Phylogeography of the subfamily Scaphidiinae (Coleoptera、 Staphylinidae) in Sulawesi, with its systematic revision

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インドネシア・スラウェシ産デオキノコムシ亜科（コウチュウ目, ハネカクシ科）
の系統地理学と分類学的検討

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Abstract

Sulawesi, which is the largest island in the biodiversity hotspot of Wallacea as a transitional ecozone between the Oriental region and the Australasian region, has been formed through the collisions of three continental plates (Sundaland, Philippines, and Sahul). Thus this island's endemic fauna has multiple elements in phylogeography. The origins of Sulawesi's fauna have been debated on the variety of organisms by many authors, but those of invertebrate fauna are still controversial with regard to the role of "vicariance" versus "dispersal". As mycophagous beetles, the Scaphidiinae (Coleoptera, Staphylinidae) depend on the fungi grown up in humid forests and thus likely migrate with the forests on the continental plates in displacement. Therefore, phylogeographical studies of them are expected to support the "vicariance" hypothesis.

This study, for the consideration of the role of "vicariance" versus "dispersal" on the scaphidiine fauna in Sulawesi, analyzed the phylogenetic relationships of the Sulawesian scaphidiines (based on mitochondrial COI and nuclear 28S genes) together with morphological data and estimated the divergence time for the splits of Sulawesi lineages from sister-groups in Asia or Australia.

Prior to the phylogeographical study, my taxonomical study of Scaphidiinae from Sulawesi recognized 45 species of 13 genera with 31 undescribed species and many new records. The phylogenetic analyses of Sulawesian scaphidiines showed that the estimation of divergence time for the splits of Sulawesi lineages from sister-groups postdated the vicariant events from Asia and most Sulawesian species were related to the species distributed in Sundaland, supporting the "dispersal" hypothesis. However, the estimation of divergence time for the genus *Scaphidium* was consistent with the vicariant events from Australia and some of them were related to the species distributed in Sahul (New Guinea), indicating their origin of "vicariance". In conclusion, the Sulawesian's Scaphidiinae were predominantly derived from the "dispersal" of the Asian origin, but partly from the "vicariance" of the Australian origin.

Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Ogawa, R., Löbl, I., & Maeto, K. (2014) Three new species of the genus *Scaphicoma* Motschulsky, 1863 (Coleoptera, Staphylinidae, Scaphidiinae) from Northern Sulawesi, Indonesia. ZooKeys, (403): 1–13.

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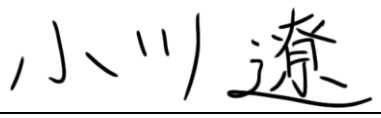

Ryo OGAWA February, 2015

Disclaimer: No name or nomenclatural act proposed in Chapter 4 should be considered valid as defined by the ICZN (2000) [Article 8.2].

Chapter 1 — Introduction

1. 1 Family Staphylinidae

The family Staphylinidae is one of the largest lineages of Coleoptera, commonly called the rove beetles, containing more than 59,000 described species of the 33 subfamilies (Grebennikov & Newton 2009; McKenna *et al*. 2014; Newton & Thayer 1992). The feeding habits of this family are diverse, i.e., mycophagous, predatory, or saprophagy, while some groups are known to have highly specialized habits and life histories; for instance, the larvae of *Aleochara* are parasitoids on the blow fly (Maus *et al*. 1998; Peschke & Fuldner 1977).

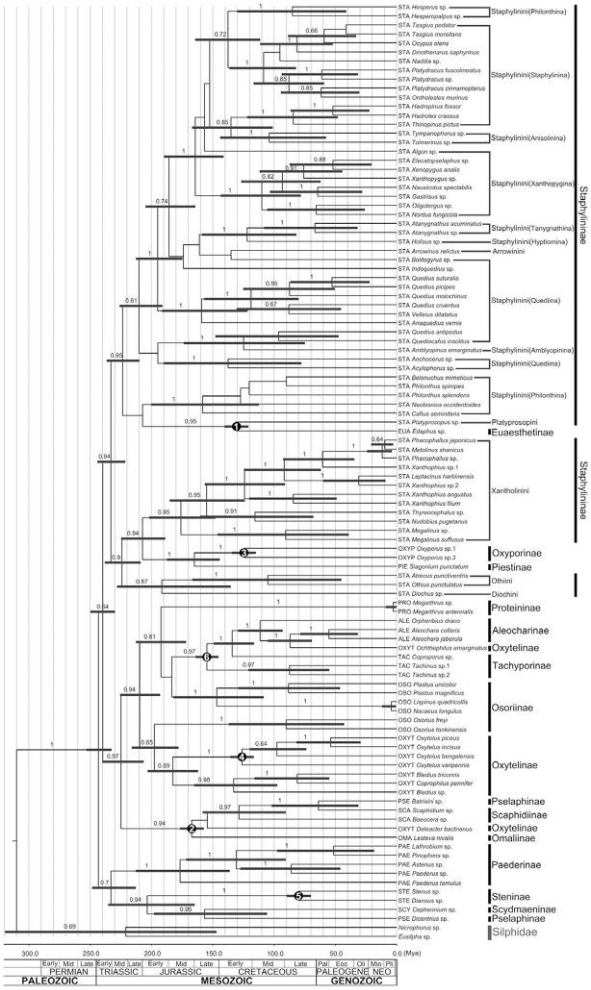

Fig. 1. BEAST chronogram of the family Staphylinidae, based on the combined analysis of COI+Wg+28S (Zhang & Zhou 2013).

Most staphylinids have short elytra and exposing abdominal segments, but the structure of their abdomen is very flexible with many exceptions, such as in the dasycerines, scaphidiines, pselaphines, scydmaenines, and silphines (Frank & Thomas 1999).

Zhang & Zhou (2013) has estimated the divergence time based on fossils available for calibration using three genes (mitochondrial COI, nuclear protein-coding wingless and the 28S ribosomal RNA) and supposed that the rove beetles dated from approximately the Early Triassic epoch and most lineages of the family started to radiate in the Late Jurassic to the Early Paleogene (Fig. 1).

1. 1. 1 Phylogeny of the Staphylinidae

Four major lineages were proposed within the Staphlinidae by Lawrence & Newton (1982, 1995), i.e., the Omaliine Group, the Tachyporine Group, the Oxyteline Group,

and the Staphylinine Group (Table 1).

Table 1. Four major lineages and subfamilies of the Staphylinidae, proposed by Lawrence & Newton (1982, 1995) (modified from McKenna *et al*. 2014).

Omaliine Group	Tachyporine Group	Oxyteline Group	Staphylinine Group
Dasycerinae Reitter	Aleocharinae Fleming	Apateticinae Fauvel	Euaesthetinae Thomson
Empelinae Newton & Thayer	Habrocerinae Mulsant & Rey	Osoriinae Erichson	Leptotyphlinae Fauvel
Glypholomatinae Jeannel	Olisthaerinae Thomson	Oxytelinae Fleming	Megalopsidiinae Leng
Micropeplinae Leach	Phloeocharinae Erichson	Piestinae Erichson	Oxyporinae Fleming
Microsilphinae Crowson	Tachyporinae MacLeay	Scaphidiinae Latreille	Paederinae Fleming
Neophoninae Fauvel	Trichophyinae Thomson	Trigonurinae Reiche	Pseudopsinae Ganglbauer
Omaliinae MacLeay	Pseudopsinae Ganglbauer		Solieriinae Newton & Thayer
Proteininae Erichson			Staphyliniae Latreille
Protopselaphinae Newton & Thayer			Steninae MacLeay
Pselaphinae Latreille			Scydomaeninae Leach
			(Silphidae Latreille)

Monophyly of the each four major staphylinid lineages mentioned above has not been supported by the recent morphological and/or molecular phylogenetic studies, while a part of the Omaline Group and most of the Oxyteline Group are most likely monophyletic (e.g., Hansen 1997; Ballard *et al*. 1998; Beutel & Leschen 2005; Caterino *et al*. 2005; Grebennikov & Newton 2012; Lawrence *et al* 2011).

The higher phylogeny of Staphyliniformia and Scarabaeiformia has been recently analyzed by Mckenna *et al*. (2014) based on the nuclear 28S rRNA and protein-coding gene CAD. They showed that the family Staphylinidae was monophyletic, including the family Silphidae, which had been treated as a sister group of the Staphylinidae (Fig. 2).

1. 1. 2 Mycophagy, myxomycophagy, and termitophily

The Staphylinidae are mostly carnivorous with some exceptions in the subfamilies Aleocharinae, Micropeplinae, Oxyporinae, Tachyporinae, and all those of the Oxyteline Group. The Oxyteline Group is often associated with decaying trees or other decaying matter and is entirely saprophagy or mycophagy in adults and larvae (Lawrence & Newton 1982, 1995; Newton 1984; Thayer 2005; Grebennikov & Newton 2012). Only the subfamily Scaphidiinae, which has been included in the Oxyteline Group, is a monophyletic group closely assoicated with fungi or myxomycetes in the Staphylinidae.

The termitophily in the Staphylinidae is often known as one of highly specialized habits (Seevers 1957), particularly within the subfamily Aleocharinae. Many termitophilous staphylinides are mostly carnivorous with the exception of the mycophagous Scaphidiinae and have the aberrant morphological features such as the limuloid or physogastric body form (Fig. 3).

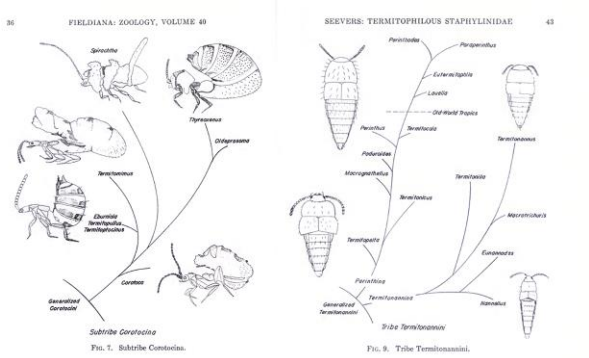

Fig. 3. The diverse-morphological features of the termitophilous Staphylinidae (Seevers 1957)

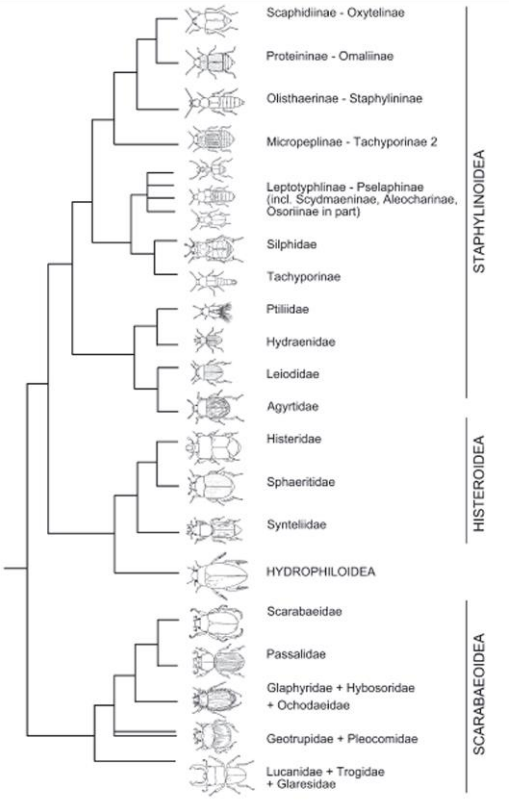

Fig. 2. The phylogenetic tree of the selected families, supra-familial taxonomic groups, and subfamilies of Staphylinidae recovered in the Bayesian phylogenetic analysis. (McKenna et al. 2014)

1. 2 Subfamily Scaphidiinae

The subfamily Scaphidiinae has over 1,500 described species worldwide, belonging to four tribes Cyparinii, Scaphidiini, Scaphiini, and Scaphisomatini (Löbl 1997; Leschen & Löbl 2005). It has been treated as a monophyletic group, differing from the majority of Staphylinidae by having several characters: a modified teardrop- or box-shaped, highly convex body, and the elytra covering most of the abdomen (Leschen & Löbl 2005; Löbl & Leschen 2003; Thayer 2005). The Scaphidiinae had been hitherto treated as a family, but it was first recognized as a subfamily of Staphylinidae by Kasule (1966) based on larval characters, and it has been placed in the Oxyteline Group (Lawrence & Newton 1982; Newton & Thayer 1992).

Some fossils of this subfamily have been known (e.g., Heer 1847, 1862;

Weyenbergh 1869). *Scaphidiopsis hageni* is the oldest scaphidiine occurring in the Late-Jurassic (150.8–145.5 Ma) in Germany and the remaining two species, *Scaphidium deletum* and *Scaphisoma gracile*, was obtained from the Cenozoic era (12.7–11.6 Ma) in Germany. The divergence times estimated by Zhang & Zhou (2013) indicated that the scaphidiines and all other subfamilies of the staphylinids had come into existence in the Late-Triassic.

Most Scaphidiinae are known as mycophagous beetles, while some have been obtained from the Myxomycetes or slime molds and the fungi in termite fungus gardens or combs (e.g., Champion 1927; Leschen & Löbl 2005; Löbl 1982). Newton (1984) has comfirmed that two genera *Baeocera* and *Scaphobaeocera* feed on the Myxomycetes or slime molds (cf., Newton & Stephenson 1990). A few host records of the termitophilous scaphidiines were reported by Leschen & Löbl (2005). They are exclusively associated with the subfamiliy Macrotermitinae of the family Termitidae, which cultivates fungus gardens of the genus *Termitomyces*.

1. 2. 1 Phylogeny of the Scaphidiinae

Phylogenetic relationships of the subfamily Scaphidiinae were studied based on morphological characters by Löbl & Leschen (1995) and Leschen & Löbl (2005), but hitherto they have not been analyzed based on the molecular data.

Leschen & Löbl (2005) conducted a cladistic analysis of the world genera of the tribe Scaphisomatini based on 47 terminal taxa and 110 adult characters. As a consequence, they indicated two large lineages including six generic groups: Lineage A (*Amalocera*, *Scaphisoma*, and *Baeoceridium* groups) and Lineage B (*Baeocera*, *Birocera*, and *Toxidium* groups). Both *Scaphisoma* and *Baeocera* groups are well-supported monophyletic groups and the monophyly of the *Baeoceridium* group, which is associated with the cultivated fungus gardens by termites, is also supported by a large number of morphological synapomorphies and unique feeding habit.

1. 2. 2 Sulawesian scaphidiines

Fourteen Sulawesian species of the scaphidiines belonging to seven genera are known hitherto as follows: *Baeocera derougemonti* Löbl, 1983, *Baeoceridium celebense* Löbl, 1982, *Birocera derougemonti* Löbl, 1982, *Birocera puntatissima* (Reitter, 1880),

Scaphicoma sp. *sensu* Leschen & Löbl 2005, *Scaphidium celebense* Pic, 1915, *Scaphidium sondaicum* Gestro, 1879, *Scaphisoma bugi* Löbl, 1983, *Scaphisoma latitarse* Löbl, 2012, *Scaphisoma napu* Löbl, 1983, *Scaphisoma obliquemaculatum* Motschulsky, 1863, *Scaphisoma palu* Löbl, 1983, *Scaphisoma sandang* Löbl, 1983, and *Termitoscaphium kistneri* Löbl, 1982 (Löbl 1982, 1983, 2012; Leschen & Löbl 2005). Two of them, *B. celebense* and *T. kistneri*, were described as termitophilous beetles. Also, some other undescribed species from Sulawesi have been reported by Löbl (1983). In this study, moreover, I have found a lot of undescribed or unrecorded species from Sulawesi.

1. 3 Sulawesi Island

Sulawesi, which is located between Borneo and the Moluccas and formerly called Celebes, is the largest island in the biodiversity hotspot of Wallacea (Bibby *et al*. 1992; Cardillo *et al*. 2006; Mittermeier *et al*. 1998). Twenty five areas have been chosen as the biodiversity hotspots, and eight of them are a higher-priority important area for the conservation, which are called “silver bullet” strategy on the conservation plan for the life of humankind and the financial reasons (Myers *et al*. 2000). Therefore, the use district (zonation or zoning) of the hotspot areas have been required to pick out whether is available for human activities (e.g. agriculture) while the biodiversity is kept (Burkard & Fremerey 2008; Nasution et al. 2013; Whitten et al. 1987).

1. 3. 1 Wallacea

Wallacea is the appellation of a transitional ecozone between the Oriental region — the Asian (Sunda) Shelf with Borneo, Java, and Sumatra — and the Australasian region — the Australian (Sahul) Shelf with New Guinea (Fig. 4).

Alfred Russel Wallace, who travelled within the Malay Archipelago between 1853 and 1862, drew a faunal boundary line between Asian and Australian origins in 1863, which was later coined as the Wallace line by Huxley (1868). Concurrently, the Wallace line was modified by Huxley to include all the oceanic islands of the Philippines as shown in Fig. 4 (Mayr 1944; Simpson 1977; Cox 2001). After that, Lydekker (1896) proposed a boundary line later called the Lydekker line, as an easternmost extension limit of Oriental animals. In addition, the Weber line is known as the midpoint (balance)

where Asian and Australian fauna are approximately equally represented (Weber 1902).

Wallacea is currently defined as the geological space between the Wallace line and Lydekker line (Dickerson *et al*. 1928). Recently, Wallace's biogeographic regions have been updated by Holt *et al*. (2013), who placed Sulawesi into the Oriental region and strongly supported the Weber line, although they dealt with only terrestrial vertebrates and not with invertebrates as well as fish (Fig. 5).

