** N - SUMATRA: 6 exs.: Bukit Lawang, 26.-27.II.1990, leg. Jäch; 1 ♀: Louser NP, Ketambe, ca. 30 km NW Kutacane, 23.2.1990, leg. Jäch.

**DIAGNOSIS** (based on type specimens): Length (pronotum + elytra), ca. 1.2 - 1.3 mm; width, ca. 0.6 mm.

Colouration dark brown to black; labrum, mouth parts, antennae, legs and anterior margin of pronotum yellowish brown or reddish brown.

Externally, this species is very similar to *A. tenuior* from which it can be distinguished by the following characters:

1) Elytra not subparallel, but slightly curved between shoulder and subapical constriction, thus appearing slightly wider (length/width of elytra = 1.35 - 1.40 in *A. spinosus*; ca. 1.50 in *A. tenuior*).

2) Contrary to the external similarity, the aedeagus (Figs. 25, 26) differs significantly from that of *A. tenuior*: Penis about 7 - 8 times as long as phallobase, subparallel, ca. 5 times as long as wide; sclerotizations of ejaculatory duct consisting of moderately large spines in apical half and small speckles and spinules in basal half.

3) Tarsi not (or not noticeably) dimorphic in male.

**VARIABILITY:** Sublateral pronotal grooves vestigial (as in *A. tenuior*) in certain specimens (e.g. the holotype), but more distinct in some of the paratypes.

The specimens from Sumatra differ from the type specimens and the Thai material mainly in the slightly more acute aedeagal apex (Fig. 27).

**DISCUSSION:** Since the aedeagus of *Aulacosolus* is generally rather poor in characters and since we do not know very much about inter-populational variability, it cannot be excluded that *A. spinosus* has to be split.

**DISTRIBUTION:** Northern Thailand to Sumatra.

**ETYMOLOGY:** *Spinosus* (Latin: spiny), referring to the spinose ejaculatory duct.

***Aulacosolus tarsalis* sp.n.**

**TYPE LOCALITY:** Shallow river, ca. 10 m wide, flowing through secondary forest, ca. 700 m a.s.l., ca. 50 km E Muang Paksong, Bolavens Plateau, southern Laos.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "S-LAOS: Prov. Champasak ca. 50km E Muang Paksong 25.5.1996, 700m leg. Schillhammer (9)". **Paratypes** (NMW): 3 ♀♀, same label data as holotype.

**DIAGNOSIS:** Length (pronotum + elytra), ca. 1.10 - 1.20 mm; width, ca. 0.55 mm.

Colouration dark brown or black; labrum, mouth parts, antennae, legs, anterior margin of pronotum and a small humeral spot yellowish brown or reddish brown.

Externally, this species is very similar to *A. spinosus* from which it can be distinguished by the following characters:

1) Sublateral pronotal grooves slightly more distinct (at least one specimen with traceable sublateral carinae); 2) pronotal median groove more parallel-sided; 3) interval 1 - 4 and 6 without subbasal granules; 4) 8th elytral interval more or less flat; 5) metasternal disc glabrous; 6) aedeagus; 7) secondary sexual dimorphism.

**Aedeagus** (Figs. 18, 19): Penis about 3 times as long as phallobase, gradually tapering toward apex, ca. 4.5 times as long as wide; apex acute; sclerotizations of ejaculatory duct consisting of comparatively sparse, minute speckles and spinules.

**Secondary sexual dimorphism:** Legs, especially tibiae and tarsi of front legs, slightly thickened in male. First three tarsal segments with conspicuously long, ventro-lateral setae. Metasternal impressions considerably more distinct in male.

**DISTRIBUTION:** So far known only from the type locality.

**ETYMOLOGY:** Tarsalis (Latin: pertaining to the tarsus), referring to the modified (sexually dimorphic) male tarsus.

### *Aulacosolus scida* sp.n.

**TYPE LOCALITY:** River, ca. 5 - 10 m wide, Mae Sa Falls, Mae Sa NP, W Mae Rim, Chiang Mai Province, northern Thailand.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "THAILAND 30./31.11. Chiang Mai Prov. 1995 W Mae Rim, Mae Sa NP leg. Zettel (2)". **Paratypes** (NMW): 1 ♀, same label data as holotype.

**DIAGNOSIS:** Length (pronotum + elytra), ca. 1.2 mm; width, ca. 0.6 mm.

Externally, this species is very similar to *A. spinosus* from which it can be distinguished by the following characters: 1) aedeagus; 2) secondary sexual dimorphism.

So far we are unable to distinguish females of *A. spinosus* and *A. scida*. There may be differences in the ovipositor (e.g. in the lateral setae of the distal sclerite of the preterminal segment which seem to be smaller in *A. scida*). More material is needed to examine this character more thoroughly.

**Aedeagus** (Figs. 20, 21): Penis about 4.7 times as long as phallobase, subparallel, ca. 6 times as long as wide; apex acute; sclerotizations of ejaculatory duct as in *A. tenuior*.

**Secondary sexual dimorphism** as in *A. tarsalis*.

**DISTRIBUTION:** So far known only from the type locality.

**ETYMOLOGY:** Scida (Latin: small piece of paper), noun in apposition; dedicated to Herbert K. Zettel (NMW), in recognition of his most productive hydroentomological activities in Southeast Asia. Scida is the Latin translation for the German word "Zettel".

### *Aulacosolus carinatus* sp.n.

**TYPE LOCALITY:** Small stream (upper course of I Thao), ca. 1 - 2 m wide, flowing through dense forest, north of National Park Head Quarter (near watching tower), Khao Yai National Park, Thailand.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "THAILAND 14.11. Khao Yai NP leg. Jäch 88 (5)". **Paratypes** (NMW): 1 ♀, same label data as holotype; 1 ♀: "THAILAND 14.11. Khao Yai NP leg. Jäch 88 (2)".

**DIAGNOSIS:** Length (pronotum + elytra), ca. 1.20 - 1.25 mm; width, ca. 0.55 - 0.60 mm. **Habitus** (Fig. 3).

Colouration brown to black; labrum, mouth parts, antennae, legs and anterior margin of pronotum always yellowish brown or reddish brown; remainder of head always black.

Dorsal surface of head mat, impunctate, moderately densely covered with minute granules.