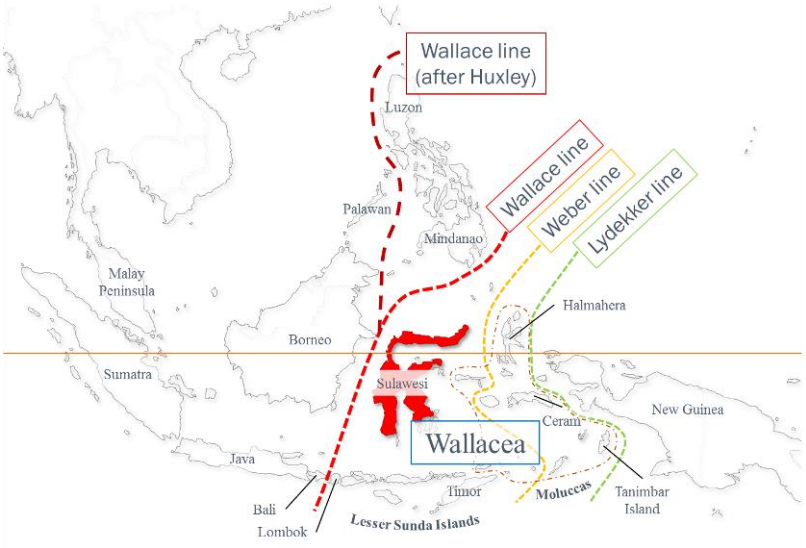

Fig. 4. Map showing the Southeast Asia, the region of Wallacea, and its biogeographic boundary lines.

Fig. 5. Maps showing the zoogeographic regions of the world (Wallace 1876: above; Holt *et al*. 2013: below).

1. 3. 2 Geological history of Sulawesi

Wallacea has a highly complex geological history and is the place where the collision is going between three continental plates, i.e., Sundaland (including Borneo, Sumatra, and Java), the Philippines, and Australia (Hall 2009; Stelbrink *et al*. 2012). Sulawesi is located at the center of this collision zone, and its geological history is described by Spakman & Hall (2010) and Hall (2012) as shown in Fig. 6. The West Sulawesi was a part of the Asian margin (Sunda) in Late Cretaceous and separated from it in the Eocene of Cenozoic (ca. 45 Ma) by the rifting that led to the formation of the Makassar Straits. The North Sulawesi existed as a volcanic arc near the Philippines in the Eocene. A large promontory, the Sula spur, which was the northern part of the Australian continental margin (Sahul), caused the subduction at the Java Trench leading to the extension of the Sula spur and collided with the west Sulawesi and the North Sulawesi in the Early Miocene (ca. 23–20 Ma). At last, Sulawesi has been formed by such subsequent collisions between two continents (Sunda and Sahul) and a volcanic arc (near the Philippines).

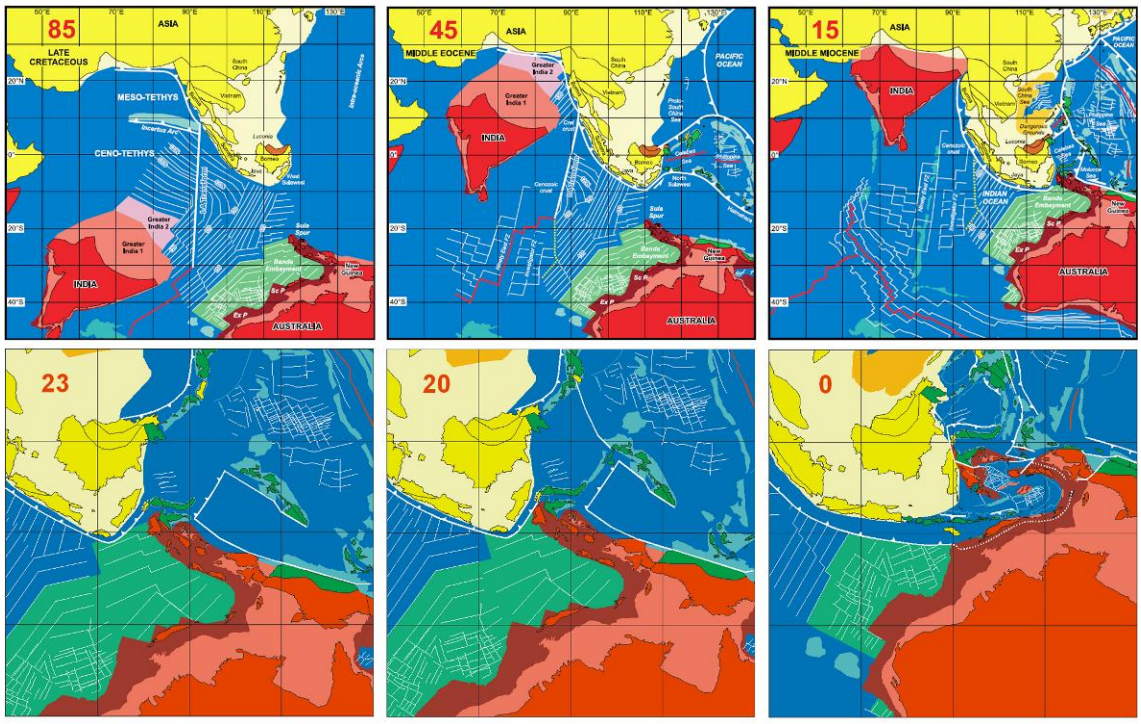

Fig. 6. Geological history of the Australia – SE Asia collision (Hall 2012: above; Spakman & Hall 2010: below). The upper left figures show geological time (Mega annum).

1. 3. 3 Invertebrate biogeography of Sulawesi

The origin of some endemic invertebrates to Sulawesi, involving mite harvestmen, giant freshwater prawn, water beetles, freshwater crabs, cockroaches, net-winged beetles, and grasshoppers, has been discussed (Stelbrink *et al*. 2012; Michaux 2010), indicating that they are predominantly Asian origin. Indeed, the Asian origin of Sulawesi's fauna is well supported by recent molecular phylogenetics involving in many vertebrate taxa from across Wallacea, but it is still controversial with regard to the role of "vicariance" and "dispersal" to form current distribution patterns. According to Michaux (2010), "vicariance" can be also interpreted as "tectonic dispersal" and likely depends on the past distribution of land areas. Moreover, "dispersal" can be also interpreted as "rafts" and likely depends on the past drift through natural driftage. Stelbrink *et al*. (2012) discussed the origin of Sulawesi's fauna using a comparative approach based on dated phylogenies and geological constraints and therefore estimated the divergence time for the split of Sulawesi's lineages on invertebrates and vertebrates. As a consequence, only one arthropod taxon (mite harvestmen) was supported to be consistent with the tectonic dispersal vicariance hypothesis from the Asian plate. Sulawesi's fauna of most other invertebrates seems to have been formed by "dispersal", but this topic is still controvertible.

The mycophagous Scaphidiinae depend on the fungi grown up in the forests, the stable condition of which is essential to their habitats. If the forests migrate through the continental displacements, they also likely migrate together with the displacements.

1. 4 Aims of this study

The aim of this study is to discuss the origin of the subfamily Scaphidiinae in Sulawesi after three approaches as follows: (1) to analyze the phylogenetic relationships of the higher taxa within the Scaphidiinae based on the nuclear 28S ribosomal RNA to make sure of the monophyly of target groups of (2), (2) to analyze the interspecific relationships of target groups based on the mitochondrial gene cytochrome oxidase I (mtCOI) as well as on morphological characters after the systematic revision of Sulawesian species, and (3) to consider the origin of Sulawesi's fauna to be "vicariance" or "dispersal".

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Chapter 2 — Materials and Methods

2. 1 Sampling methods

To make sampling of scaphidiine beetles, I followed the methods as described by Löbl & Leschen (2003).

1) Mass collection by hand sorting

This is the collecting method of small beetles from the mixed debris of sifted leaf litter, rotten wood, and fungi, using a set of sieve and tray. The beetles were gathered with an insect aspirator after hand sorting.

2) Hand collecting

This is a method by which the beetles are directly captured from fungi. It is convenient for getting living materials, making observation of host associations, and locating adults or larvae usually concealed in frass-covered tunnels of Basidiomycetes or among sporocarps of Myxomycetes.

3) Collection in flight intercept traps (FITs)

This is a useful method for capturing specimens of flight-capable rare species. The trap was mainly composed of the plastic folders and cups as shown in Fig. 2–1 (Maruyama 2006; Masner & Goulet 1981; Peck & Davies 1980). Saturated saline-water was used as stock solution. Several traps were set in prime forests with rich fallen trees and leaf litter for 1~2 days.

Fig. 2–1. Photo showing the flight intercept traps put on the fields.

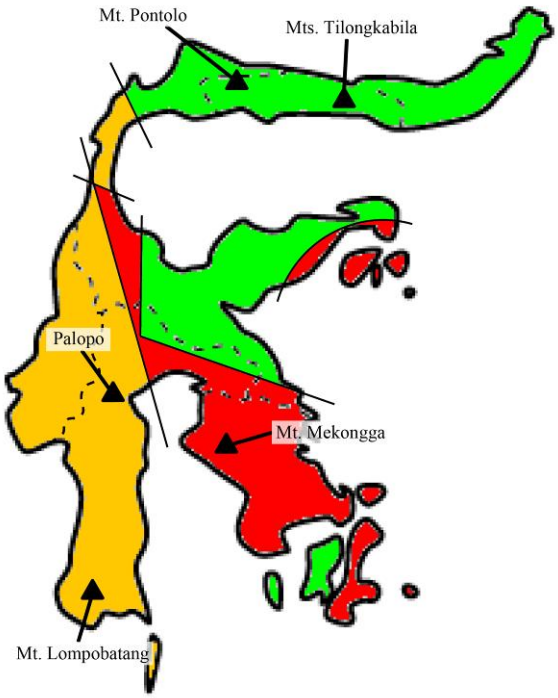

Fig. 2–2. Map of Sulawesi, showing the sampling localities. Dash lines show the administrative boundary of provinces. The colors show the geological elements of the Sundaland (Yellow), Philippines (Green), and Australia (Red) (Spakman & Hall 2010).

2. 1. 1 Sampling localities

The sampling localities are showed in Fig. 2–2. I selected five mountains for sampling from three administrative districts likely related with the elements of the Sundaland, Philippines, and Australian (Spakman & Hall 2010; Table 2–1).

In South Sulawesi (Sulawesi Selatan), mountain ranges of Lompobatang are continued toward northwest with a high altitude and interrupted at south of montain ranges of Palopo district. A gap as plain field exists between both mountains.

Mountain ranges of Tilongkabila and Pontolo are adjacent mountains centering on the town of Gorontalo and an adjacent area between them is a gap.

Mt. Mekongga is present in Southeast Sulawesi (Sulawesi Tenggara) and a plain field spreads from the mountain to the southeast.

Table 2–1. The details of sampling localities

Administrative district	**Locality**	**Peak altitude**	**Element of geological history**
South Sulawesi (Sulawesi Selatan)	Mt. Lompobatang	ca. 2900 m	Sundaland
	Palopo district	ca. 1900 m	Sundaland
Gorontalo	Mt. Pontolo	ca. 2000 m	Philippines
	Mts. Tilongkabila	ca. 1500 m	Philippines
Southeast Sulawesi (Sulawesi Tenggara)	Mt. Mekongga	ca. 2700 m	Australian

2. 1. 2 Deposition of voucher specimens

The specimens examined were collected by my own self or had been deposited at the British Natural History Museum, London (BMNH); Ehime University Museum, Matsuyama, Japan (EUMJ); Muséum national d'Histoire naturelle, Paris, France (MNHN); and the Muséum d’histoire naturelle, Genève, Switzerland (MHNG). For extracting DNA, I mainly used the specimens that I collected in Sulawesi. Voucher specimen, including holotypes, will be deposited at Museum Zoologicum Bogorience, Bogor, Indonesia (MZBI), BMNH, MNHN, and MHNG. Most paratypes and the remaining specimens, from which DNA was extracted, will be deposited at EUMJ and

Hasanuddin University, R. Ogawa collection, Makassar, Indonesia (HUOI).

2. 1. 3 Taxon sampling for molecular phylogenetics

Table 2–3 shows all taxa used in molecular analyses. DNA was extracted from the 59 species belonging to 14 genera of the Scaphidiinae from Sulawesi. Additional DNA sequences of Scaphidiinae and other Staphylinidae and Silphidae (as outgroups) were obtained from the GenBank database, at which they were deposited by Chatzimanolis *et al*. (2010), Zhang Zhou (2013), and McKenna *et al*. (2014).

2. 2 Dissection and morphological observation

The dissecting method of adult specimens mainly followed by Löbl & Leschen (2003). Microstructures were observed by using SEM (JEOL® JSM-6010LV) without gold coating. The photos of habitus in dorsal and lateral views were taken by a single-lens reflex camera (CANON® EOS Kiss X7) with a macro photo lens (CANON® MP-E 65mm Macro lens) attached to the stand (LPL® CSC-10). A stereomicroscope (OLYMPUS® SZ61) and biological microscope (NIKON® ECLIPSE 50i) with the single-lens reflex camera (described above) were used for getting illustrations, which were later edited with ADOBE® Illustrator. The dissected specimens were preserved in the manner of Maruyama (2004), using half a cover glass, glue, and euparal. The measurements of body length and width were taken with an ocular micrometer under the stereomicroscope. The specimens were measured in dorsal view as shown in Fig. 2–3. Antennae were measured on slide-mounted specimens under the biological microscope.

2. 3 Morphological terminology

The terminology of morphological structures for the description of Scaphidiinae species was described by Ogawa & Löbl (2013). Only a term ‘paramesepimeron’ (see Chapter4, Fig. 4–10c), which is exclusively recognized as a part of mesepimeron in *Scaphidium*, is newly added in this study (Fig. 2–3).

As shown in Fig. 2–3, the body parts were measured in dorsal view and abbreviated as follows: the length of elytra from posterior end of pronotum to apex of elytra (EL); maximum width of elytra (EW); maximum width of head including eye

(HW); width of interspace between eyes (ID); maximum length of pronotum (PL); and maximum width of pronotum (PW).

2. 4 DNA extraction, amplification, and sequencing

Dried specimens and those preserved in 95–100% EtOH were provided for DNA extraction. Total genomic DNA was extracted from each specimen (thorax, legs, or entire specimen) by using the DNeasy® Blood & Tissue Kit (Qiagen, Inc.). PCR amplification was carried out in 25 μL reactions: 12.5 μL 5X buffer, 5 μL 2mM dNTPs, 0.5 μL of each primer (10 pM), 1 μL milli-Q water, 0.5μL KOD FX Neo polymerase (Toyobo), 5 μL extracted DNA (if necessary, diluted by milli-Q water).

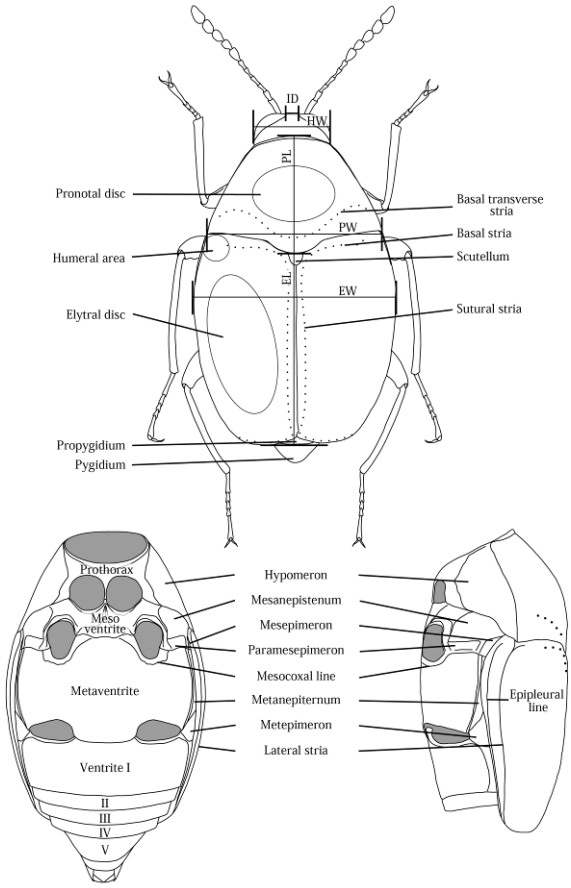

Fig. 2–3. General morphology of the adult showing body parts for biometric measurements and terminology. Dorsal view (above), ventral view (left below), and lateral view (right below) of *Scaphidium celebense* Pic, 1915

The paired primers C1-J-2195 (TTGATTTTTTGGTCATCCAGAAGT; Simon *et al*. 1994) and TL2-N-3014 (TCCAATGCACTAATCTGCCATATTA; Simon *et al*. 1994) were used to yield approximately 800-bp product for the cytochrome oxidase I gene of mitochondrial DNA (mtCOI) (Leschen *et al*. 2008). When the amplification was a failure, the forward primer C1-J-2183 (CAACATTTATTTTGATTTTTTGG; Simon *et al*. 1994) was used instead of C1-J-2195. A pair of primers, NFL184/21 (ACCCGCTGAAYTTAAGCATAT; Van der Auwera *et al*. 1994) and LS1041R (TACGGACRTCCATCAGGGTTTCCCCTGACTTC; Maddison 2008), were used to yield approximately 1200-bp product for the 28S gene of nuclear ribosomal RNA. The alternate primers, LS58F (GGGAGGAAAAGAAACTAAC; Ober 2002) and LS998R

(GCATAGTTCACCATCTTTC; Ober 2002), were also used. The typical amplification protocols were as follow: for COI, 2min at 94°C (predenaturation), 40 cycles of 30s at 98°C (denaturation), 30s at 48°C (annealing) and 1min at 68°C (extension), 5min at 68°C (final extension), and hold at 12°C; for 28S, 5min at 94°C, 40 cycles of 45s at 98°C, 30s at 48°C, and 1min at 68°C, 5min at 68°C and 12°C. PCR reaction was run on Bio-Rad T100^{TM} Thermal Cycler. PCR products were purified by using illustra^{TM} GFX^{TM} PCR Purification kit (GE Healthcare Life Sciences) and were amplified by using the ABI PRISM® BigDye® Terminator v3.1 Cycle Sequencing kit (Applied Biosystems). I also used illustra^{TM} GFX^{TM} PCR Purification kit for the gel extracted 28S amplification products when the extra bands were obtained. The purified PCR products were further purified by using HiDi^{TM}Formamide (Applied Biosystems) or AGENCOURT® CLEANSEQ® Dye-Terminator Removal for the following detector. Cycle sequencing reactions were carried out on ABI PRISM® 3100 Genetic Analyzer (Applied Biosystems).