Surface of pronotum rather smooth, sparsely covered with minute granules, lateral margins and traces of sublateral grooves microreticulate; median groove gradually narrowing anteriorly; sublateral grooves traceable, but very shallow; sublateral carinae absent.

Scutellum microreticulate. Elytra slightly ovoid; stria punctures large, well impressed (especially in anterior half); non-carinate intervals rather smooth and glabrous; carinae positioned on intervals 3, 5, 7 and 8; carina of interval 3 ending at beginning of declivity; carina of interval 5 almost reaching apex; carina of interval 7 slightly shorter than that of interval 5; carina of interval 8 less strongly raised than remaining carinae, about as long as carina of interval 3; occasionally, very faintly developed, subbasal carinae can be observed on intervals 4 and 6; intervals 1 - 4 and 6 each with a few isolated granules (visible only at a magnification of at least 80x).

Metasternal disc mat.

Aedeagus (Figs. 30, 31): very similar to that of *A. spinosus* (specimens from Sumatra).

Secondary sexual dimorphism: Female metasternum flat; female metasternal groove long, almost reaching anterior margin of metasternum. Male metasternum convex; male metasternal groove more or less completely effaced in anterior half of metasternum.

**DIFFERENTIAL DIAGNOSIS:** *Aulacosolus carinatus* is easily recognized by the long carina on elytral interval 3.

**DISTRIBUTION:** So far known only from Thailand (Khao Yai National Park).

**ETYMOLOGY:** Carinatus (Latin: carinate), referring to the conspicuously carinate elytra.

### *Aulacosolus* sp. ♀

**Material examined** (NMW):

**M A L A Y S I A:** 1 ♀: Langkawi, Telaga Tujuh, 2.II.1988, leg. Madl.

**DISCUSSION:** The single female from Langkawi differs from the types of *A. carinatus* in the 1) slightly smaller size (Length of pronotum + elytra ca. 1.1 mm), 2) entirely microreticulate pronotum, 3) sublateral pronotal grooves being totally obsolete, 4) carina on the 8th elytral interval being less prominent.

### *Aulacosolus bharatensis* sp.n.

**TYPE LOCALITY:** Small stream (tributary of Pambayiar River), ca. 1 m wide, partly shaded, flowing through degraded forest, ca. 300 m a.s.l., ca. 50 km NW Pathanamthitta, Cardamom Hills, Kerala, South India.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "S-INDIA, Kerala 300m, Cardamom Hills, 50km NW Pathanamthitta, nr Pambayiar river (P2) // 27.-28.12.1993, 77°05'E/09°25'N, Boukal D. + Kejval Z. lgt.". **Paratypes** (NMW, CBB): 3 exs., same label data as holotype; 3 exs., "S-INDIA, Kerala, Cardamom Hills, 10 km SW Kumily, Vallakadavu

1000m // 24.12.1993, 77°07'E/09°31'N, Boukal D. + Kejval Z. lgt."; 1 ex., "S-INDIA, Kerala, Cardamom Hills 1000m, 15 km SW Munnar, Kallar Valley (K2) // 6.-18.12.1993, 76°58'E/10°02'N, Boukal D. + Kejval Z. lgt.".

**DIAGNOSIS:** Length (pronotum + elytra), ca. 1.2 - 1.3 mm; width, ca. 0.6 mm. Habitus (Fig. 2).

Colouration dark brown to black; labrum, mouth parts, antennae, legs and anterior margin of pronotum yellowish brown or reddish brown.

Dorsal surface of head mat, impunctate, moderately densely covered with minute granules.

Large parts of surface of pronotum smooth and glabrous, lateral margins and depressions microreticulate; very sparsely covered with minute granules; median groove moderately deeply impressed, gradually narrowing anteriorly; sublateral grooves at least basally completely absent; sublateral carinae absent.

Scutellum glabrous or microreticulate. Elytra ovoid, widest near apical 0.3; stria punctures moderately large, usually well impressed (especially in middle portion); non-carinate intervals rather smooth and glabrous; carinae positioned on intervals 3, 5 and 7; carina of interval 3 short, ending before elytral depression; carina of interval 5 almost reaching apex; carina of interval 7 ending near posterior 0.2; a very faintly developed, subbasal carina is present on interval 6; interval 8 completely flat.

Metasternal disc mat.

Aedeagus (Figs. 16, 17): Penis about 7 - 8 times as long as phallobase, subparallel and more slender (7.5 times as long as wide) than in the other species; apex acute; sclerotizations of ejaculatory duct consisting of minute speckles and spinules.

Secondary sexual dimorphism not pronounced.

**DIFFERENTIAL DIAGNOSIS:** The short carina on elytral interval 3 and the totally flat 8th interval serve to distinguish *A. bharatensis* from all other species of the genus.

**DISTRIBUTION:** So far known only from South India.

**ETYMOLOGY:** Bharat is the Hindi name of the Republic of India; referring to the species' distribution.

### *Nesonychus* gen.n.

Type species: *Nesonychus kodadai* sp.n.

**DESCRIPTION:** Habitus (Fig. 4). Body form obovate; surface sparsely covered with yellowish, short, adpressed or semi-erect hairs; plaston distribution: vertex and lateral parts of frons, around eyes, middle of hypomera, a narrow, horizontal band on lateral declivity of prosternum, elytra between lateral margin and 8th interval, epipleura, lateral parts of meso-, metasternum and coxae, femora, tibiae, lateral parts of abdominal sternites (especially along posterior margin).

Head (Figs. 44, 45) partly retractable; clypeus slightly shorter than labrum and approximately as wide as labrum; fronto-clypeal suture faintly impressed, slightly arched; anterior angles of frons slightly upturned posterior to antennal insertions; eyes (Fig. 44) well developed, with at least 50 facets; antennae (Figs. 13, 44) eight-segmented, segments 3 - 7 small, terminal segment large and oval; mandible (Fig. 14); labium (Figs. 12, 45), labial palpi two-segmented, ligula wide, umbrella-shaped.

Pronotum (Figs. 46, 47) wider than long (length/width ratio = ca. 0.8 - 0.9), widest usually at base or near basal 0.3; lateral margin more or less smooth, never distinctly crenulate, finely rimmed, not distinctly explanate; posterior angles more or less rectangular, anterior angles acuminate produced anteriorly; disc more or less regularly convex, without median groove or



(very rarely) with a vestigial median groove indicated by a more dense microreticulation; distinct sublateral grooves or carinae absent, but a very characteristic, minute, sublateral, basal puncture or slightly elongate impression is present.

Scutellum (Fig. 49) subtriangular. Elytra (Figs. 15, 49) obovate; disc more or less evenly convex in cross section or slightly impressed between suture and interval 5 near basal 0.3 or somewhat roof-shaped along suture or more or less strongly vaulted along suture before declivity; lateral margin not explanate, distinctly crenulate to serrate; elytral striae superficial, with 8 rows of punctures between suture and lateral margin, however, the punctures are very small and inconspicuous, more distinct only in middle portion; distinct carinae are found on intervals 5 and 7; all carinae crenulate; epipleura moderately wide, gradually narrowing towards apex. Hind wings (Fig. 11): venation more or less as in *Indosolus* (see JÄCH & BOUKAL 1995: Fig. 32), but third and fourth anal veins almost obsolete, fourth anal vein not Y-shaped. Numerous examined specimens are brachypterous.

Prosternum (Fig. 48) produced anteriorly; prosternal process subtriangular, its apex rounded; middle of mesosternum (Fig. 50) deeply grooved for reception of prosternal process; suture between meso- and metasternum not impressed admedially; metasternum (Fig. 50) rather smooth, disc rather flat, median longitudinal suture shallowly impressed; disc laterally margined by a robust (sometimes irregular) carina; posterior margin of metasternum laterally bordered by a row of coarse punctures or an impressed line.

Legs (Fig. 51) moderately long; femora with golden setae on inner surface; tibiae with cleaning fringes; claws simple.

Abdomen (Figs. 50, 52) with five ventrites; occasionally with a few scattered minute granules; admedian carinae of first ventrite unabbreviated; posterior angles of ventrites III and IV distinctly produced.

Aedeagus (Figs. 28, 29, 32, 33): Long and slender; fibula and corona absent; ventral sac developed in apical half of the penis; ejaculatory duct laterally bordered by a sclerotized band, ejaculatory duct with distinct sclerotizations; parameres absent; phallobase short, cylindrical.

Ovipositor (Fig. 34): Terminal segment moderately long, slender, more or less straight. Preterminal segment long and slender; distal sclerite distinctly longer than proximal sclerite, mesally pubescent. Basal segment about twice as long as preterminal.

**PHYLOGENY:** The following genera are phylogenetically united by the very similar male and female genitalia and by the presence of 8 elytral striae: *Aulacosolus*, *Graphosolus*, *Loxostirus* and *Nesonychus*. The adelphotaxon of *Nesonychus* is probably *Graphosolus*. The sister genus of *Aulacosolus* + *Graphosolus* + *Loxostirus* + *Nesonychus* seems to be *Indosolus*.

**DIFFERENTIAL DIAGNOSIS:** *Nesonychus* differs from *Aulacosolus* and *Loxostirus* in the absence of a distinct pronotal median groove.

*Nesonychus* differs from *Graphosolus* in the following characters: 1) surface of pronotum without granules, 2) pronotum with distinct sublateral basal puncture or impression, 3) 8th elytral interval never distinctly carinate and not clearly visible in dorsal aspect.

*Nesonychus* differs from *Indosolus* - among other characters - in the presence of 8 elytral striae, in the unmodified suture between meso- and metasternum and in the unabbreviated carinae on the first ventrite.

**DISTRIBUTION:** This genus is known to occur in three of the Greater Sunda Islands (Borneo, Sumatra, Java) and in one of the Lesser Sunda Islands (Lombok).

**ETYMOLOGY:** "Neso-" (Greek: island) [compare: Indonesia] and "-onychus", referring to the type genus of the tribe (*Macronychus*). This genus is so far known only from the Sunda Islands.

*Nesonychus kodadai* sp.n.

**TYPE LOCALITY:** River, ca. 6 m wide, flowing through degraded primary forest, ca. 1000 m a.s.l., near Pa Ukat, ca. 5 km E Bario [= Bareo], Kelabit Highlands, northern Sarawak, Borneo, Malaysia.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "MAL., Sarawak 1993 Kelabit HL, 5km E Bario Pa Ukat, 27.2., 1000m leg. M. Jäch (15)". **Paratypes** (NMW, CBB, CKB, CSN, BML): 17 exs., same label data as holotype; 6 exs.: "MAL., Sarawak 1993 Kelabit HL, 5km E Bario Pa Ukat, 1.3., ca.1000m leg. M. Jäch (17)"; 4 exs.: "MAL., Sarawak 1993 Kelabit HL, Umg. Bario 28.2., 1000 - 1200m leg. M. Jäch (16)"; 10 exs.: "MAL., Sarawak 1993 Kelabit HL, Umg. Bario 28.2., ca. 1000 m leg. M. Jäch (14)"; 5 exs.: "MAL., Sarawak 1993 Kelabit HL, Bareo Pa Ukat, 27.2., 1000m leg. H. Zettel (12)"; 2 exs.: "MALAYSIA, Sarawak Mulu NP, Long Iman 4.3.1993 leg. M. Jäch (20)"; 3 exs.: "MALAYSIA, Sarawak Mulu NP 3.3.1993 leg. M. Jäch (19)"; 56 exs.: "Malaysia, Sabah, Kamut river env. near Kampung Pisang Pisang, 3.-4. VII. 1996, 14 a, shaded stream in primary forest with submerged wood"; 2 exs.: "Malaysia, SABAH, Kamut river env. near Kampung Pisang Pisang, 3.-4.VII. 1996, 14 b: ca 10m wide tributary of Kuamut river in primary forest"; 69 exs.: "Malaysia, Sabah, Crocker Range, Bingkor env., Taman Bandukan, 6.-7.VII 1996, 10b, shaded stream 1.5-3.0m wide, in dense primary forest"; 2 exs.: "Malaysia, SABAH, Crocker Range, Bingkor env., Taman Bandukan, 6.-7.VII 1996, 10 b, shaded stream 1.5-3.0m wide, in primary forest"; 5 exs.: "Malaysia, SABAH, Crocker Range, Bingkor env., Taman Bandukan, 6.-7.VII 1996, 10 a, river ca 10 m wide, flowing through degraded primary forest"; 2 exs.: "Malaysia, SABAH, Crocker Range, Moyog env., around km 20 of road Kota Kinabalu Tambunan, 15.VI.1996, 1 b"; 74 exs.: "Malaysia, Sabah, Crocker Range, Sunsuron, 10.-11.VI. 1996, 8a, Sunsuron riv. flowing through deforested area".