2. 5 Sequence alignment, model selection, and phylogenetic analyses

Sequences data were assembled and edited by using the DNA Dynamo Sequence Analyze Software (Blue Tractor Software) or MEGA 6.0 (Tamura *et al*. 2013). The alignments were conducted on Clustal W (http://www.genome.jp/tools/clustalw/) for COI and on the E-INS-I algorithm in MAFFT v6.864 (http://www.genome.jp/tools/mafft/) for 28S.

The Bayesian analyses were executed by using MrBayes v3.2 (Huelsenbeck & Ronquist 2001; Ronquist *et al*. 2012). The best-fit substitution model was selected by using the MrModelTest 2.3 (Nylander 2004) with PAUP 4.0beta (Swofford 2002) under the Akaike's information criterion (AIC). The analyses ran for 1 802 000 generations, each having four chains, default heating, and sampling every 1000 generations. Tracer v1.6 was used as a convergent diagnostic tool to estimate the time of burn-in.

The maximum likelihood analyses were performed by using raxmlGUI v1.3 (Silvestro & Michalak 2012), through the rapid bootstrap algorithm with 1000 replicates. All analyses were executed under a model of GTR+I+Gamma.

Maximum likelihood reconstruction methods for ancestral state reconstruction were conducted using the model Mk1 in Mesquite v2.75 (build 564) (Maddison &

Maddison 2011). The ecological character states of taxa were referred from the published literature (Lawrence & Newton 1982, 1995; Newton 1984; Thayer 2005; Grebennikov & Newton 2012).

The estimation of divergence time was performed using an MCMCTREE (Yang & Rannala 2006; Rannala & Yang 2007; Inoue *et al*. 2010; Miya *et al*. 2013; Springer *et al*. 2012). The branch lengths were estimated on maximum likelihood under the GTR+Gamma substitution model with independent-rates. Analyses for MCMC approximation were run with samples taken every 50 cycles in order to create a total of 10,000 samples after a burn-in period of 10,000 cycles.

Ten fossil-based time constraints on seven nodes were used (Table 2–2). Using the two shape parameters (p and c) of the Cauchy distribution, the minimum- and maximum-bound densities were estimated. For searching the fossil records, I mainly used a website of "fossil works" (http://fossilworks.org/bridge.pl).

Table 2–2. Fossil data for the estimation of divergence time using MCMCTREE.

Most recent common ancestor of	**Species**	**Absolute age estimation**	**References**
Silphidae+Staphylinidae	*Leehermania prorova*	231.5 Ma	Chatzimanolis *et al*. (2012)
Nicrophorinae+Silphinae	Nicrophorinae sp. and Silphinae sp.	165 Ma	Cai *et al*. (2014b)
Tachyporinae	*Mesotachinus major*	160.2 Ma	Sharov (1968)
Oxytelinae	*Mesoxytelus* sp.	154 Ma	Yuo *et al*. (2010)
	Oxytelus pristinus	50.3 Ma	Scudder (1875)
Apateticinae+Trigonurinae	*Kovalevia onokhoica*	138 Ma	Ryvkin (1990)
Olisthaerinae	*Protolisthaerus jurassicus*	165 Ma	Cai *et al*. (2014a)
Scaphidiinae	*Scaphidiopsis hageni*	154.7 Ma	Weyenbergh (1869)
Scaphidium	*Scaphidium deletum*	12.15 Ma	Heer (1847)
Scaphisoma	*Scaphisoma gracile*	12.15 Ma	Heer (1847)

Table 2–3. Taxa, GenBank accession numbers, and references of the specimens used for molecular phylogenetics in this study. All "o" are my original data but not yet registered in the Genbank.

Family	Subfamily	Tribe	Speices	Identification code on label	28S	COI	Reference
Silphidae			*Nicrophorus* sp.	-	JX878746	-	Zhang & Zhou (2013)
			Nicrophorus tomentosus	-	KJ845105	-	McKenna *et al*. (2014)
			Oiceoptoma inaequale	-	KJ844996	-	McKenna *et al*. (2014)
			Eusilpha sp.	-	JX878745	-	Zhang & Zhou (2013)
Staphylinidae	Apateticinae		*Apatetica* sp.	-	KJ844960	-	McKenna *et al*. (2014)
	Olisthaerinae		*Olisthaerus substriatus*	-	KJ844932	-	McKenna *et al*. (2014)
	Oxytelinae	Euphaniini	*Deleaster peckorum*	-	JX878724	-	Zhang & Zhou (2013)
			Oxypius peckorum	-	KJ844984	-	McKenna *et al*. (2014)
		Oxytelini	*Oxytelus bengalensis*	-	JX878726	-	Zhang & Zhou (2013)
			Oxytelus incisus	-	JX878727	-	Zhang & Zhou (2013)
			Oxytelus piceus	-	JX878728	-	Zhang & Zhou (2013)
			Oxytelus varipennis	-	JX878729	-	Zhang & Zhou (2013)
	Paederinae		*Paederus* sp.	-	GU377340	-	Chatzimanolis *et al*. (2010)
	Piestinae		*Piestus extimus*	-	KJ844984	-	McKenna *et al*. (2014)
			Siagonium punctatum	-	JX878736	-	Zhang & Zhou (2013)
	Tachyporinae		Gen. Unknown. sp.	O16	o	o	-

			Gen. Unknown. sp.	O17	o	o	-
	Trigonurinae		*Trigonurus crotchii*	-	KJ845111	-	McKenna *et al*. (2014)
	Scaphidiinae	Cyparini	*Cyparium concolor*	-	KJ845083	-	McKenna *et al*. (2014)
			Cyparium sp.	O'6	o	-	-
			Cyparium sp.	O'7	o	-	-
		Scaphiini	*Scaphium castaneipes*	-	KJ845099	-	McKenna *et al*. (2014)
		Scaphidiini	*Scaphidium celebense*	O’42	-	o	-
			Scaphidium celebense	O’43	-	o	-
			Scaphidium celebense	O’44	-	o	-
			Scaphidium celebense	O73	o	o	-
			Scaphidium celebense	O74	o	o	-
			Scaphidium celebense	O84	o	o	-
			Scaphidium grande-complex	O64	-	o	-
			Scaphidium grande-complex	O65	o	o	-
			Scaphidium medionigrum	O67	o	o	-
			Scaphirium picconi	O68	o	o	-
			Scaphidium quadrimaculatum	O'5	o	o	-
			Scaphidium reitteri	O63	o	o	-
			Scaphidium sp.	-	JX878738	-	Zhang & Zhou (2013)

		Scaphidium sp.	-	KJ845044	-	McKenna *et al*. (2014)
		Scaphidium spp.	O66	o		-
		Scaphidium sp1	O'2	-	o	-
		Scaphidium sp1	O'30	-	o	-
		Scaphidium sp2	O'3	-	o	-
		Scaphidium sp3	O83	o	o	-
		Scaphidium sp4	O’31	-	o	-
		Scaphidium sp4	O’33	-	o	-
		Scaphidium sp4	O58	o	-	-
		Scaphidium sp4	O70	o	o	-
		Scaphidium sp4	O81	-	o	-
		Scaphidium sp5	O'4	o	o	-
		Scaphidium sp9	O69	o	o	-
		Scaphidium sp9	O75	o	o	-
		Scaphidium sp9	O'8	o	-	-
	Scaphisomatini	*Baeocera nr. deroungemonti*	O'40	o	-	-
		Baeocera sp.	-	KJ845084	-	McKenna *et al*. (2014)
		Baeocera sp.	-	JX878737	-	Zhang & Zhou (2013)
		Baeoceridium celebense	O'12	o	o	-
		Bironium amicale	O21	o	-	-

	Bironium amicale	O22	o	-	-
	Bironium sp. Malaysia	O'1	o	-	-
	Pseudobironium sp. Malaysia	O'98	o	-	-
	Sapitia vericolor	O'54	o	o	-
	Scaphicoma sp1	O4	o		-
	Scaphicoma sp1	O86	o		-
	Scaphicoma bidentia	O11	o		-
	Scaphicoma bidentia	O13	o		-
	Scaphicoma bidentia	O14	o		-
	Scaphicoma quadrifasciata	O5	o		-
	Scaphicoma quadrifasciata	O41	o		-
	Scaphicoma quadrifasciata	O48	o		-
	Scaphicoma subflava	O85	o		-
	Scaphicoma subflava	O88	o		-
	Scaphicoma sp2	O10	o		-
	Scaphicoma sp2	O32	o		-
	Scaphicoma sp2	O33	o		-
	Scaphicoma hiranoi	O'21	o	o	-
	Scaphicoma pallens	O90	-	o	-

	Scaphicoma sp1. Taiwan	O77	-		-
	Scaphisoma palu	O'91	o		-
	Scaphisoma sp.	O'92	o		-
	Scaphisoma sp3	O'95	o		-
	Scaphisoma sp8	O'96	o		-
	Scaphisoma sp. *Bali*	O93	o		-
	Scaphisoma sp5	O76	o		-
	Scaphisoma sp1. Malaysia	O'99	o		-
	Scaphisoma sp2. Malaysia	R2	o		-
	Scaphisoma sp3. Malaysia	R3	o		-
	Scaphisoma sp4. Malaysia	R5	o		-
	Scaphisoma latitarse	O'88	o		-
	Scaphisoma napu	O'93	o		-
	Scaphisoma palu	O'87	o		-
	Scaphisoma sadang	O'94	o	o	-
	Scaphisoma tricolor	O54	o		-
	Scaphisoma tricolor	O8	o		-
	Scaphisoma tricolor	O94	o		-

	Scaphisoma tricolor	O91	o		-
	Scaphisoma tricolor	O92	o		-
	Scaphisoma tricolor	O72	o		-
	Scaphisoma tricolor	O35	o		-
	Scaphisoma tricolor	O56	o		-
	Scaphisoma tricolor	O34	o		-
	Scaphobaeocera sp1	O30	o	-	-
	Scaphobaeocera sp2	O98	o	-	-
	Scaphobaeocera sp3	O99	o	-	-
	Scaphobaeocera sp. Malaysia	R1	o	-	-
	Scaphoxium sp. Malaysia	R4	o	-	-
	Termitoscaphium sp. Borneo	O'53	o	o	-
	Vituratella termitophila	O78	o	o	-
	Vituratella termitophila	O'13	o	o	-
	Xotidium sp. Taiwan	O96	o	-	-
	Xotidium sp1	O97	o	-	-

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Chapter 3 — Phylogeny of the Subfamily Scaphidiinae

3. 1 Phylogenetic analyses based on 28S sequences

The phylogeny recovered under the Bayesian (BI: Bayesian Inference) and maximum likelihood analyses (MLE: Maximum Likelihood Estimation) based on 28S sequences showed that Staphylinidae (1.0 BPP: Bayesian Posterior Probability, 72 MLB: Maximum Likelihood Bootstrap) and Scaphidiinae (1.0 BPP, 98 MLB) were each monophyletic group (Fig. 3–1). A sister group of Scaphidiinae was Olisthaerinae (0.92 BPP, 52 MLB) here, but this sister-group relationship is still unclear because some previous studies have shown other sister-groups. McKenna *et al*. (2014) (also, Leschen & Löbl 2005) indicated that Apateticinae and Scaphidiinae were sister-groups, but this sister-group was not supported relationships by my tree. In contrast, Grebennikov & Newton (2012) found a weak support for the sister-group relationship of Scaphidiinae and the Oxyteline Group but not Apateticinae based on morphological characters, while my tree did not support the Oxyteline Group *sensu* Hansen (1997). Such unclear relationships for the sister-group of Scaphidiinae must be due to the limited taxon sampling.

The Scaphidiinae under my tree, being indicated to be a monophyletic group, included the four tribes proposed by Löbl (1997), i.e., Scaphisomatini, Scaphiini, Scaphidiini, and Cyparini. In the tribe Scaphisomatini, some well-supported monophyletic groups were shown as below: *Baeocera* group, *Bironium*, *Scaphicoma*, *Scaphisoma* group, and the termitophilous scaphidiines.

The *Baeocera* group was consisted of two genera *Scaphobaeocera* and *Baeocera*. My MLE (Fig. 3–5) excluded *Xotidium* and *Baeocera derougemonti*, but my BI (Fig. 3–4) included *Xotidium* as polytomy. Leschen & Löbl (2005) supported the sister-group relationship of *Scaphobaeocera* and *Baeocera* based on morphological characters, and they showed that *Xotidium* was located intermediately between the *Baeocera* group and the *Toxidium* group (including *Scaphicoma*). My tree recovered under BI was consistent with their conclusion based on morphological characters. The *Scaphobaeocera* clade was strongly supported to be a monophyletic group (1.0 BPP, 100 MLB). A Chinese species of *Baeocera* (Zhang & Zhou 2013) was involved in this clade while this is possibly due to the misidentification.

The genus *Bironium* was shown to be a monophyletic group (1.0 BPP, 97 MLB). The phylogenetic tree of Leschen & Löbl (2005) supported the *Birocera* group

consisting of *Bironium* and *Birocera*, while the monophyly of *Bironium* and *Birocera* was not supported by my tree since DNA samples of *Birocera* were not obtained.

The genus *Scaphicoma* must be a well-supported monophyletic group (1.0 BPP, 100 MLB). The genus *Toxidium*, related to *Scaphicoma* based on morphological characters (Leschen & Löbl 2005), was not examined in this study.

The monophyly of the *Scaphisoma* group including the termitophilous scaphidiines was strongly supported (1.0 BPP, 100 MLB). The termitophilous scaphidiines called the *Baeoceridium* group were indicated to be a morphologically well-supported group by Leschen & Löbl (2005). However, the termitophilous scaphidiines shown by my tree (1.0 BPP, 97 MLB) included not only the *Baeoceridium* group but also *Scaphisoma sadang*, which was a typical member of *Scaphisoma* on morphological characters.

The resulting tree was almost consistent with the tree provided by Leschen & Löbl (2005) on morphological study. My tree supported four monophyletic groups as follows: *Scaphidium*, *Scaphicoma*, *Scaphisoma*, and Termitophilous scaphidiines. The phylogenetic relationships in the Scaphisomatini, however, were unclear yet because the taxon sampling was limited.

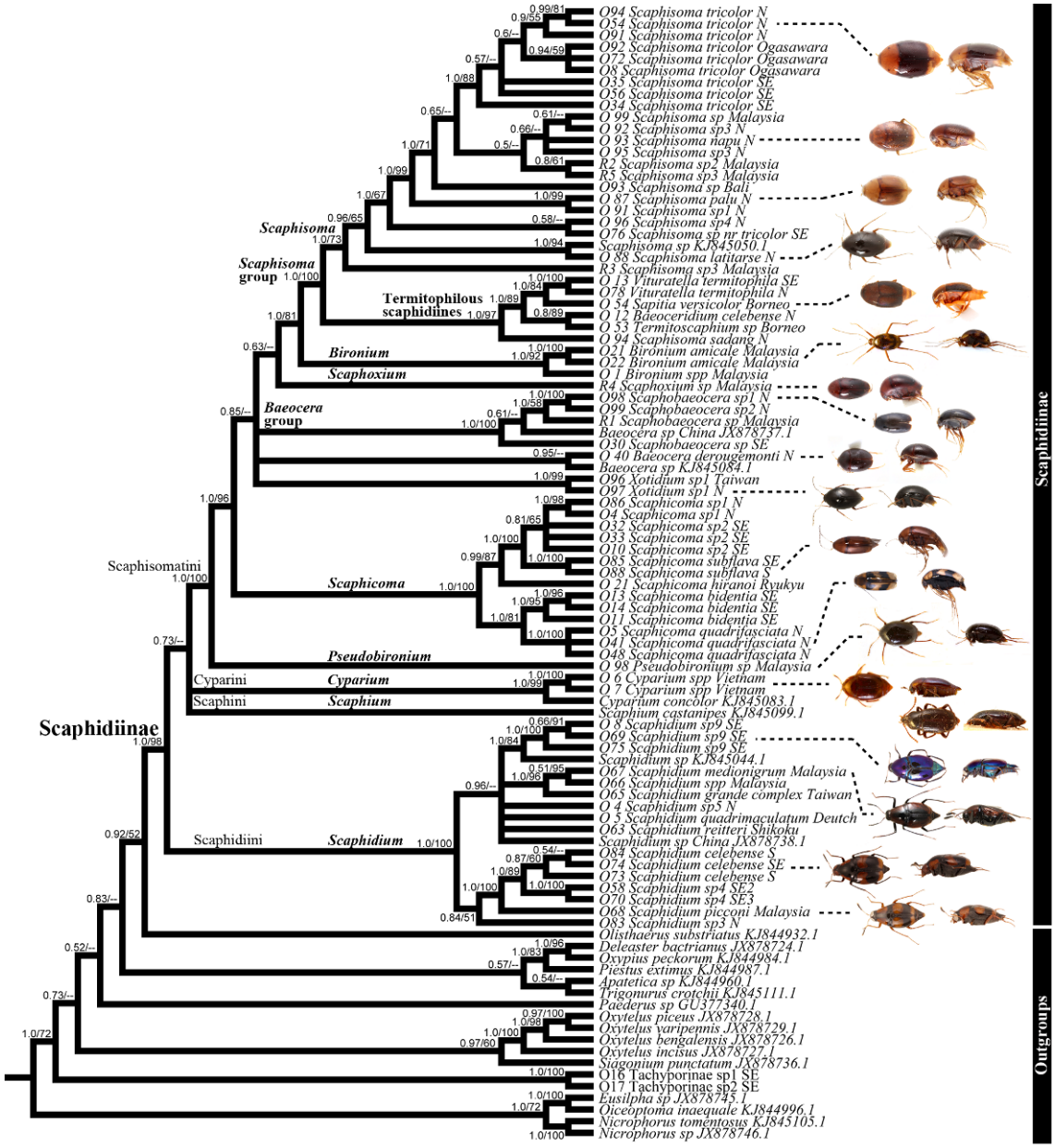

Fig. 3–1. Bayesian 50% majority-rule consensus tree based on 28S sequences, showing the phylogenetic relationships in the Scaphidiinae. BPP (left) and partitioned MLB (right) are shown above branches (see Figs. 3–4, 5).