**Additional material examined** (NMW, CBB):

**M A L A Y S I A:** SARAWAK: 4 exs.: "MAL., Sarawak 1993 80km S Kuching, 18.2. Kampung Ana Rais leg. M. Jäch (4)"; 1 ex.: "SARAWAK (Borneo), Gunung Serapi, ca 19 km W Kuching \ primary forest, III. 1994, J. Kodada leg."; 4 exs.: "MAL., Sarawak 1993 E Bandar Sri Amman Batang Ai NP, 20.2. leg. M. Jäch (9)"; 16 exs.: "SARAWAK (Borneo), ca 25 km E KAPIT III.1994, Kodada leg."

**DIAGNOSIS:** Length (pronotum + elytra), ca. 0.85 - 1.10 mm; width, ca. 0.50 - 0.55 mm. Habitus (Fig. 4).

Colouration variable: pale brown to black; labrum, mouth parts, antennae, legs and anterior margin of pronotum always more or less extensively yellowish brown or reddish brown; shoulders and elytral apices sometimes paler (yellowish or brown) than rest of elytra; remainder of head always black.

Surface of pronotal disc (Fig. 46) sparsely punctate; punctures fine and inconspicuous; hind angles distinctly and lateral margin narrowly microreticulate; sublateral basal puncture deeply impressed, laterally bordered by a very short inconspicuous ridge; sublateral basal punctures connected by a moderately deeply impressed transverse line.

Scutellum (Fig. 49) usually glabrous, rarely microreticulate. Elytra (Fig. 49) suboval, widest near apical 0.3; stria punctures usually minute (very rarely more distinct), clearly discernible in middle portion only; non-carinate intervals rather flat; carinae positioned on intervals 5 and 7; carina of interval 5 almost reaching apex; carina of interval 7 ending near posterior 0.2; elytral apices distinctly acuminate.

Metasternum (Fig. 50) smooth and glabrous, with few, minute punctures. First ventrite shallowly impressed behind anterior margin.

Aedeagus (Figs. 32, 33): Penis about 4.5 - 6.0 times as long as phallobase, subparallel; apex acuminately produced; sclerotizations of ejaculatory duct consisting of minute speckles and spinules.

**VARIABILITY:** Surface of pronotal disc smooth and glabrous in the holotype and all paratypes. However, in the specimens listed under "additional material" the proximal half of the disc is remarkably variable (even in specimens from the same locality): either 1) glabrous as in the type material, or 2) with traces of a faint microreticulation, or 3) even with distinct microreticulation (consisting of moderately large polygonal meshes); furthermore, the non-carinate elytral intervals

are smooth and glabrous in the type material, but they are mat in some of the specimens listed under "additional material".

The shape of the elytral disc varies in the type material as well as in the "additional material": more or less evenly convex or slightly impressed between suture and interval 5 near basal 0.3; or suture somewhat roof-shaped between base and declivity or distinctly vaulted before declivity.

**DISCUSSION:** Taking into account the morphological variability of the material studied it cannot be excluded that it will be found to represent a complex of closely related species.

**DISTRIBUTION:** So far known only from Sarawak and Sabah, Borneo.

**ETYMOLOGY:** Named for our friend Ján Kodada.

### *Nesonychus gibbulus* sp.n.

**TYPE LOCALITY:** River, ca. 5 - 8 m wide, limestone, flowing through forest and pastures, Lembah Harau Nature Reserve, ca. 15 km NE Payakumbu, ca. 30 km E Bukittinggi, western Sumatra, Indonesia.

**TYPE MATERIAL:** **Holotype** ♂ (NMW): "INDONESIEN 1991 (12b) W-Sumatra, NSG Lemba Harau 15km NE Payakumbu leg. Jäch 11.2.". **Paratypes** (NMW): 6 exs., same label data as holotype.

**DIAGNOSIS:** Length (pronotum + elytra), ca. 1.05 - 1.10 mm; width, ca. 0.55 mm.

Head black, pronotum (except anterior margin) dark brown or almost black, elytra chestnut brown; labrum, mouth parts, antennae, legs and anterior margin of pronotum yellowish brown or reddish brown.

Externally, this species is very similar to *N. kodadai* from which it can be distinguished by the following characters:

1) Pronotum more extensively microreticulate; basal third and lateral margin more or less covered by microreticulation; microreticulation consisting of regular meshes. 2) Sublateral basal puncture less deeply impressed. 3) Elytra more strongly vaulted in middle along suture, thus distinctly roof-shaped in cross section. 4) First ventrite more strongly impressed behind anterior margin. 5) Aedeagus (Figs. 28, 29) slightly wider (especially subapically) and slightly shorter than in *N. kodadai*. Penis about 3 - 4 times as long as phallobase.

**VARIABILITY:** Holotype with a trace of a sublateral pronotal groove, which is lacking in the paratypes. Microreticulation of basal third of pronotum sometimes reduced to area in front of scutellum.

**DISTRIBUTION:** So far known only from Sumatra.

**ETYMOLOGY:** *Gibbulus* (Latin: slightly gibbous), referring to the distinctly vaulted elytra.

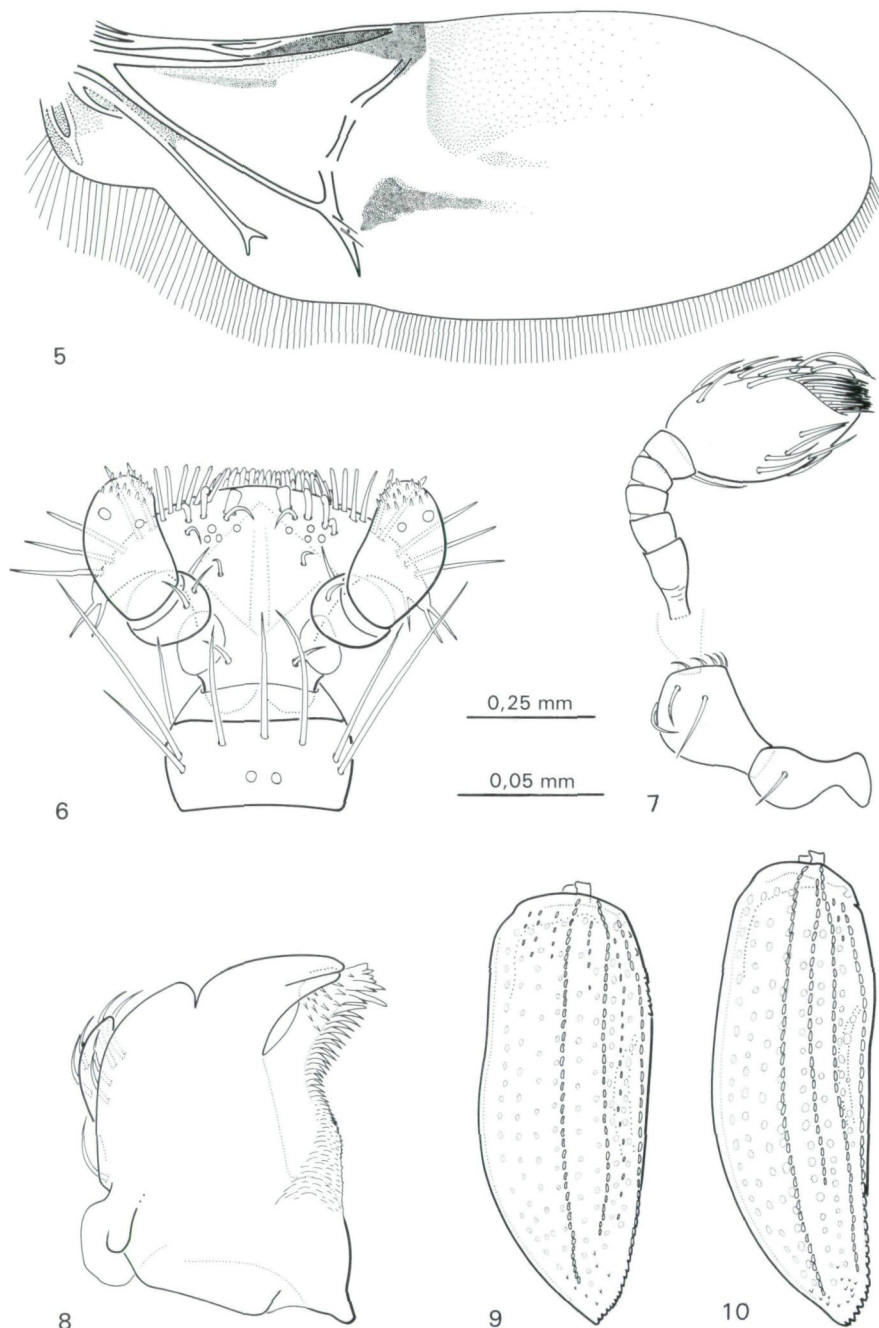
### *Nesonychus* sp. 3

**Material examined (NMW):**

**I N D O N E S I A:** JAVA: 5 ♀♀: Kali Cilember, Cisarua, S Bogor, 15.1.1987, 28.1.1989, leg. Jäch; **LOMBOK:** 1 ♀: Suranadi, 6.2.1988, leg. Jäch.

**DISCUSSION:** These females differ from the types of *Nesonychus gibbulus* only in the elytral vault being less prominent and the first abdominal ventrite being not distinctly impressed. Two specimens possess a vestigial median groove indicated by the more dense microreticulation.

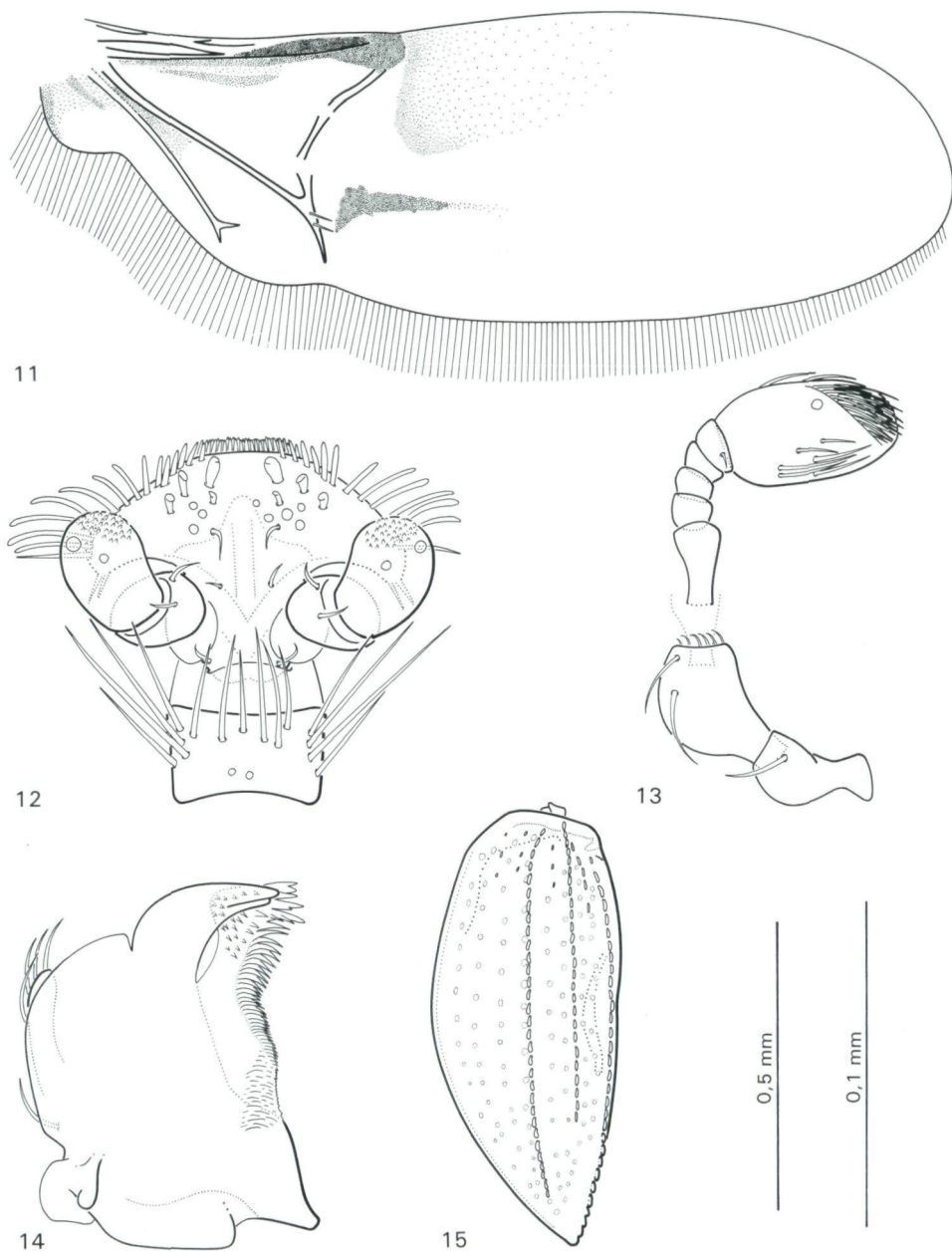
More material is necessary to determine the status of these specimens.