3. 2 Ancestral state reconstruction for feeding habits

The scaphidiines, mostly associated with fungi, are most probably originated from the saprophagous beetles (Fig. 3–2). Based on not a few available host records of the scaphidiines are known (Newton 1984; Newton & Stephenson 1990; Löbl & Leschen 2003; Leschen & Löbl 2005), my analyses of the ancestral state reconstruction indicated that the termitophilous scaphidiines (*Baeoceridium*, *Saptia*, *Termitoscaphium*, and *Vituratella*) had a common ancestor feeding on the unique fungus of the genus *Termitomyces* of the Basidiomycetes. It is presumable that the ancestor made a shift from feeding on nonsymbiotic Basidiomycetes as *Scaphisoma* to termitophily. The evolution of the termitophilous scaphidiines has been discussed in Leschen & Löbl (2005) as follows: when *Termitomyces* fruiting bodies were present on the nest exterior of the fungus-growing termites (the subfamily Macrotermitinae), it is expected that the ancestors of the termitophilous scaphidiines used them as food resources, and later they intruded the termite's nest in which the fungi were cultivated. My tree showed that the termitophilous scaphidiines were related to the genus *Scaphisoma* and the termitophyly has evolved once at the base of the termitophilous scaphidiines and *Scaphisoma*, supporting the hypothesis of Leschen & Löbl.

My ancestral state reconstruction also showed that the feeding habit on the Basidiomycetes was likely widespread and primitive in the Scaphidiinae, as previously mentioned by Leschen & Löbl (2005) after morphological analyses. Indeed most Scaphidiinae occur on the Basidiomycetes, but the genera *Scaphobaeocera* and *Baeocera* are known to feed exclusively on the Myxomycetes, except for a few *Baeocera* (Newton 1984). As shown in the ancestral state reconstruction of my analyses, the habit of feeding on the Myxomycetes has evolved probably once at the base of the clade of *Baeocera* + *Scaphobaeocera* + *Xotidium*. The reverse shift of the feeding habit from the Basidiomycetes to the Myxomycetes is expected to have occured within the genus *Baeocera*.

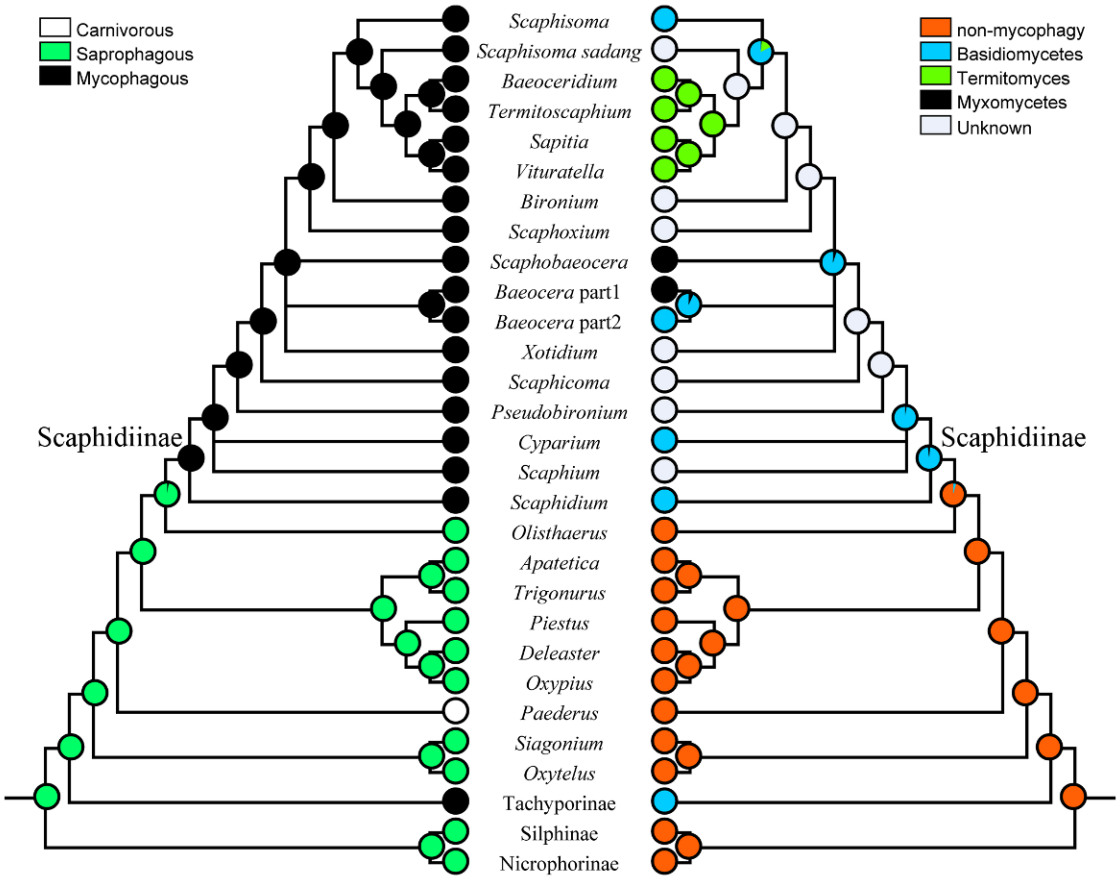

Fig. 3–2. Ancestral state reconstruction for feeding habits in the Scaphidiinae. On the left tree, the feeding types are categorized as carnivorous (white), saprophagous (green), and mycophagous (black). On the right same tree, the food resources are categorized as non-mycophagy (orange), basidiomycetes (blue), termitomyces (green), myxomycetes (black), and unknown (gray). The tree topology is derived from the BI tree of Fig. 3–1. Pie charts indicate the relative likelihood at each node.

3. 3 Estimation of divergence time

Divergence time estimation for staphylinid beetles including silphids by the MCMCTREE analyses with hard-bounded constraints indicated that Scaphidiinae had began to diversify during the Middle- and the Late-Jurassic with a 95% credible interval of 155–164 Ma (Fig 3–3).

The estimation of divergence time under my time tree also indicated that the most genera of Scaphidiinae likely originated from during the Late-Cretaceous and the Paleogene era of Cenozoic (ca. 25 Ma of mean divergence time). This is consistent with the divergence time of many other genera of beetles estimated by Gomez-Zurita *et al*. (2007), Hunt *et al*. (2007), and Ge *et al*. (2011).

Indeed, two genera *Scaphidium* and *Scaphicoma* seem to have begun to diverge from the ancestor during the Late-Paleogene era of Cenozoic (ca. 25 Ma or 27 Ma of mean divergence time).

However, the termitophilous scaphidiines, whose divergence time was older than the two genera above, seem to have begun to diverge from the ancestor of the *Scaphisoma* group during the Late-Cretaceous and the Paleogene era of Cenozoic (ca. 78 Ma of mean divergence time). They feed on *Termitomyces* cultivated by the fungus-growing termites of the Macrotermitinae, which originated at 80 Ma in the Late-Cretaceous (Grimaldi & Engel 2005). Therefore, it is most likely that the termitophilous scaphidiines originated and radiated together with their associated fungus-growing termites and then they began to expand their distribution together. Indeed, the distribution of Macrotermitinae is limited to the tropics of Africa and Asia, excluding New Guinea and Australia (Emerson 1955; Aanen *et al* 2002), and is the same as the termitophilous scaphidiines (Leschen & Lobl 2005).

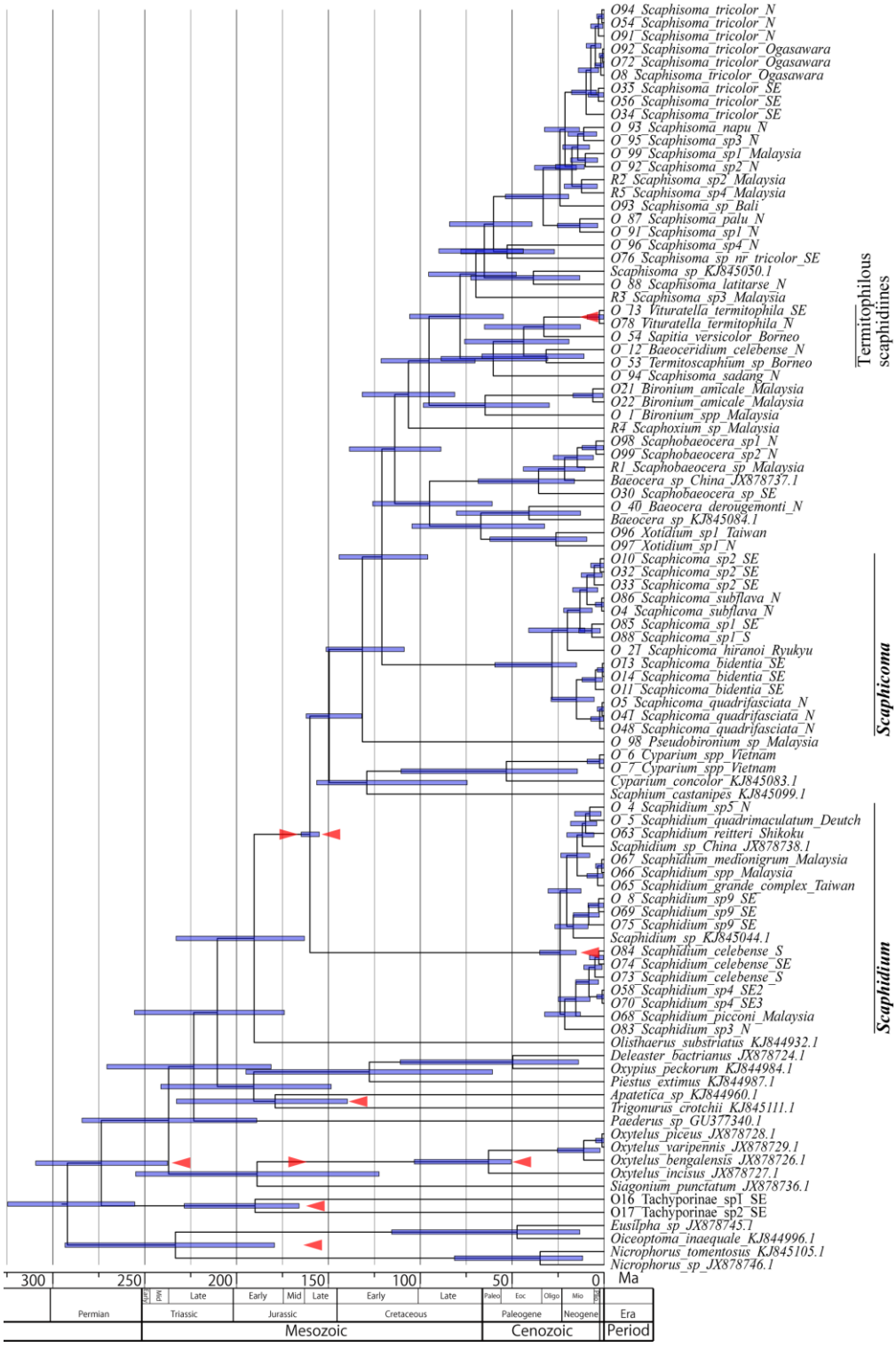

Fig. 3–3. A time tree for staphilinids by MCMCTREE with hard-bounded constraints. Ten nodes were used for time constraints based on fossil records (arrowheads; for details, see Chapter 2 and Table 2). Horizontal bars indicate 95% credible intervals of the divergence time estimates.

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Appendix

Fig. 3–4. Phylogenetic tree of the Scaphidiinae by the Bayesian Interence (BI) based on 28S sequences. Bayesian posterior probabilities (BPP) are shown above branches.

Fig. 3–5. Phylogenetic tree of the Scaphidiinae by the Maximum Likelihood Estimation (MLE) based on 28S sequences. Maximum likelihood bootstrap (MLB) values are shown above branches. Interspace on branch is shown as differences of base-pair of 0.2%.

Chapter 4 — Systematics of the Subfamily Scaphidiinae from Sulawesi

Key to genera of Sulawesian scaphidiines

1 Antennae clavate with a well developed club. 2

– Antenna filiform with a loosely articulated club. 3

2 Eyes emarginate near antennal insertion. Pronotum with basal stria. Metanepisternum with a longitudinal line. Male setiferous sex patch on metaventrite. ..... ***Scaphidium*** Olivier

– Eyes not emarginate near antennal insertion. Pronotum without basal stria. Metanepisternum without a longitudinal line. Male without setiferous sex patch. ..... ***Cyparium*** Erichson

3 Profemora with ctenidium. 7

– Profemora without ctenidium. 4

4 Body compressed laterally, strongly convex dorsally. Each meso- and metacoxae adjacent. 6

– Body not compressed laterally, normally convex dorsally. Each meso- and metacoxae distant. 5

5 Mesepimera exposed. Tibiae and femora not conspicuously long. ..... ***Birocera*** Löbl

– Mesepimera concealed or fused. Tibiae and femora conspicuously long. ..... ***Bironium*** Csiki

6 Scutellum exposed. Posterior angles of pronotum not elongated. Mesoventrite with secondary lines. Sutural striae extending outwards along basal margin to form basal striae. ..... ***Xotidium*** Löbl

– Scutellum concealed. Posterior angles of pronotum elongated basally. Mesoventrite without secondary lines. Sutural striae evanescent towards base, not reaching to posterior margin of pronotum. ..... ***Scaphoxium*** Löbl

7 Antennomere III usualy shorter than antennomere IV, asymmetrical triangular. 8

– Antennomeres III almost as long as IV, usually symmetrical, not triangular. 11

8 Antennomeres VII–XI forming loose, widened club. Metafemora usually not or weakly widened (more than twice longer than wide). Dorsum of body with very short, hardly visible pubescence. ..... ***Scaphisoma*** Leach

– Antennomeres VII–XI not forming club. Metafemora strongly widened (twice as long as wide). Dorsum of body pubescent or glabrous. 9

9 Body surface almost pubescent, with microsculptures. ..... ***Vituratella*** Reitter

– Body surface almost glabrous. 10

10 Elytra with very long setae, lacking sutural striae. ..... ***Termitoscaphium*** Löbl

– Elytra with short marginal setae and sutural striae. ..... ***Baeoceridium*** Reitter

11 Pronotum with entire anterior bead. Posterior angles of pronotum elongated basally. Mesepimera exposed. 12

– Pronotum with anterior bead widely interrupted. Posterior angles of pronotum not elongated. Mesepimera concealed or fused. ..... ***Scaphicoma*** Motschulsky

12 Body compressed laterally, strongly convex dorsally. Elytra usually with microsculptures and iridescent luster. ..... ***Scaphobaeocera*** Csiki

– Body not compressed laterally, normally convex dorsally. Elytra usually without microsculptures. ..... ***Baeocera*** Erichson

4. 1 Genus *Scaphidium*

Scaphidium Olivier, 1790 [gender: neuter]

Scaphidium Olivier, 1790: 1 (page 1 of No. 20) [No. 20, pl. 1]; type species: *Scaphidium quadrimaculatum* Olivier, 1790; by subsequent designation: Latreille, 1810: 176.

Ascaphidium Pic, 1915a: 24; type species: *Ascaphidium sikorai* Pic, 1915. Synonymy: Leschen & Löbl, 1995.

Cribroscaphium Pic, 1920c: 93 (as subgenus of *Scaphidium*); type species: *Scaphidium irregulare* Pic, 1920. Synonymy: Leschen & Löbl, 1995.

Falsoascaphidium Pic, 1923a: 16; type species: *Scaphidium subdepressum* Pic, 1921. Synonymy: Leschen & Löbl, 1995.

Hemiscaphium Achard, 1922: 12; type species: *Scaphidium striatipenne* Gestro, 1879. Synonymy: Leschen & Löbl, 1995.

Hyposcaphidium Achard, 1922: 12 (as subgenus of *Scaphidium*); type species: *Scaphidium rufopygum* Lewis, 1893; **by present designation**. Synonymy: Leschen & Löbl, 1995.

Isoscaphidium Achard, 1922: 12 (as subgenus of *Scaphidium*); type species: *Scaphidium*

reitteri Lewis, 1879; **by present designation**. Synonymy: Leschen & Löbl, 1995.