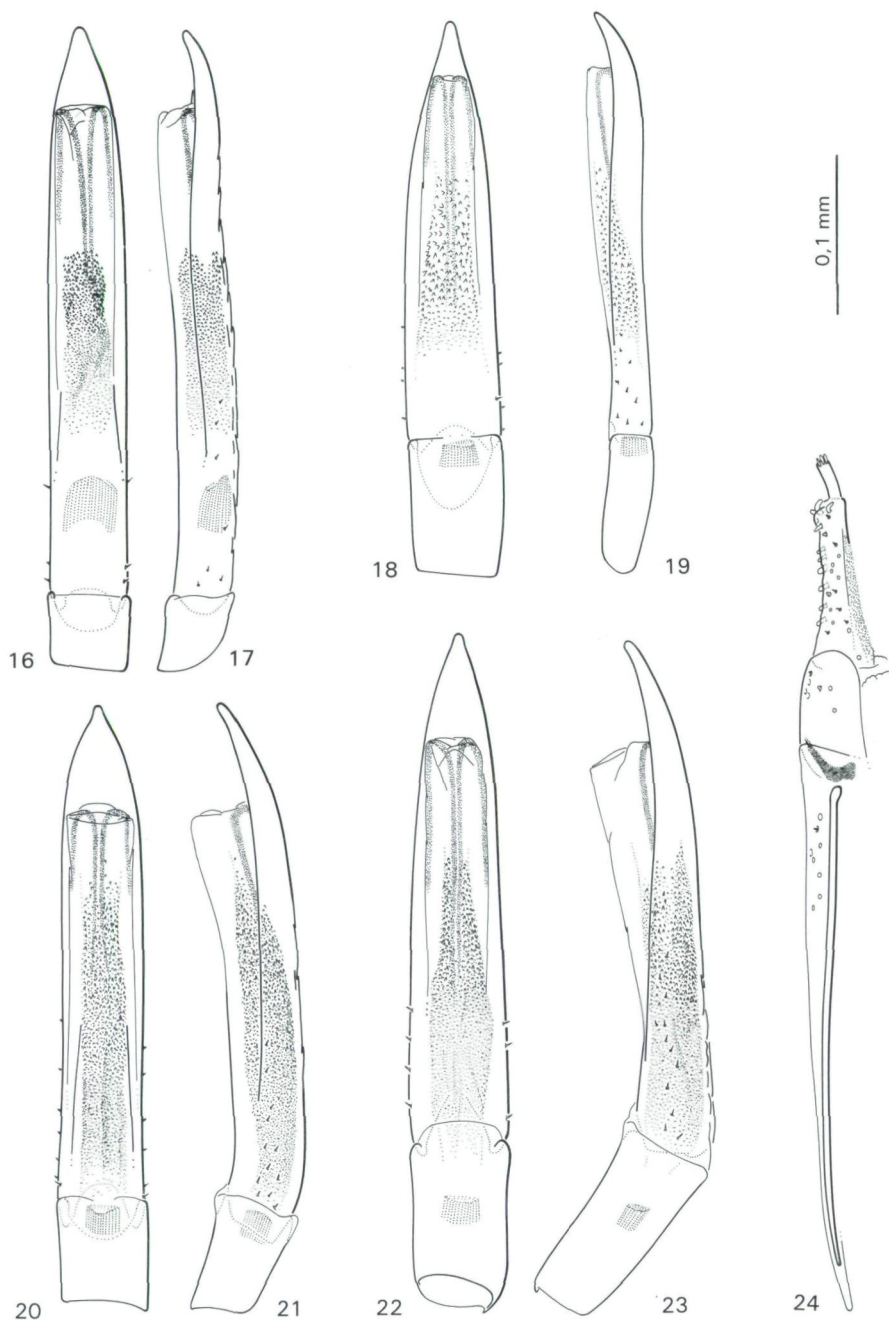
Figs. 5 - 9: *Aulacosolus tenuior*; 5) hind wing, 6) labium, 7) antenna, 8) mandible, 9) right elytron, dorso-lateral view.

Fig. 10: *Indosolus* sp., Thailand, Tham Tharn Lot, right elytron, dorso-lateral view.

Long scale: Figs. 6 - 8; short scale: Figs. 5, 9, 10.

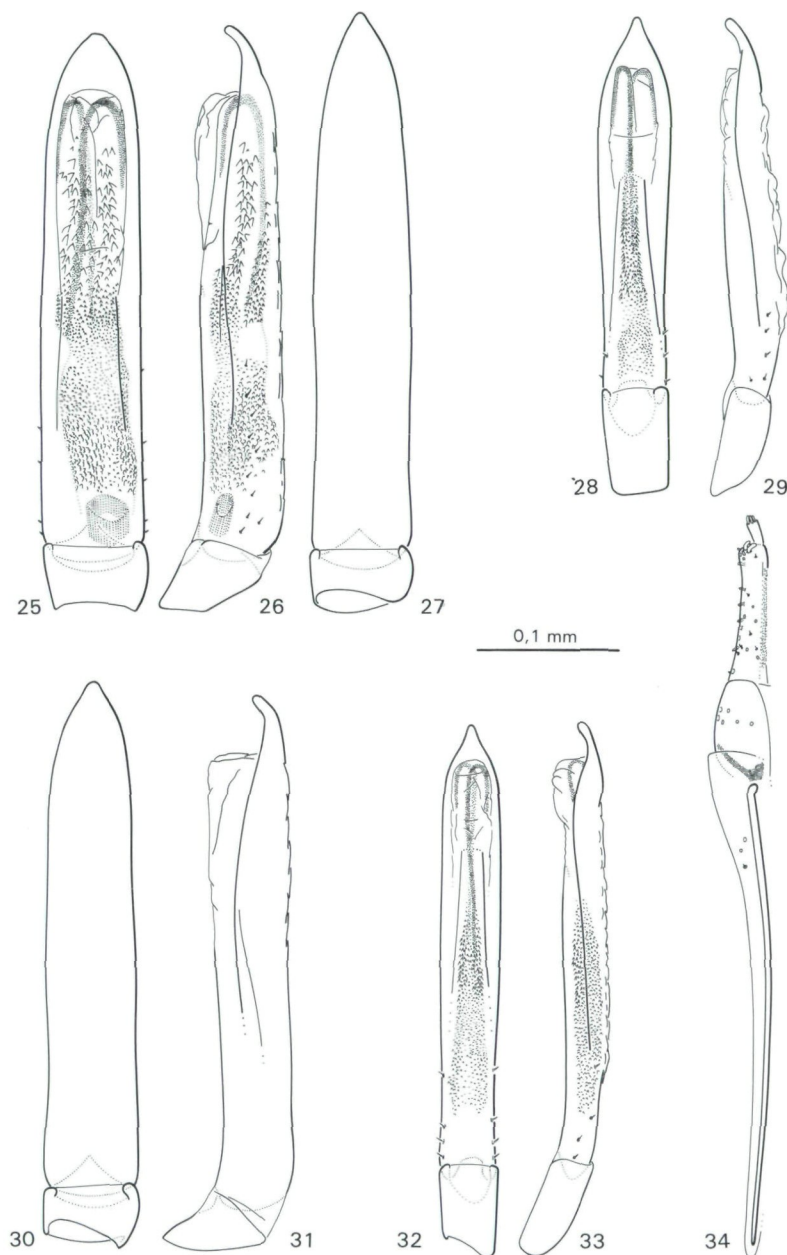


Figs. 11 - 15: *Nesonychus kodadai*; 11) hind wing, 12) labium, 13) antenna, 14) mandible, 15) right elytron, dorso-lateral view. Long scale: Figs. 12 - 14; short scale: Figs. 11, 15.



Figs. 16 - 23: Aedeagus of 16) *Aulacosolus bharatensis*, ventral view, 17) same, lateral view, 18) *A. tarsalis*, ventral view, 19) same, lateral view, 20) *A. scida*, ventral view, 21) same, lateral view, 22) *A. tenuior*, ventral view, 23) same, lateral view.

Fig. 24: Ovipositor of *A. tenuior*.

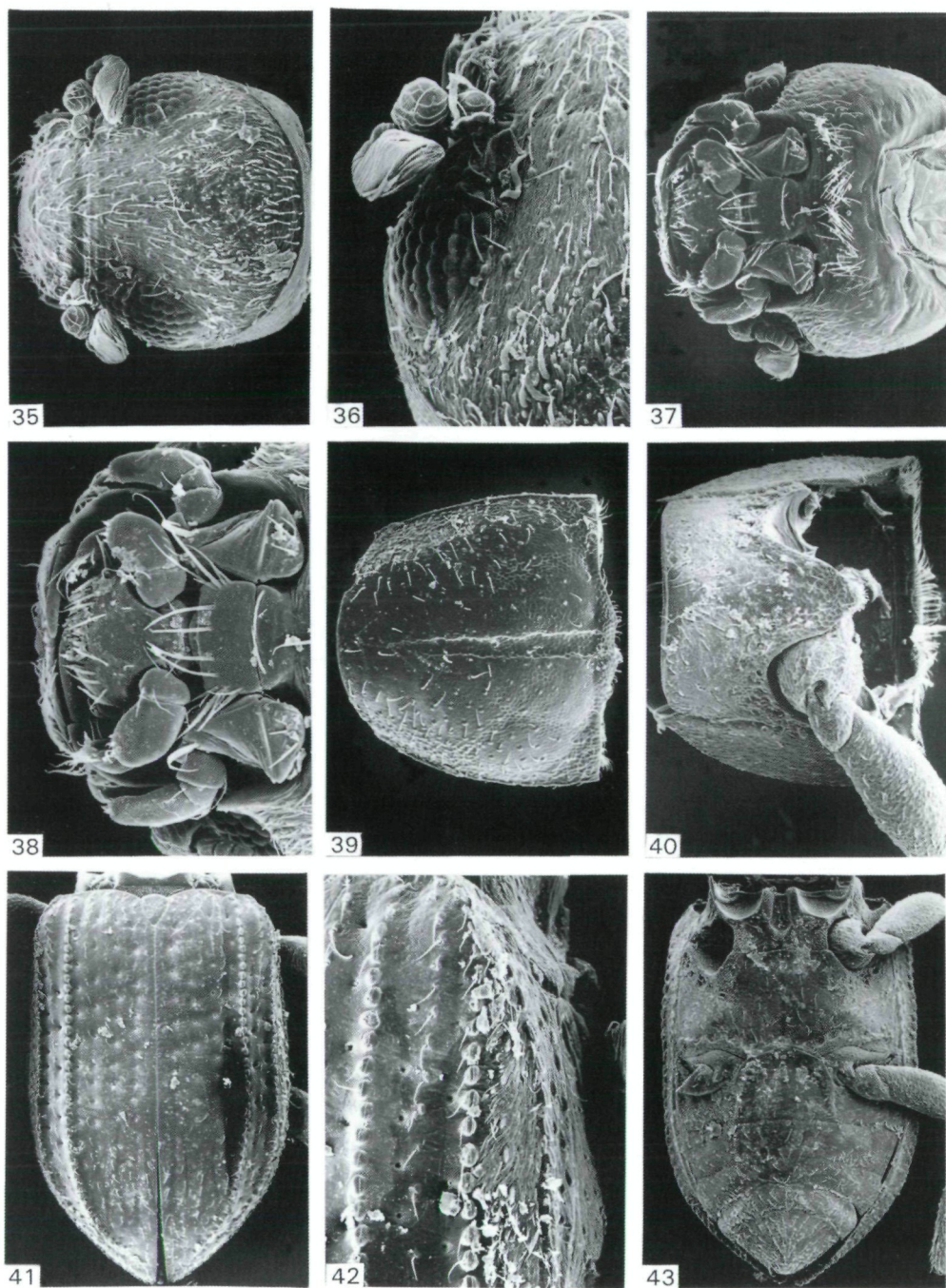


Figs. 25 - 33: Aedeagus of 25) *Aulacosolus spinosus*, ventral view, 26) same, lateral view, 27) *A. ? spinosus*, Sumatra, ventral view, 28) *Nesonychus gibbulus*, ventral view, 29) same, lateral view, 30) *Aulacosolus carinatus*, ventral view, 31) same, lateral view, 32) *Nesonychus kodadai*, ventral view, 33) same, lateral view.