Pachyscaphidium Achard, 1922: 12 (as subgenus of *Scaphidium*); type species: *Scaphidium arrowi* Achard, 1920. Synonymy: Leschen & Löbl, 1995.

Parascaphium Achard, 1923: 97; type species: *Scaphium optabile* Lewis, 1893. Synonymy: Löbl, 1968c.

Scaphodopsis Achard, 1922: 12; type species: *Scaphidium pardale* Laporte de Castelnau, 1840. Synonymy: Leschen & Löbl, 1995.

Scaphidiolum Achard, 1922: 12; type species: *Scaphidium basale* Laporte de Castelnau, 1840. Synonymy: Leschen & Löbl, 1995.

Diagnosis. Maxillary palpomere IV normal. Labial palpus normal. Antenna usually forming club, flattened; antennomeres each VII–XI covered with microsetae. Mandible bidentate; mola with brush. Galea broad (wider than long); brush apical and paniculate. Surface of mentum setose. Anterior margin of pronotum with a bead. Neck not prolonged behind. Posterior angles of pronotum pointed, lateral margin not sinuate. Eyes notched. Hypomeron without fovea. Prothoracic corbiculum absent. Mesocoxal lines present on metaventrite. Metaventrite of male with setiferous sex patch. Secondary lines of mesoventrite present. Metanepisternum with longitudinal line. Abdominal ventrite I without metacoxal bead. Profemoral ctenidium absent. Mesotibia with two ventral spines. Metacoxae separated. Empodium bisetose. Internal sac with complex symmetrical sclerites.

Comments. Achard (1922) established *Hyposcaphidium* as subgenus of *Scaphidium*, including two species, *Scaphidium rufopygum* Lewis 1893 and *S. incisum* Lewis, 1893. *Isoscaphidium* as subgenus of *Scaphidium* was also established by Achard (1922) for over six species including *Scaphidium quadriguttatum* Say, 1823, *S. piceum* Melsheimer, 1846, *S. obliteratum* LeConte, 1860, *S. antennatum* Reitter, 1880, *S. ornatum* Casey, 1900, *S. reitteri* Lewis, 1879, and others. A type species of each subgenus was not designated and so I designate here *S. rufopygum* Lewis as the type species of the subgenus *Hyposcaphidium* and *S. reitteri* Lewis as the type species of the subgenus *Isoscaphidium*.

Key to the Sulawesian species of *Scaphidium*

1 Pronotum and elytra unicolorous (Fig. 1a, b). 2

– Pronotum and/or elytra bicolorous (Fig. 1c). 5

2 Body coloration brown to reddish-brown. Width of antennomere IX less than twice as long as length. 3

– Body coloration metallic luster. Width of antennomere IX more than twice as long as length. ..... ***S.* sp9**

3 Femora, tibiae, and tarsus yellowish-brown to brown. Antennomere XI longer than III. 4

– Femora and tibiae black, tarsus reddish-brown. Antennomere XI almost as long as III. ..... ***S. sondaicum*** Gestro

4 Body 4.72–5.48 mm. Each antennomeres VII–X distinctly longer than wide. Male protarsomeres I–III strongly enlarged. ..... ***S.* sp3**

– Body 3.15–3.90 mm. Each antennomeres VII–X almost as long as wide. Male protarsomeres I–III not enlarged. ..... ***S.* sp4**

5 Antennae almost yellowish-brown. Pronotum uniformly reddish-brown. Femora bicolorous. Elytra black. Abdomen yellowish-brown. ..... ***S.* sp6**

– Antennae almost yellowish-brown, except for antennal segments of VI–X black. Pronotum bicolorous. Femora unicolorous. 6

6 Elytra bicolorous. 9

– Elytra unicolorous. 7

7 Apical half of antennomere XI yellowish-brown Elytra purplish-metallic luster. ..... ***S.* sp8**

– Antennomere XI almost yellowish-brown. Elytra yellowish- or reddish-brown. 8

8 Pronotum with two black spots on apicomedian and basal portions. Elytra uniformly yellowish-brown. ..... ***S.* sp7**

– Pronotum almost black, apico-lateral margin and median hump reddish-brown and extending from apicomedian to base. Elytra uniformly reddish-brown. ..... ***S.* sp5**

9 Elytra with some fasciae. 11

– Elytra without some fasciae. 10

10 Elytra with an elongate-oval black band at median. Femora and tibiae black,

tarsus reddish-brown. Abdomen yellowish-brown, except for basal half of ventrite I. ..... ***S. sondaicum*** Gestro [***S. medionigrum*** sensu Pic]

– Median portion of each elytron black to dark reddish-brown. Femora, tibiae, and tarsus yellowish-brown. Epipleura and Abdomen yellowish-brown. ..... ***S*. sp1**

11 Lateral side of pronotum and hypomeron orange to reddish-brown. Elytra each with two orange to reddish-brown fasciae on basal and apical portions. ..... ***S. celebense*** Pic

– Basal margin of pronotum black. Elytra each with a black fascia at median portion. ..... ***S*. sp2**

Scaphidium celebense Pic, 1915

Scaphidium celebense Pic, 1915b: 3; Achard, 1920: 126.

(Figs. 4–2e, 4–3a, 4–4a, 4–5d, 4–8a, 4–10b)

Redescription. Head almost black, clypeus and frons brown to reddish brown. Antennomeres I–VI and apical half of XI yellowish-brown; VII–X and basal half of XI black. Pronotum on median and basal portion black, lateral side of pronotum and hypomeron orange to reddish brown. Elytra each with two orange to reddish brown fasciae around basal and apical portion; anterior margin of anterior fasciae sinuate. Propygidium and pygidium black or dark brown. Legs yellowish brown to light orange; tarsus paler than tibiae and femur. Ventral surface almost black, except for lateral side of hypomeron orange to reddish-brown (Fig. 4–2e). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about four times as interocular distance. Punctuation sparse and fine (Fig. 4–10b). Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; each segments of V and VI about twice as long as III; III about 1.5 times as long as I; each segment of VIII, IX, and XI almost as long as wide; VII and X slightly longer than wide (Fig. 4–4a).

Pronotum wider than long, with an anterior bead. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra longer than wide, widest at basal third to fourth, lateral margins gradually

narrowed apically, minutely serrate at inner part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite finely and sparsely punctate, medial portion coarsely and sparsely punctate. Mesocoxa about 1.5 times as wide as space between them. Mesanepisternum about 1.5 times as long as wide. Mesepimeron about two times as long as wide, paramesepimeron about three times as long as wide. Metanepisternum about six times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I from base to basal 1/3 densely and finely punctate, with microsculptures.

Protarsomeres V 2.5 to 3.0 times as long as each I–IV. Mesotarsomeres each I and V 2.0 times as long as II; II 1.2 times as long as each III and IV. Metatarsomeres I 2.0 times as long as each II and III, and 1.5 times as long as V; II and III each 1.2 times as long as IV; V 2.0 times as long as IV.

Male. Protarsomeres I–III with tenent setae, not enlarged. Aedeagus 1.4 mm long; parameres symmetrical, enlarged at apical portion and curved forward body axis from dorsal view; internal sac with multiple sclerites, two sclerites at base, an inverted Y-shaped and a pair of sclerites at middle, two sclerite at apex, and each two strip-shaped sclerite at lateral sides of middle and apex (Fig. 4–5d).

Female. Protarsomeres I–III without tenent setae, not enlarged. Ovipositor simple; bursa copulatrix slightly sclerotized with numerous spines (Fig. 4–8a), sclerotized portion forming octagon shape. Spermatheca as Fig. 4–8a, connecting to bursa copulatrix of vaginal plate.

Measurements (n = 20). Length (PL+EL): 3.62–4.33 mm. PW: 2.08–2.48 mm; EW: 2.32–2.88 mm. HW: 0.94–1.10 mm. ID: 0.08–0.16 mm. PL/PW: 0.71–0.80. EL/EW: 0.84–0.92. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.5 (0.4) : 0.8 (0.3) : 1.0 (0.3) : 0.8 (0.3) : 0.6 (0.3) : 0.5 (0.3) : 0.8 (0.6) : 0.7 (0.7) : 0.8 (0.9) : 0.8 (1.0) : 1.1 (1.0).

Specimens examined. 1♀ (Holotype), Tjamba, Zuid Celebes, VIII. IX, Doherty leg. (MNHN); 1♂4♀, Puncak Palopo, S. Sulawesi, 2. I. 2000, K. Ando leg.; 3♀, Puncak

Palopo, C. of S. Sulawesi, 3. I. 2000, K. Ando Collection, Y. Utsunomiya leg.; 3♀, Puncak Palopo, S. Sulawesi, 3. I. 2000, K. Ando leg.; 4♀, Bulu Dua, alt. 720 m, S. Sulawesi, 28. XII. 1999, K. Ando leg.; 13♂, Bulu Dua, alt. 720 m, S. Sulawesi, 28. XII. 1999, K. Ando leg.; 1♂1♀, same data above, but 3. I. 2000, K. Ando leg.; 1♂1♀, Puncak Palopo, C. of S. Sulawesi, 3. I. 2000, K. Ando Collection, Y. Utsunomiya leg.; 1♂, S. Sulawesi, Kayulangi, 4. XI. 1985, S. Nagai leg.; 1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34'28.52N–0°35'18.14N, 123°11'30.61E–123°13'22.71E, 9. VI. 2012, R. Ogawa leg.; 1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34'28.52N–0°35'18.14N, 123°11'30.61E–123°13'22.71E, O'45, 9. VI. 2012, Y. Hara leg. (all specimens preserved in EUMJ, except for holotype).

Distribution. Indonesia: throughout Sulawesi.

Comments. This species is very similar to three described species, *Scaphidium coomani* (Pic 1926), *S. longithorax* Pic, 1916, and *S. picconi* Gestro, 1879, but it is easily distinguished from them by the black legs and abdomen.

Scaphidium sondaicum Gestro, 1879

Scaphidium sondaicum Gestro, 1879: 54; Achard, 1920 (*Scaphidium sundaicum* [sic] Gestro var. *medionigrum* Pic; *Scaphidium sundaicum* [sic] Gestro ab. *ruficolor* Pic): 53; Pic, 1920a: 188.

Scaphidium medionigrum Pic, 1915a: 36. **New Synonym.**

Scaphidium sundaicum Achard, 1920: 53 (incorrect subsequent spelling).

(Figs. 4–2f, 4–3b, c, 4–4k, 4–7a–c)

Redescription. Head, clypeus, and frons brown to reddish brown. Dorsal surface almost reddish-brown, sometimes bearing an elongate-oval black band at median. Propygidium and pygidium paler brown to reddish brown, sometimes black (Figs. 4–2f, 4–3b, c). Ventral surface almost black including coxae, sometimes except for apical half of ventrite I and ventrite II–IV yellowish-brown. Femora and tibiae black, except for tarsus reddish-brown. Antennomeres I and II yellowish-brown; III–VI darker than I and II; VII–X and basal half XI black; apical half of XI yellowish-brown. Head, pronotum and elytra sparsely and finely pubescent.

Head with eye width about 4.5 times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III, IV, and XI almost same length; III about twice as long as II and VI; each segment of VI, VII, and XI almost as long as wide; each segment of VIII–X longer than wide (Fig. 4–4k).

Pronotum wider than long, with an anterior bead. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as long as wide, widest at basal third, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium coarsely and sparsely punctate with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite finely and sparsely punctate, medial portion coarsely and sparsely punctate. Mesocoxa about 1.2 times as wide as space between them. Mesanepisternum about 1.5 times as long as wide. Mesepimeron about two times as long as wide, paramesepimeron about four times as long as wide. Metanepisternum about ten times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I finely and sparsely punctate, with microsculptures.

Protarsomeres V 2.5 to 3.0 times as long as each I–IV. Mesotarsomeres each I and V 2.5 times as long as II; II 1.2 times as long as each III and IV. Metatarsomeres I 2.5 times as long as II; II 1.2 times as long as each III and IV; V 3.0 times as long as each III and IV.

Male. Protibiae moderately curved, and longer than female. Protarsomeres I–III with tenent setae, hardly enlarged. Aedeagus about 1.4 mm long; parameres symmetrical, slightly enlarged at apical portion, moderately curved inward; internal sac with multiple sclerites as Fig. 4–7c.

Female. Protibiae almost straight, short. Protarsomeres I–III without tenent setae. Ovipositor simple; bursa copulatrix sclerotized with spines, sclerotized portion forming triangular shape. A pair of spermatheca connected to vaginal plate.

Measurements (n = 8). Length (PL+EL): 3.97–4.80 mm (male, n=6: 4.27–4.80 mm; female, n=2: 3.97–4.00 mm). PW: 2.17–2.60 mm; EW: 2.43–2.87 mm; HW:

1.02–1.18 mm. ID: 0.11–0.16 mm. PL/PW: 0.71–0.81, EL/EW: 0.93–0.97. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.2 (0.4) : 0.6 (0.3) : 1.0 (0.3) : 1.0 (0.3) : 0.7 (0.4) : 0.5 (0.4) : 0.8 (0.8) : 0.7 (0.9) : 0.7 (1.0) : 0.7 (1.0) : 1.0 (0.9).

Specimens examined. 1♂ (Holotype), Sumatra/ Ajer Mantcior/ Agosto. 1878/ O. Beccari// sondaicum typ. Gestro [handwritten]// TYPE [red] (MNHN); 1♂ (Holotype), Perak/ Malacca/ Doherty// n.sp. [handwritten]// type [handwritten]// TYPE [red]// medionigrum Pic [handwritten] (MNHN); 2♂1♀, 19 mile (Withered tree), Cameron Highland, Daerah Cameron Highlands, Pahang State, Malaysia, 3. III. 2009, Y. Senda leg., Yoshihiro Senda Collection (EUMJ); 2♂1♀, Batu 19 (alt. 600m), Cameron Highland, Daerah Cameron Highlands, Pahang State, Malaysia (dead tree), 2. III. 2009, Y. Senda leg. (EUMJ).

Distribution. West Malaysia: Malacca; Indonesia: Sumatra and Sulawesi.

Comments. *Scaphidium medionigrum* Pic is newly synonymized with *S. sondaicum* on the comparison of type series (Fig. 4–7). The former species has been distinguished from the latter species by the body coloration, but they are hardly distinguished from each other by the structure of male genitalia and other morphological charcters. Thus, I recognize *S. medionigrum* as a color variation of *S. sondaicum*. Also, *Scaphidium maculaticeps* (Pic, 1923) and *Scaphidium longicolle* Pic, 1948 are very similar to *S. sondaicum* in the color pattern on body surface and the structure of male and female genitalia (Ogawa, personal observation). *Scaphidium sondaicum* was recorded from Sulawesi by Gestro (1879), while I could not examine the specimens.

***Scaphidium* sp1**

(Figs. 4–1a, 4–4c, 4–6c, 4–9c)

Description. Head, mouthparts, and antenna yellowish-brown to brown, except for antennomeres VII–X black. Pronotum around basal portion reddish-brown to brown, discal pronotum and hypomeron dark reddish-brown. Median portion of each elytron transversally black to dark reddish-brown because of wings under elytra. Propygidium and pygidium yellowish-brown. Legs yellowish brown. Ventral surface almost brown,

except for hypomeron and head (Fig. 4–1a). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about two times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III about twice as long as VI; each segment of VIII–X almost as long as wide; each segments of III, IV, VII, and X almost same length (Fig. 4–4c).

Pronotum wider than long, with an anterior bead. Punctuation sparse and coarse, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae; humeral area concaved by two punctuations stronger than on basal stria.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about 1.5 times as wide as space between them, mesocoxal area moderately broadened. Mesanepisternum about 1.5 times as long as wide. Mesepimeron about two times as long as wide, paramesepimeron about four times as long as wide. Metanepisternum about ten times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres I and II 1.2 times as long as III; III 1.2 times as IV; V 4.0 times as long as IV. Mesotarsomeres I 1.5 times as long as II; II 1.5 times as long as III; III 1.2 times as long as IV; V 3.0 times as long as IV. Ratio of metatarsomeres length almost same as its mesotarsomeres.

Male. Protarsomeres I–III with tenent setae, hardly enlarged. Aedeagus 1.1 mm long; parameres symmetrical, strongly enlarged at apical portion, curved inward; internal sac with apparent two-arm candlestick shaped sclerite at median portion (Fig. 4–6c).

Female. Protarsomeres I–III without tenent setae. Ovipositor unique, distal

gonocoxite broadened, extended apically; bursa copulatrix slightly sclerotized without spines (Fig. 4–9c), sclerotized portion forming triangular shape. Spermatheca as Fig. 4–9c, connecting under vaginal plate.

Measurements (n = 4). Length (PL+EL): 3.47–3.91 mm. PW: 1.90–2.18 mm; EW: 2.23–2.48 mm. HW: 0.88–0.93 mm. ID: 0.15–0.21 mm. PL/PW: 0.70–0.74, EL/EW: 0.92–0.96. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.2 (0.4) : 0.7 (0.4) : 1.0 (0.3) : 1.0 (0.3) : 0.8 (0.4) : 0.6 (0.4) : 1.0 (0.7) : 0.8 (0.7) : 0.9 (0.8) : 1.0 (0.9) : 1.3 (1.0).

Specimens examined. 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 1300–1500 m, 0°35’18.14”N–0°35’18.37”N, 123°13’22.71”E–123°13’22.61”E, 28. I. 2011, R. Ogawa leg. (MZBI); Paratypes, 1♀, same data above (HUOI); 1♂, same data above (EUMJ); 1♀, same data above, but Y. Hara leg. (EUMJ).

Distribution. Indonesia: northern Sulawesi.

Comments. This species is very similar to *Scaphidium crassipes* Löbl, 2006 from the phillippines by the body coloration, but it is easily distinguished from the latter by the color pattern on elytra, the structure of parameres and sclerites.

***Scaphidium* sp2**

(Figs. 4–1b, 4–4d, 4–5a)

Description. Head and mouthparts yellowish-brown to brown. Antennomeres I–VI and XI yellowish-brown; VII–X and basal half XI black; apical half XI yellowish-brown. Pronotum almost yellowish brown, except for posterior marigin of pronotum black. Elytra each with a black fascia at median portion. Propygidium and pygidium yellowish-brown. Legs yellowish brown including tarsus. Ventral surface almost yellowish brown, but darker than dorsal surface (Fig. 4–1b). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about 3.5 times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; each segments of III and I about twice as long as VI; each III and IV almost same length; each segment of VIII–X almost as long as wide; XI about twice as long as II (Fig. 4–4d).

Pronotum distinctly wider than long, with an anterior bead; anterior margin sinuate. Punctuation sparse and coarse, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as wide as long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae; humeral area concaved by two punctuations stronger than on basal stria..

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about 1.5 to 1.7 times as wide as space between them, mesocoxal area moderately broadened; mesocoxal line sinuate. Mesanepisternum about twice as long as wide. Mesepimeron about 1.5 times as long as wide, paramesepimeron about four times as long as wide. Metanepisternum about ten times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres V about three times as long as each I–IV. Mesotarsomeres each I and V about two times as long as II; II 1.2 times as long as each III and IV. Ratio of metatarsomeres length almost same as mesotarsomeres.

Male. Protarsomeres I–III without tenent setae, hardly enlarged. Aedeagus 1.0 mm long; parameres symmetrical, enlarged at apical portion, strongly curved at subapical portion from lateral view; internal sac with multiple sclerites, oar-shaped sclerite at a base, two pairs of sclerite and a trifurcate sclerite at middle, two rod-shaped sclerites at apex (Fig. 4–5a).

Female. Unknown.

Measurements (n = 2). Length (PL+EL): 3.10–3.30 mm. PW: 1.90–1.96 mm; EW: 2.05–2.13 mm. HW: 0.85–0.89 mm. ID: 0.10–0.13 mm. PL/PW: 0.58–0.60, EL/EW: 0.94–1.04. Approximate ratio of each antennal segments in length (width) (n = 1) = 1.2 (0.4) : 0.7 (0.3) : 1.0 (0.3) : 0.9 (0.3) : 0.8 (0.3) : 0.6 (0.4) : 0.8 (0.6) : 0.7 (0.6) : 0.8 (0.7) : 0.8 (0.9) : 1.3 (0.9).

Specimens examined. 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300 m, 0°35’18.14N, 123°13’22.71E, 10. VI. 2012, R. Ogawa leg. (MZBI); 1♂, same data above (EUMJ).

Distribution. Indonesia: northern Sulawesi.

Comments. This species is apparently the unique characters on the structure of male genitalia, in comparison with other *Scaphidium* species.

***Scaphidium* sp3**

(Figs. 4–1d, 4–4e, 4–5b, 4–9d)

Description. Dorsal surface including legs and head almost yellowish-brown to brown, except for antennomeres IV–IX black. Ventral surface darker than dorsal surface (Fig. 4–1d) . Head, pronotum and elytra sparsely and finely pubescent.

Head with eye width about three times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; each segments VII–X longer than wide; XI three times as long as II; XI 1.7 times as long as III (Fig. 4–4e).

Pronotum wider than long, with an anterior bead, slightly sinuate at lateral margin. Punctuation sparse and coarse, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about 1.5 times as wide as space between them, mesocoxal area moderately broadened. Mesanepisternum about twice as long as wide. Mesepimeron about 1.5 times as long as wide, paramesepimeron with transversal line about four times as long as wide.

Metanepisternum about ten times as long as wide, with a longitudinal line. Metepimeron about 1.5 times as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres V about twice as long as each I–IV. Mesotarsomeres each I and V about two times as long as II; II about 1.5 times as long as each III and IV. Ratio of metatarsomeres length almost same as its mesotarsomeres.

Male. Protarsomeres I–III with tenent setae, strongly enlarged; protarsomeres each I and II slightly longer than females. Aedeagus 1.5 mm long; parameres symmetrical, enlarged at apical portion and curved forward body axis from dorsal view; internal sac with multiple sclerites, two pairs of sclerite at base, a Y-shaped sclerite at middle, and a pair of strip-shaped sclerite at apex (Fig. 4–5b).

Female. Protarsomeres I–III without tenent setae, hardly enlarged. Ovipositor simple; bursa copulatrix slightly sclerotized without numerous spines (Fig. 4–9d), sclerotized portion forming pentagon shape. Spermatheca as Fig. 4–9d, connecting under bursa copulatrix of vaginal plate.

Measurements (n = 6). Length (PL+EL): 4.72–5.48 mm. PW: 2.96–3.24 mm; EW: 3.32–3.60 mm. HW: 1.24–1.30 mm. ID: 0.14–0.19 mm. PL/PW: 0.65–0.73, EL/EW: 0.84–0.89. Approximate ratio of each antennal segments in length (width) (n = 1) = 1.1 (0.4) : 0.6 (0.3) : 1.0 (0.3) : 1.0 (0.3) : 0.9 (0.3) : 0.7 (0.4) : 1.1 (0.6) : 1.1 (0.6) : 1.1 (0.8) : 1.0 (0.8) : 1.7 (0.8).

Specimens examined. Holotype, 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 800 m, 0°34’28.52N, 123°11’30.61E, 8. VI. 2012, R. Ogawa leg. (MZBI); Paratypes, 1♂1♀, same data above (HUOI); 2♂1♀, same data above (EUMJ); 2♂, INDONESIA: SULAWESI UTARA/ Dumoga-Bone N.P./ August. 1985// G. Mogogonipa/ summit 1008 m// Malaise trap// R. Ent. Soc. Lond. PROJECT WALLACE/ B. M. 1985–10.

Distribution. Indonesia: northern Sulawesi.

Comments. This species is similar to *Scaphidium flavicorne* Löbl, 2006 by the body coloration and size, but it is easily distinguished from the latter by the antennal coloration and the structure of male genitalia.

***Scaphidium* sp4**

(Figs. 4–1c, 4–4f, 4–5c, 4–8b, 4–10a, c, d)

Description. Dorsal and ventral surface almost brown to dark yellowish-brown, except for dark central spot on elytra (Fig. 4–1c). Antennomeres I–V, basal half of VI, and XI yellowish-brown; apical half of VI and VII–X black. Propygidium and pygidium paler than dorsal surface. Legs yellowish brown to light orange; tarsus paler than tibiae and femur. Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about four times as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae (Fig. 4–10a); each segments of I and XI about twice as long as II; each segment of III and IV about twice as long as VI; each segment of VI–IX as long as wide; XI longer than wide; XI 2.5 times as long as VI (Fig. 4–4f).

Pronotum wider than long, with an anterior bead. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly longer than wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite finely and sparsely punctate, medial portion coarsely and sparsely punctate. Mesocoxa about 1.5 times as wide as space between them. Mesanepisternum about 1.5 times as long as wide. Mesepimeron about two times as long as wide, paramesepimeron about three times as long as wide. Metanepisternum about eight times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I from base to basal 1/3 densely and finely punctate, with microsculptures.

Protarsomeres V 2.5 to 3.0 times as long as each I–IV. Mesotarsomeres I 2.0 times as long as II; II 1.5 times as long as each III; III 1.2 times as long as IV; V 5.0 times as long as IV. Metatarsomeres I about twice as long as II; each III and IV 1.2 times as long as II; IV about three times as long as each III and IV.

Male. Protarsomeres I–III with tenent setae, not enlarged. Aedeagus 1.3 mm long; parameres symmetrical, slightly enlarged at apical portion and curved forward body axis from dorsal view; internal sac with multiple sclerites, two sclerites at base, an inverted Y-shaped and a pair of sclerites at middle, two sclerite at apex, and two pairs of strip-shaped sclerite at apex (Fig. 4–5c).

Female. Protarsomeres I–III without tenent setae, not enlarged. Ovipositor simple; bursa copulatrix slightly sclerotized with numerous spines (Fig. 4–8b), sclerotized portion forming triangular shape. Spermatheca as Fig. 4–8b, connecting to bursa copulatrix of vaginal plate.

Measurements (n = 20). Length (PL+EL): 3.15–3.90 mm. PW: 1.95–2.33 mm; EW: 2.15–2.70 mm. HW: 0.90–1.09 mm. ID: 0.05–0.13 mm. PL/PW: 0.65–0.77, EL/EW: 0.79–0.90. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.3 (0.4) : 0.7 (0.3) : 1.0 (0.3) : 0.9 (0.3) : 0.6 (0.3) : 0.5 (0.4) : 0.8 (0.7) : 0.7 (0.7) : 0.9 (0.8) : 0.9 (0.9) : 1.4 (0.8).

Specimens examined. 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–400 m, 3°38’40”S–3°38’31”S, 121°07’32”E–121°05’42”E, O70, 18. III. 2014, S. Fujie leg.; 2♂1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 500–800 m, 0°34’04.63N–0°34’28.52N, 123°11’15.42E–123°11’30.61E, O44, O51, O81, 26–27. I. 2011, R. Ogawa leg.; 2♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800 m, 0°34’28.52N, 123°11’30.61E, O’31, 28. I. 2011, R. Ogawa leg.; 2♂1♀, same data, but 29. I. 2011, R. Ogawa leg.; 2♂, same data, but 29. I. 2011, Y. Hara leg.; 1♂, Puncak Palopo, Sulawesi Selatan, alt. ca. 800 m, S02°57, E120°05, O’32, 30. I–4. II. 2013, J. Yamasako leg.; 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700m, 3°38’40”S, 121°07’32”E, Malaise trap, set up on 16. III. 2014, collected in 18. III. 2014, R. Ogawa leg.; 2♂, same data, but ca. 400–700 m (Danau), O7, O’33, 21. IX. 2013, R. Ogawa leg.; 1♀, same data, but ca. 0 (Desa)–400 m, 22. IX. 2013, R. Ogawa leg.; 1♂1♀, same data, but ca. 700–400 m, 3°38’40”S–3°38’31”S, 121°07’32”E–121°05’42”E, 24. IV. 2014, R. Ogawa leg.; 2♂2♀, same data, but ca. 700–200 m, 3°38’40”S–3°38’08”S, 121°07’32”E–121°04’35”E, 25. IV. 2014, R. Ogawa leg.; 4♂1♀, same data, but ca. 400–700 m, 3°38’31”S–3°38’40”S, 121°05’42”E–121°07’32”E, 23. IV. 2014, R. Ogawa leg.

Distribution. Indonesia: throughout Sulawesi.

Comments. This species is very similar to *Scaphidium celebense* by the structure of male genitalia. In addition, it is similar to *Scaphidium badium* Heller, 1917 by the body coloration. However, this species is easily distinguished from *S. celebense* by the body coloration, the length of antennomere XI and from *S. badium* by the structures of male genitalia.

***Scaphidium* sp5**

(Figs. 4–1e, f, 4–4g, 4–6d, 4–9b)

Description. Head and mouthparts reddish-brown. Antennomeres I and II yellowish-brown; III–VI dark brown; VII–X black; XI yellowish-white. Basic color of pronotum black, but apicolateral margin and median hump reddish-brown, and extending from apicomedian to base. Elytra, propygidium, and pygidium reddish-brown. Ventral surface almost reddish-brown, except for part of hypomeron black. Legs almost black, but all tibiae reddish-brown on one third of basal portion (Fig. 4–1 e, f). Head, pronotum and elytra sparsely and finely pubescent.

Head with eye width about 2.5 times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; I about twice as long as each II and VI; each segment of VII, IX, and XI longer than wide; each segment of VIII and X as long as wide; XI about 2.5 times as long as II (Fig. 4–4g).

Pronotum wider than long, with an anterior bead. Punctuation sparse and coarse, as on head. Scutellum about 1.5 times as long as wide, with exposed apex.

Elytra wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about 1.2 times as wide as space between them, mesocoxal area moderately broadened.

Mesanepisternum about twice as long as wide. Mesepimeron almost as long as wide, paramesepimeron about six times as long as wide. Metanepisternum about eight times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres I 1.2 times as long as each II–IV; each II–IV 4.5 to 5.0 times as long as V. Mesotarsomeres each I about twice as long as II; II 1.5 times as long as each III and IV; V 3.5 times as long as each III and IV. Ratio of metatarsomeres length almost same as its mesotarsomeres.

Male. Protarsomeres I–III with tenent setae, moderately enlarged. Aedeagus about 1.5 mm long; parameres symmetrical, enlarged at apical portion, slightly curved at subapical portion; internal sac with multiple sclerites, two pairs of sclerite at base, a X-shaped sclerite at middle, a pair of strip-shaped sclerite at apex (Fig. 4–6d).

Female. Protarsomeres I–III without tenent setae, not enlarged. Ovipositor unique, relatively distal gonocoxite enlarged, sclerotized portion forming triangular shape; bursa copulatrix sclerotized with numerous spines (Fig. 4–9b), forming shell shape. Spermatheca as Fig. 4–9b, connecting under bursa copulatrix of vaginal plate.

Measurements (n = 2). Length (PL+EL): 4.63–4.88 mm. PW: 2.77–2.93 mm; EW: 3.13–3.40 mm. HW: 1.11–1.13 mm. ID: 0.18–0.20 mm. PL/PW: 0.67–0.71, EL/EW: 0.85–0.86. Approximate ratio of each antennal length (width) as follows (n = 1); 1.4 (0.4) : 0.7 (0.4) : 1.0 (0.4) : 1.1 (0.4) : 0.8 (0.5) : 0.7 (0.5) : 1.1 (0.9) : 1.0 (0.9) : 1.2 (1.0) : 1.2 (1.1) : 1.9 (1.2).

Specimens examined. Holotype, 1♂, INDONESIA: SULAWESI UTARA/ Dumoga-Bone N. P.// G. Mogogonipa summit, 1008m/ May. 1985// Malaise trap// R. Ent. Soc. Lond./ PROJECT WALLACE/ B. M. 1985–10 (BMNH); Paratype, 1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300m, 0°35’18.14N, 123°13’22.71E, FIT, set up on 9. IV. 2012, collected in 11. IV. 2012, R. Ogawa leg. (EUMJ); 1♀, INDONESIA: SULAWESI UTARA/ Dumoga-Bone N. P.// G. Mogogonipa summit, 1008m/ May. 1985// Malaise trap// R. Ent. Soc. Lond./ PROJECT WALLACE/ B. M. 1985–10 (BMNH).

Distribution. Indonesia: northern Sulawesi.

Comments. This species is very similar to *Scaphidium* sp3 from Sulawesi by the

body coloration and size, but it is easily distinguished from the latter by the coloration of pronotum, the length and coloration of the antennae, the structure of male and female genitalia.

***Scaphidium* sp6**

(Figs. 4–2a, 4–4j, 4–8c)

Description. Head and mouthparts reddish-brown. Antennae yellowish-brown. Pronotum reddish-brown. Elytra almost black, and from apical one-eighth to apex dark reddish-brown; scutellum reddish-brown. Metaventrite black, abdomen yellowish-brown, coxae dark reddish-brown. Tibiae and tarsus yellowish-brown; femur dark reddish to blackish brown, yellowish-brown from apical one-fifth to apex (Fig. 4–2a). Head, pronotum and elytra sparsely and finely pubescent.

Head with eye width about four times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III about twice as long as IV; each segment of VII and VIII slightly longer than wide; X slightly wider than long; XI about twice as long as II; XI about three times as long as III (Fig. 4–4j).

Pronotum apparently wider than long, lateral margins sharply narrowed apically, with an anterior bead. Punctuation sparse and coarse, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as long as wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about 1.2 times as wide as space between them, mesocoxal area moderately broadened. Mesanepisternum about twice as long as wide. Mesepimeron almost as long as wide, paramesepimeron about three times as long as wide. Metanepisternum about six times

as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres V about three times as long as each II–IV. Mesotarsomeres each I about three times as long as II; II 1.5 times as long as each III and IV; V 3.5 times as long as each III and IV. Ratio of metatarsomeres length almost same as its mesotarsomeres.

Male. Unknown.

Female. Protarsomeres I–III without tenent setae, not enlarged. Ovipositor simple; bursa copulatrix sclerotized without numerous spines, sclerotized portion forming triangular shape. A pair of spermatheca connected under bursa copulatrix of vaginal plate (Fig. 4–8c).

Measurements (n = 1). Length (PL+EL): 3.36 mm; PW: 1.89 mm; EW: 2.13 mm. HW: 0.89 mm. ID: 0.09 mm. PL/PW: 0.65, EL/EW: 1.00. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.2 (0.4) : 0.7 (0.3) : 1.0 (0.3) : 0.9 (0.3) : 0.7 (0.3) : 0.5 (0.4) : 0.8 (0.6) : 0.7 (0.6) : 0.8 (0.8) : 0.8 (0.9) : 1.5 (0.9).

Specimen examined. 1♀, INDONESIA: SULAWESI UTARA/ Dumoga-Bone N. P.// March. 1985// Flight/ interception/ trap// Lowland forest/ ca. 200m// R. Ent. Soc. Lond./ PROJECT WALLACE/ B. M. 1985–10// 31| – 19 [pink] (BMNH).

Distribution. Indonesia: northern Sulawesi.

Comments. This species is similar to *Scaphidium minutum* Pic, 1920 by the body shape, but it is easily distinguished from the latter by the pattern of body coloration with the dark femur.