Fig. 34: Ovipositor of *N. kodadai*.

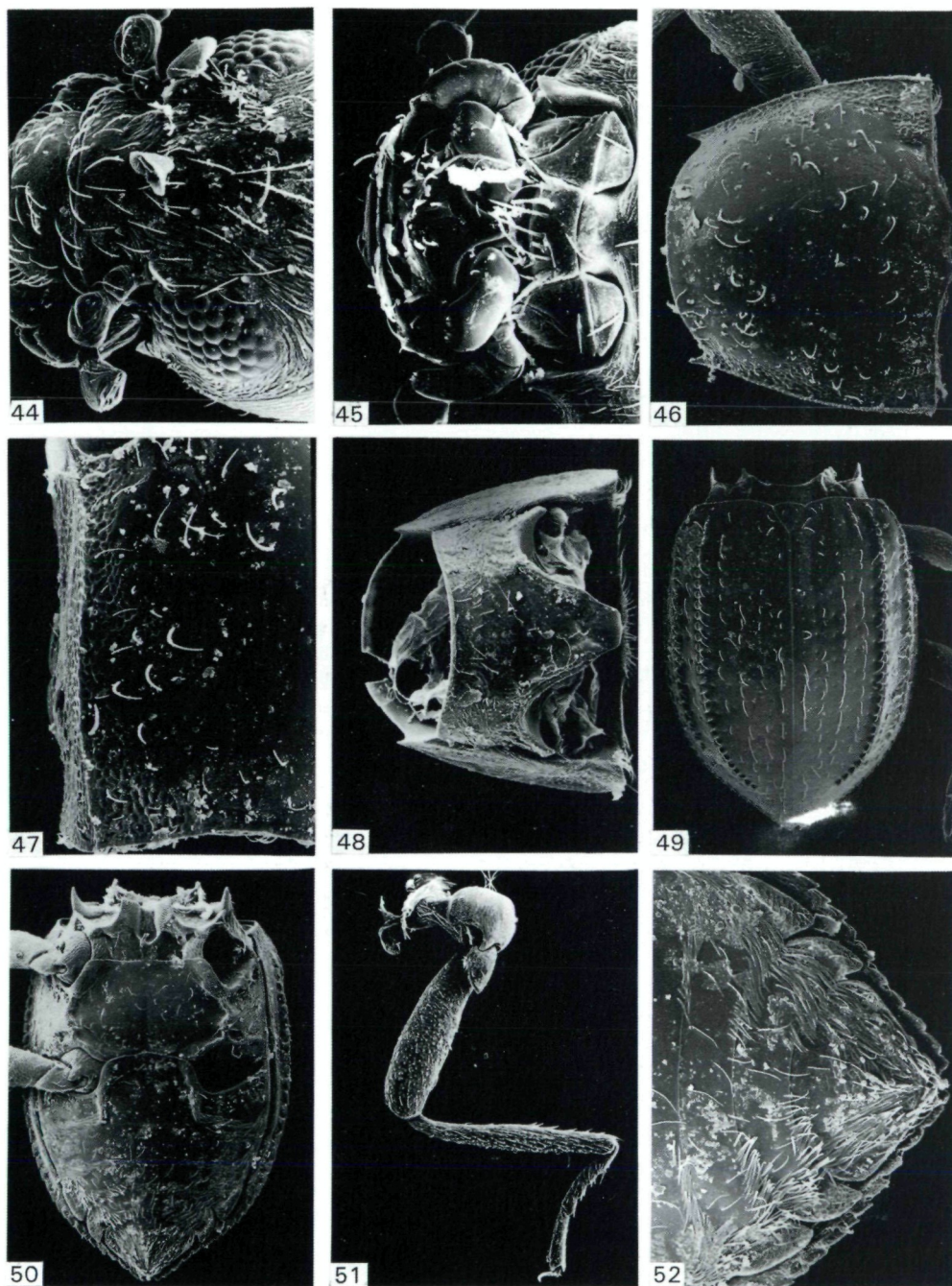
Details of ejaculatory duct omitted in Figs. 27, 29 - 31. Setae omitted in Figs. 27, 30, 31.





Figs. 35 - 43: *Aulacosolus tenuior*, 35) head, dorsal view, 36) same, enlarged, 37) head, ventral view, 38) same, enlarged, 39) pronotum, 40) prothorax, ventral view, 41) scutellum and elytra, dorsal view, 42) right elytron, humeral area, dorsolateral view, 43) meso- and metasternum, abdomen, ventral view.





Figs. 44 - 52: *Nesonychus kodadai*, 44) head, dorsal view, 45) head, ventral view, 46) pronotum, 47) same, lateral half, enlarged, 48) prothorax, ventral view, 49) scutellum and elytra, dorsal view, 50) meso- and metathorax and abdomen, ventral view, 51) fore leg, 52) abdominal apex.

### *Nesonychus* sp. 4

#### Material examined (NMW):

M A L A Y S I A: BORNEO: SARAWAK: 3 ♀♀: Lambir Hills, 30 km S Miri, 24.2.1993, leg. Jäch.

**DISCUSSION:** A distinctly different species which is characterized by the following features: Length (pronotum + elytra), ca. 1.00 mm; width, ca. 0.55 mm; pronotum entirely microreticulate and mat, microreticulation dense and strongly impressed, consisting of regular polygonal meshes; elytral disc superficially microreticulate and mat; elytra slightly impressed before middle and strongly vaulted (more strongly than in any other known species) along suture before declivity.

As long as males are unknown we refrain from a formal description.

### *Nesonychus* sp. 5

Numerous specimens from Malaysia (Sabah) were received shortly after the present paper was submitted. This species differs from *Nesonychus kodadai* mainly in the pronotum being mat (but not microreticulate) and in the elytral punctures being more distinct.

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