***Scaphidium* sp7**

(Figs. 4–2c, 4–4b, 4–9a)

Description. Head and mouthparts yellowish-brown. Antennomeres I–VI and XI yellowish-brown; VII–X black. Basic color of pronotum yellowish-brown, except for two spots on apicomedian and basal portions black; anterior spot extending to base and forming ginkgo leaf; posterior spot extending to apex and forming shape of spread bat's wings. Elytra, propygidium and pygidium yellowish-brown. Ventral surface including

legs almost yellowish-brown, except for part of hypomeron black (Fig. 4–2c). Head, pronotum and elytra sparsely and finely pubescent.

Head with eye width about 2.5 times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; I about twice as long as VI; each segment of VII, VIII, and IX longer than wide; each segment of X and XI almost as long as wide; XI slightly longer than III (Fig. 4–4b).

Pronotum wider than long, with an anterior bead. Punctuation sparse and coarse, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as long as wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron, lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about two times as wide as space between them, mesocoxal area moderately broadened. Mesanepisternum about 1.25 times as long as wide. Mesepimeron about two times as long as wide, paramesepimeron about four times as long as wide. Metanepisternum about six times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres V about three times as long as each I–IV. Mesotarsomeres each I and V about twice as long as II; II 1.2 times as long as each III and IV. Ratio of metatarsomeres length almost same as mesotarsomeres.

Male. Unknown.

Female. Protarsomeres I–III without tenent setae, hardly enlarged. Ovipositor unique, apparently distal gonocoxite enlarged, sclerotized portion forming triangular shape, with indistinctly border between distal and proximal gonocoxites; bursa copulatrix sclerotized with numerous spines (Fig. 4–9a), forming trapezoid shape. Spermatheca as Fig. 4–9a, connecting under bursa copulatrix of vaginal plate.

Measurements (n = 4). Length (PL+EL): 4.06–4.60 mm. PW: 2.18–2.33 mm; EW: 2.56–2.72 mm. HW: 0.96–1.00 mm. ID: 0.12–0.20 mm. PL/PW: 0.68–0.89, EL/EW: 0.93–1.03. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.3 (0.4) : 0.8 (0.4) : 1.0 (0.3) : 0.9 (0.3) : 0.9 (0.4) : 0.7 (0.4) : 1.1 (0.7) : 0.9 (0.6) : 1.0 (0.8) : 1.0 (1.0) : 1.2 (1.1).

Specimens examined. 1♀, Mt. Lompo Battang, S. Sulawesi, 25-XII-1999, K. Ando leg., K. Ando collection (EUMJ); Paratypes, 2♀, same data above (EUMJ); 1♀, same data above, but M. Ando leg. (EUMJ)

Distribution. Indonesia: southern Sulawesi.

Comments. This species is similar to *Scaphidium* sp5 from Sulawesi by the structure of female genitalia, but it is easily distinguished from the latter by the pattern of pronotal coloration, all tibiae yellowith-brown, and the shape of antennae.

***Scaphidium* sp8**

(Figs. 4–2b, 4–4i, 4–6a)

Description. Head and mouthparts reddish-brown. Antennomeres I–V reddish-brown; VI dark reddish-brown; VII–X and basal half XI black; apical half XI yellowish-brown. Basic color of pronotum cupric luster, but apical portion reddish-brown, extending to base and forming trifurcate hoe. Elytra purplish-metallic. Propygidium and pygidium reddish-brown with cupric luster. Ventral surface reddish-brown to darker. Legs almost dark reddish-brown, but one third areas of all tibiae and tarsus reddish brown, claws yellowish-brown (Fig. 4–2b). Head, pronotum and elytra sparsely and finely pubescent.

Head with eye width about two times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; I about twice as long as VI; III almost as long as each IV, VII, and IX; each VII and XI longer than wide; each VIII, IX, and X wider than long; each X and XI twice as wide as VI (Fig. 4–4i).

Pronotum wider than long, with an anterior bead. Punctuation sparse and coarse, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation

slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about 1.2 times as wide as space between them, mesocoxal area moderately broadened. Mesanepisternum about 1.2 times as long as wide. Mesepimeron about 1.5 times as long as wide, paramesepimeron about three times as long as wide. Metanepisternum about ten times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomere V about three times as long as each II–IV; II–IV about 1.2 times as long as I. Mesotarsomeres each I and V about two times as long as II; II about 1.2 times as long as each III and IV. Metarsomere I about 2.2 times as long as each II–IV; V about three times as long as each II–IV.

Male. Protarsomeres I–III with tenent setae, slightly enlarged. Protibiae curved inward and enlarged forming triangular shape at apical portion. Inner margin of meso- and metatibiae slightly sinuate. Aedeagus about 1.3 mm long; parameres symmetrical, sinuate from lateral view; internal sac with multiple sclerites, a T-shaped and two pairs of sclerites at middle, a pair of strip-shaped sclerite at apex (Fig. 4–6a).

Female. Unknown.

Measurements (n = 1). Length (PL+EL): 4.00 mm. PW: 2.40 mm; EW: 2.90 mm. HW: 1.00 mm. ID: 0.20 mm. PL/PW: 0.69, EL/EW: 0.80. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.4 (0.4) : 0.9 (0.4) : 1.0 (0.4) : 1.0 (0.4) : 0.9 (0.4) : 0.7 (0.5) : 1.0 (0.9) : 0.9 (1.0) : 1.0 (1.2) : 1.1 (1.4) : 1.8 (1.4).

Specimen examined. 1♂, Mangkaluku, Malimbu, Sabbang, C. Sulawesi, 27–29. IV. 2009, A. Saito leg. (EUMJ).

Distribution. Indonesia: central Sulawesi.

Comments. This species is very similar to *Scaphidium alternans* Löbl, 1978 and *Scaphidium cyanipenne* Gestro, 1879 by the pattern of body coloration, but it is easily distinguished from them by the body coloration of ventral surface and the structure of

male genitalia.

***Scaphidium* sp9**

(Figs. 4–2d, 4–4h, 4–6b, 4–8d)

Description. Body metallic luster over all. Head bluish metallic luster, mouthparts reddish-brown. Antennomeres I–VI reddish-brown; VII–XI black. Pronotal disc purplish-metallic, around margins bulish-metallic. Elytral disc purplish-metallic, around margins bluish-metallic. Propygidium and pygidium bulish or greenish-metallic. Ventral surface brightly bluish-metallic. Legs bluish-metallic (Fig. 4–2d). Head, pronotum and elytra sparsely and finely pubescent.

Head with eye width about 2.5 times as interocular distance. Punctuation sparse and coarse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; I about twice as long as V; each III, IV, VII, and IX almost as long as wide; each VIII, IX, and X apparently wider than long; width of X about twice as long as length; X about three times as wide as VI; XI about 2.5 times as long as VI (Fig. 4–4h).

Pronotum wider than long, with an anterior bead. Punctuation sparse and coarse, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation slightly coarser than or almost same as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite smooth, medial portion coarsely and sparsely punctate. Mesocoxa about 1.2 times as wide as space between them, mesocoxal area moderately broadened. Mesanepisternum about 1.2 times as long as wide. Mesepimeron almost as long as wide, paramesepimeron about twice as long as wide. Metanepisternum about seven times as long as wide, with a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomere V about three times as long as each I–IV. Mesotarsomeres I 2.5 times as long as II; II 1.2 times as long as each III and IV; V 3.2 times as long as each III and IV. Ratio of metatarsomeres length almost same as mesotarsomeres, but metatarsomere V almost as long as I.

Male. Protarsomeres I–III with tenent setae, strongly enlarged. All tarsus almost as wide as tibiae. Protibiae curved inward and projected at apical portion. Inner margin of metatibiae slightly sinuate. Aedeagus about 1.4 mm long; parameres symmetrical, sinuate from lateral view; internal sac with multiple sclerites, a small U-shaped sclerite at base, a Y-shaped and two pairs of sclerites at middle, a pair of strip-shaped sclerite at apex (Fig. 4–6b).

Female. Protarsomeres I–III without tenent setae, hardly enlarged. Ovipositor simple, but with setose gonocoxites; bursa copulatrix sclerotized without numerous spines (Fig. 4–8d), sclerotized portion forming shield shape. Spermatheca as Fig. 4–8d, connecting under bursa copulatrix of vaginal plate.

Measurements (n = 4). Length (PL+EL): 4.40–4.73 mm. PW: 2.50–2.80 mm; EW: 2.83–3.13 mm. HW: 1.07–1.11 mm. ID: 0.16–0.20 mm. PL/PW: 0.75–0.82, EL/EW: 0.79–0.87. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.6 (0.4) : 0.9 (0.4) : 1.0 (0.4) : 1.0 (0.4) : 0.8 (0.4) : 0.6 (0.5) : 1.0 (1.0) : 0.9 (1.2) : 1.0 (1.6) : 0.9 (1.8) : 1.6 (1.7).

Specimen examined. 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–400 m, 3°38’40”S–3°38’31”S, 121°07’32”E–121°05’42”E, 18. III. 2014, S. Fujie leg. (MZBI); Paratypes, 1♀, same data above, but O69 (HUOI); 2♀, same data above, but O75, O’8 (EUMJ), 1♀, Palu, Palopo, Kamarora [Lore Lindu N.P.?], 700 m, trail to waterfall, C-Sulawesi, 23–27. VIII. 1997, A. Riedel leg., 46 Stück, O’9, (MHNG).

Distribution. Indonesia: central and southeast Sulawesi.

Comments. This species is very similar to *Scaphidium papuanum* Löbl, 1975 and *Scaphidium coerulans* Löbl, 1978 from New Guinea by the body coloration and the shape of leg on male, but it is easily distinguished from them by the pattern of body coloration and the structure of male genitalia.

4. 2 Genus *Cyparium*

Cyparium Erichson, 1845 [gender: neuter]

Cyparium Erichson, 1845: 3; type species *Cyparium palliatum* Erichson, 1845.

Yparicum Achard, 1920a: 126; type species: *Yparicum yunnanum* Achard, 1920. Synonymy: Löbl, 1992.

Diagnosis. Maxillary palpomere IV normal. Labial palpus normal. Antenna not filiform, usually forming club, rounded and compact; antennomeres each VII–XI covered with microsetae. Mandible bidentate; mola with brush. Galea somewhat narrow (longer than wide), without subapical short bristles. Anterior margin of pronotum with a bead. Neck not prolonged behind. Posterior angle of pronotum pointed, lateral margin not sinuate, sub-basal stria absent. Eyes entire. Prothoracic corbiculum absent. Mesocoxal lines present on metaventrite. Metaventrite of male without setiferous sex patch. Secondary lines of mesoventrite present. Anterior portion of proventrite greatly reduced. Elytra with some rows of punctures. Metanepisternum without longitudinal line. Abdominal ventrite I without metacoxal bead. Profemoral ctenidium absent. Tibiae with spines. Metacoxae separated.

***Cyparium* sp1**

(Figs. 4–11a–c)

Description. Head almost black, clypeus and frons dark brown to reddish brown, mouth parts yellowish-brown. Antennomeres I–VI and apical half of XI brown to yellowish-brown; VII–X dark brown to black; XI paler yellowish-brown. Pronotum and elytra black, without iridescent luster. Propygidium and pygidium dark brown to black. Tibiae and femur dark reddish-brown; tarsus paler than tibiae and femur. Ventral surface almost black, except for all coxae dark reddish-brown (Fig. 4–11a). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about 1.2 times as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; I about 2.5 times as long as VI; each VI and VII almost as long as wide; each VIII–XI about wider than long; XI about twice as long as each III and IV; XI 2.5

times as long as VI (Fig. 4–11c).

Pronotum wider than long, with an anterior bead. Punctuation sparse and fine, as on head. Scutellum wider than long, with exposed apex.

Elytra slightly wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, latero-posterior margin with some setae. Disc of elytral punctuation coarser than on pronotum, with five rows and an indistinct row of punctures; first row of punctures extending outwards along basal margin and joined with third row of punctures. Intervals between rows of punctures, finely and sparsely punctate. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron and lateral portion of mesoventrite smooth. Lateral portion of metaventrite coarsely and sparsely punctate, medial portion coarsely and sparsely punctate. Mesocoxa almost as wide as space between them. Mesepimeron about twice as long as wide. Metanepisternum about six times as long as wide, without a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Median portion of ventrite I coarsely and sparsely punctate, slightly weaker than punctures of metaventrite.

Protarsomeres each segment of I–III 1.2 times as long as IV; V 1.5 times as long as each I–III; V twice as long as IV. Mesotarsomeres each I and V 2.0 times as long as each II–IV. Metatarsomeres I and V 1.2 times as long as III; II 1.2 times as long as each III and IV.

Male. Pro- and mesotarsomeres I–III with tenent setae, not enlarged. Aedeagus 0.8 mm long; parameres symmetrical, slightly enlarged at apical portion and narrowed apically; internal sac without sclerites, covered with fine scale-like and denticulate structures (Fig. 4–11b).

Female. Pro- and mesotarsomeres I–III without tenent setae, not enlarged. Female genitalia unexamined.

Measurements (n = 3). Length (PL+EL): 2.13–2.36mm. PW: 1.31–1.42mm; EW: 1.44–1.67mm. HW: 0.56–0.60mm. ID: 0.16–0.18mm. PL/PW: 0.64–0.67, EL/EW: 0.84–0.89. Approximate ratio of each antennal segment in length (width) (n = 1) = 1.5

(0.6) : 1.1 (0.5) : 1.0 (0.4) : 0.8 (0.4) : 0.9 (0.5) : 0.6 (0.6) : 0.9 (1.0) : 0.8 (1.1) : 0.8 (1.3) : 0.9 (1.4) : 1.6 (1.4).

Specimens examined. 1♂, Indonesia: Sulawesi Utara, Dumoga-Bone N. P. Plot A, ca 200m, Lowland forest, 24. II. 1985, Flight interception trap 2, R. Ent. Soc. Lond. PROJECT WALLACE B. M. 1985–10; 1♀, same data above but Flight interception trap 1, +31| –7 [pink label]; 1♀, same data above but Flight interception trap 3.

Distribution. Indonesia: northern Sulawesi.

Comments. This species is very similar to *Cyparium javanum* Löbl, 1990 from Java and *C. khasianum* Löbl 1984 from India by the body size, the numbers of row of punctures, and elytral coloration, but it is easily distinguished from them by the body coloration and the structure of male genitalia.

4. 3 *Scaphisoma* group

As shown in Leschen & Löbl (2005) and Chapter 3, this monophyletic group is strongly supported by the molecular and morphological data. The morphological characters of this group are as follows: one apical tooth present on the apex of the mandible, antennomere III short and/or triangulate, posterior angle of pronotum prolonged acute, anterior bead of pronotum interrupted at middle, metacoxal lines arcuate, and profemoral ctenidium present.

4. 3. 1 Termitophilous scaphidiines

This group has been known as a well-supported clade by a large number of synapomorphies and they share morphologically several characters, e.g., mesofemora flattened (enlarged), the plumate antennae, and the generally setose body. The monophyly of the molecular data is also strongly supported as shown in Chapter 3, although the clade include *Scaphisoma sadang* Löbl of a typical member of the genus *Scaphisoma*.

Comments. This group is associated with some subfamilies of termites of Termitidae, exclusively occurring on Macrotermitinae, and the distributions of Macrotermitinae and the termitophilous scaphidiines are sympatric.

Key to the Sulawesian termitophilous species of Scaphidiinae

1 Body length more than 2.5 mm. Metacoxal area extended and vertically long. Point of scutellum exposed. ..... ***Baeoceridium celebense*** Löbl

− Body length less than 2.5 mm. Metacoxal area not extended. Scutellum concealed. 2

2 Body with weakly iridescent luster and body surface pubescent. Lateral keels of elytra without macrosetae. Ventral surface of body coarsely punctate, except for hypomera; hypomera finely punctate. Tibiae not compressed and without spurs. ..... ***Vituratella termitophila*** (Champion)

Body shining without iridescent luster and body surface bare. Lateral keels of elytra with some macrosetae in dorsal view. Ventral surface of body finely punctate, except for hypomera; hypomera smooth. Tibiae compressed and enlarged with spurs. ..... ***Termitoscaphium kistneri*** Löbl

4. 3. 1. 1 Genus *Baeoceridium*

Baeoceridium Reitter, 1889 [gender: neuter]

Baeoceridium Reitter, 1889: 6; type species: *Baeoceridium depressipes* Reitter, 1889.

Baeceridium Pic, 1924: 195 (incorrect subsequent spelling).

Diagnosis. Maxillary palpomere IV normal, apical portion somewhat aciculate. Labial palpus normal. Antenna short, filiform, not forming club; antennomeres each VII–XI covered with microsetae. Mandible unidentate; mola with brush. Galea broad (wider than long), with subapical short bristles. Lacinia narrow without short bristles. Anterior margin of pronotum without a bead. Head flatted and inserted in pronotum. Posterior angle of pronotum pointed, lateral margin not sinuate, sub-basal stria absent. Eyes entire. Prothoracic corbiculum absent. Metaventrite of male without setiferous sex patch. Secondary lines of mesoventrite absent. Anterior portion of proventrite greatly reduced. Scutellum exposed. Elytra with sutural striae. Epipleuron situated ventrally. Metanepisternum without longitudinal line. Abdominal ventrite I with longitudinal metacoxal bead. Profemoral ctenidium present. Legs short. Femora strongly enlarged, flatted. Tibiae compressed, strongly enlarged with spines. Mesocoxae somewhat approximate. Metacoxae separated.

Baeoceridium celebense Löbl, 1982

Baeoceridium celebense Löbl, 1982: 29.

(Figs. 4–12d–g)

Specimens examined. 1♂ (paratype), South Sulawesi/ Tana Toraja/ Keti Kesu nr. Rantepao// 18. IX/ ex fungus gardens/ Nest T-1015/ coll. D. H. and A. C. Kistner// Baeoceridium celebense Löbl/ det. Löbl, 1981 [handwritten in part]// Paratype [orange] (MHNG); 1♀, INDONESIA: SULAWESI UTARA/ Dumoga-Bone N. P./ October. 1985// Malaise Trap 1// Plot B, ca 300m/ Lowland forest// R. Ent. Soc. Lond./ PROJECT WALLACE/ B.M. 1985-10 // Baeoceridium celebense Löbl/ det. Löbl, 1981 [printed] (MHNG); 1♂, Mt. Tilongkabila,, N. Sulawesi, Indonesia, alt. ca. 800m, 0°34'28.52N, 123°11'30.61E, F.I.T. (set up in 25. I. 2013, collected in 27. I. 2013), R. Ogawa leg (EUMJ).

Distribution. Indonesia: northern and southern Sulawesi

4. 3. 1. 2 Genus *Termitoscaphium*

Termitoscaphium Löbl, 1982 [gender: neuter]

Termitoscaphium Löbl, 1982: 31; type species: *Termitoscaphium kistneri* Löbl, 1982.

Diagnosis. Similar to the genus *Baeoceridium* in most respects, but distinctly differs in the following characters: middle of apical margin of pronotum convexly produced; elytra with setiferous punctures on lateral keels, without sutural striae.

Termitoscaphium kistneri Löbl, 1982

Termitoscaphium kistneri Löbl, 1982: 33.

(Figs. 4–12a–c)

Specimens examined. 1♂1♀ (paratypes), Central Sulawesi/ Lake Lindu area/ ±950 m// 27. IX. 1980. ex fungus gardens/ Nest T-1022/ coll. D. H. and A. C. Kistner// Paratype [orange]// Terimitoscaphium kistneri Löbl/ det. Löbl, 1981 [handwritten in part] (MHNG).

Distribution. Indonesia: northern and central Sulawesi

4. 3. 1. 3 Genus *Vituratella*

Vituratella Reitter, 1908 [gender: feminine]

Vituratella Reitter, 1908: 35; type species: *Vituratella eichelbaumi* Reitter, 1908.

Trichoscaphella Reitter, 1908: 34; type species: *Trichoscaphella suturisulcata* Reitter, 1908. Synonymy: Leschen & Löbl, 2005.

Antongilium Pic, 1920; type species: *Antongilium nitidum* Pic, 1920. Synonymy: Achard, 1924.

Mysthrix Champion, 1927: 278; type species: *Mysthrix termitophilum* Champion, 1927. Synonymy: Leschen & Löbl, 2005.

Termitoxidium Pic, 1928: 38; type species: *Termitoxidium longicolle* Pic, 1928. Synonymy: Leschen & Löbl, 2005.

Mystrix Löbl, 1992: 577 (incorrect subsequent spelling).

Diagnosis. Maxillary palpomere IV normal. Labrum trilobite. Labial palpus normal. Antenna short, filiform, not forming club; antennomeres each V–XI covered with microsetae. Mandible unidentate; mola with brush. Galea broad (wider than long), with subapical short bristles. Lacinia narrow without short bristles. Anterior margin of pronotum without a bead. Posterior angle of pronotum pointed, lateral margin not sinuate, sub-basal stria absent. Eyes entire. Prothoracic corbiculum absent. Metaventrite of male without setiferous sex patch. Secondary lines of mesoventrite absent. Anterior portion of proventrite greatly reduced. Scutellum slightly exposed. Body with pubescent and strongly sculptured surface. Elytra with sutural striae evanescent towards base. Epipleuron situated horizontal. Metanepisternum without longitudinal line, coarsely punctate. Abdominal ventrite I with metacoxal bead. Profemoral ctenidium present. Femora strongly enlarged. Tibiae with spines. Mesocoxae somewhat approximate. Metacoxae separated.

Vituratella termitophila (Champion, 1927)

Mysthrix termitophilum Champion, 1927: 278; Löbl, 1992, 1999; Rougemont, 1996.

(Figs. 4–13a–f)

Specimens examined. 1♂ (holotype), Haldwani Dist./ Kumaon/ India. H.G.C.// G.C. Champion Coll./ B.M. 1927-409.// Type H.T.// SYN-TYPE// Mysthrix termitophilum Champ./ R. J. W. Aidridge det. 1975/ SYNTYPE// In termite comb/ T. obesus?// Mysthrix/ termitophila Ch./ type (BMNH). 1♀, Indonesia, Sulawesi Utara/ Dumoga-Bone N.P./ 24. February. 1985// Flight interception trap 3// Plot A, ca 200m/ Lowland forest// R. Ent. Soc. Lond./ PROJECT WALLACE/ B.M. 1985-10 (1) (BMNH); 1♀, same data as (1) but / Flight interception trap 2 (BMNH); 1♂, same data as (1) but / Lowland forest 200–300m/ Malaise trap 8/ 31 –3 [pink] (BMNH); 1♂1♀, same data as (1) but / 9–16. May. 1985/ Malaise Trap/ Lowland forest ca 200m (BMNH); 1♀, same data as (1) but / 13–20. March. 1985/ Plot B, ca. 200m, Lowland forest/ 31 –3 [pink]; 1♀, same data as (1) but / November. 1985/ 'Hog's Back' Camp Lowland forest 492m/ Malaise Trap (BMNH); 1♀, same data as (1) but / March 1985/ Huntuk Trail Plateau 1100m/ Malaise Trap (BMNH); 1♂, same data as (1) but / Lowland forest ca. 200m/ Malaise Trap (BMNH). 1♂1♀, N. Sulawesi, Prov. Gorontalo, Pegunugan Tilongkabila, Bogani Nani Warta Bone N. P., 16. Feb.–16. Mar. 2010, malaise trap, K. Takasuka leg. (EUMJ); 1♂, INDONESIA, Sulawesi, –11. 85, Coll. H. R. Last (MHNG); 4 exs, S. CELEBES, Rante Pao, VI. 1984, Rougemont leg. (MHNG); 2exs. same data but 9, 10. VI. 1984 (MHNG); 1♂, Mt. (Gunung) Mekongga, Wawo, Indonesia, alt. ca. 400m, 3°38'31S, 121°05.42E, F.I.T (set up on 23. IV. 2014, collected in 25. IV. 2014), R. Ogawa leg. (EUMJ); 1♂, Mt. Tilongkabila, N. Sulawesi, Indonesia, alt. ca. 800m, 0°34'28.52N, 123°11'30.61E, F.I.T (set up in 25. I. 2013, collected in 27. I. 2013), R. Ogawa leg (EUMJ).

Distribution. China: Hong Kong; Nepal; India: Uttar Pradesh (Kumaon); Indonesia: northern and southeastern Sulawesi (**New record**).

Remarks. This species is very similar to *V. kistneri* from Sumatra. According to Löbl (1979), *Vituratella kistneri* may be distinguished from this species by the much paler coloration of the abdomen, and the denser punctuation of the lateral portions of the metaventrite. The first author identified the species from Sulawesi as *V. termitophila* based on a comparison with the holotype of *V. termitophila* deposited in the BMNH.

4. 3. 2 Genus *Scaphisoma*

Scaphisoma Leach, 1815 [gender: feminine]

Scaphisoma Leach, 1815: 89; type species: *Silpha agaricina* Linnaeus 1758.

Scaphosoma Agazzi, 1846: 332. Unjustified emendation.

Caryoscapha Ganglbauer, 1899: 343 (as subgenus of *Scaphosoma*); type species: *Scaphisoma limbatum* Erichson, 1845. Synonymy: Leschen & Löbl, 2005.

Scaphiomicrus Casey, 1900: 58; type species: *Scaphisoma pusilla* LeConte, 1860. Synonymy: Fall, 1910.

Pseudoscaphosoma Pic, 1915b: 31; type species: *Pseudoscaphosoma testaceomaculatum* Pic, 1915. Synonymy: Löbl, 1975.

Scutoscaphosoma Pic, 1916: 3 (subgenus of *Scaphosoma*); type species: *Scaphosoma* (*Scutoscaphosoma*) *rouyeri* Pic, 1916. Synonymy: Löbl, 1981.

Scaphella Achard, 1924: 29; type species: *Scaphosoma antennaum* Achard, 1919. Synonymy: Löbl, 1970b.

Macrobaeocera Pic, 1924: 195; type species: *Scaphosoma phungi* Pic, 1922. Synonymy: Löbl, 1975.

Mimoscaphosoma Pic, 1928: 49 (subgenus); type species: *Scaphosoma* [tabul.] (*Mimoscaphosoma*) *bruchi* Pic, 1928. Synonymy: Leschen & Löbl, 2005.

Macroscaphosoma Löbl, 1970b: 128 (subgenus *Macroscaphosoma* Pic, 1928: 33); type species: *Macroscaphosoma collarti* Löbl, 1970. Synonymy: Leschen & Löbl, 2005.

Metalloscapha Löbl, 1975: 384; type species: *Metalloscapha papua* Löbl, 1975. Synonymy: Löbl, 2002.

Diagnosis. Maxillary palpomere IV normal. Labial palpus normal. Antenna short, filiform, not forming club; antennomere III usually short and triangular; each VII–XI covered with microsetae. Mandible unidentate; mola with brush. Galea broad (wider than long), with subapical short bristles. Anterior margin of pronotum without a bead. Posterior angle of pronotum pointed, lateral margin not sinuate, sub-basal stria absent. Eyes entire or notched. Prothoracic corbiculum absent. Metaventrite of male without setiferous sex patch. Secondary lines of mesoventrite absent or present. Mesocoxal lines present on metaventrite. Anterior portion of proventrite greatly reduced. Scutellum exposed or concealed. Elytra each with basal stria present or absent. Epipleuron situated

horizontal. Abdominal ventrite I with metacoxal bead. Profemoral ctenidium present. Mesotibia with two ventral spines. Metacoxae separated. Empodium unisetose.

Key to Sulawesian species of *Scaphisoma*

(Characters of *S. obliquemaculatum* are cited from Löbl 1971, 1990)

1 Body bicolorous. 6

– Body unicolorous. 2

2 Body size usually larger than 1.5 mm. 3

– Body size usually smaller than 1.5mm. 5

3 Dorsum with iridescent luster. Parameres strongly enlarged, basal part of internal sac with some sclerites. 4

– Dorsum without iridescent luster. Parameres slightly enlarged, internal sac without sclerite. ..... ***S.* sp8**

4 Dorsum yellowish-brown. Lateral keels of elytra visible from dorsal view. Antennomere IV twice as long as III; XI 3.5 times as long as III. Apical margin of metaventrite with two projections. ..... ***S. palu*** Löbl

– Dorsum black. Lateral keels of elytra invisible from dorsal view. Antennomere IV four times as long as IV; XI 5.5 times as long as III. ..... ***S. latitarse*** Löbl

5 Body size usually larger than 1.0 mm. Punctuation of elytra coarse. 6

– Body size usually smaller than 1.0 mm. Punctuation of elytra fine. ..... ***S. sadang*** Löbl

6 Body color almost reddish-brown. Lateral portion of metaventrite coarsely and sparsely punctuate. ..... ***S. napu*** Löbl

– Body color almost black. Lateral portion of metaventrite finely and sparsely punctuate. ..... ***S.* sp7**

7 Ventral surface almost reddish or yellowish-brown, except for hypomeron and part of abdomen. 8

– Ventral surface almost black, except for hypomeron and part of abdomen. ... 10

8 Elytra almost yellowish-brown with some fasciae. 9

– Elytra almost black, posterior portion with yellowish-brown fasciae. ..... ***S.*** cf. ***tricolor*** Heller

9 Elytra each with two fasciae on base and apex. Elytral punctuation strongly coarse. Male metatibiae almost straight. ..... ***S.* sp6**

– Elytra with black fasciae on disc, base, sutural striae, and apex. Elytral punctuation fine. Male metatibiae strongly curved. ..... ***S.* sp4**

10 Pronotum with two patches. Hypomeron reddish or yellowish-brown. 12

– Pronotum without patches. Hypomeron black. Elytra each with two brown fasciae on basal and apical part. 11

11 Posterior spot of elytra located along posterior margin. Apical part of median lobe thin, pointed from dorsal view, almost straight from lateral view. ..... ***S. obliquemaculatum*** Motschulsky

– Posterior spot of elytra separated from posterior margin. Apical part of median lobe thick, not pointed from dorsal view, curved from lateral view. ..... ***S. bugi*** Löbl

12 Elytra almost reddish or yellowish-brown, but black along basal, lateral, apical, or sutural striae. Propygidium and pygidium yellowish-brown. 13

– Elytra uniformly dark brown to black. Propygidium and pygidium dark brown to black. ..... ***S.* sp2**

13 Elytra without posterior spot, lateral keels invisible from dorsal view. 14

– Elytra each with black posterior spots, lateral keels visible from dorsal view. ..... ***S.* sp3**

14 Pronotum mostly black, lateral sides reddish-brown. Ventrite I dark brown to black. ..... ***S.* sp1**

– Pronotum mostly yellowish-brown, posterior margin black. Ventrite I yellowish-brown. ..... ***S.* sp5**

Scaphisoma bugi Löbl, 1983

Scaphisoma bugi Löbl, 1983: 288.

(Figs. 4–14a, b)

Specimens examined. 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34’28.52”N, 123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 1ex, same data; 1♂, same data, but alt. ca. 800m, 0°34’28.52”N,

123°11’30.61”E, 8. VI. 2012, R. Ogawa leg.; 1♀, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 30–400 m, 3°39’10”S, 121°03’00”E–3°38’31”S, 121°05’42”E, 19. IX. 2012, R. Ogawa leg.

Distribution. Indonesia: northern and southeastern Sulawesi.

Scaphisoma latitarse Löbl, 2012

Scaphisoma latitarse Löbl, 2012: 313.

(Fig. 4–14k, l)

Specimens examined. 4♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800 m, 0°34’28.52”N, 123°11’30.61”E, 8. VI. 2012, R. Ogawa leg. 1♂, same data, but 12. VI. 2012, R. Ogawa leg.; 1♂, same data, but ca. 800–1300 m, 0°34’28.52”N, 123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 2♂, same data, but ca. 800–1500 m, 0°34’28.52”N, 123°11’30.61”E–0°35’18”N, 123°13’22”E, 22. II. 2013, R. Ogawa leg.; 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E, 16. XII. 2013, R. Ogawa leg.; 1♂, same data, but ca. 30–400 m, 3°39’10”S, 121°03’00”E–3°38’31”S, 121°05’42”E, 19. IX. 2013, R. Ogawa leg.; 1♂, Puncak Palopo, Palopo-city, Luwu, S. Sulawesi, 26. IV. 2010, R. Ogawa leg.; 1 ex., Camba, Maros, S. Sulawesi, 4. V. 2010, R. Ogawa leg.; 1 ex., Bantimurung, Sulawsi Selatan, 23. IV. 2010, Susumu Matsuo leg.; 11 exs., Bantimurung, Maros, Sulawesi Selatan, 12. II. 2013, J. Yamasako leg.; 1 ex., Tompo Bulu, Balocci, Pangkep, Sulawesi Selatan, 13–14. II. 2013, J. Yamasako leg.; 1 ex., Taka Lalla, Watansoppeng, Sulawesi Selatan, 11. II. 2013, J. Yamasako leg.

Distribution. Indonesia: throughout Sulawesi.

Scaphisoma napu Löbl, 1983

Scaphisoma napu Löbl, 1983: 289.

(Figs. 4–14i, j)

Specimens examined. 3♂, Puncak Palopo, Palopo-city, Luwu, S. Sulawesi, 23–26. IV. 2010, R. Ogawa leg.; 12 exs., same data; 1 ex., same data, but 26. IV. 2010, R. Ogawa

leg.; 1 ex., same data, but alt .ca. 800 m, S02°57', E 120°05', 30. I–4. II. 2013, J. Yamasako leg.; 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, ca. 800–1500 m, 0°34'28.52"N, 123°11'30.61"E–0°35'18"N, 123°13'22"E, 22. II. 2013, R. Ogawa leg.; 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38'31"S, 121°05'42"E–3°38'17"S, 121°11'34"E, 16. XII. 2013, R. Ogawa leg.; 1♂, same data, but ca. 30–400 m, 3°39'10"S, 121°03'00"E–3°38'31"S, 121°05'42"E, 19. IX. 2013, R. Ogawa leg.

Distribution. Indonesia: throughout Sulawesi..

Scaphisoma obliquemaculatum Motschulsky, 1863

Scaphisoma obliquemaculatum Motschulsky, 1863: 435.

Scaphosoma rufomaculatum Pic, 1921: 5. Lectotype designation & synonymy: Löbl, 1975.

Scaphosoma luteoapicale Pic, 1923a: 17. Lectotype designation & synonymy: Löbl, 1975.

(Figs. 4–14)

Distribution. Indonesia: Java, Sulawesi, Sumatra, Mascarene archipelago; East Malaysia: Sarawak; Sri Lanka; Thailand; Vietnam.

Comments. This species was recorded in Sulawesi by Löbl (1997), but it was not obtained in this study.

Scaphisoma palu Löbl, 1983

Scaphisoma palu Löbl, 1983: 290.

(Figs. 4–14g, h)

Specimens examined. 9♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34'28.52"N, 123°11'30.61"E–0°35'18.14"N, 123°13'22.71E, 9. VI. 2012, R. Ogawa leg.; 4♂, same data but ca. 800–1500 m, 0°34'28.52"N, 123°11'30.61"E–0°35'18"N, 123°13'22"E, 22. II. 2013, R. Ogawa leg.; 1♂, same data, but ca. 1300 m, 0°35'18"N, 123°13'22"E, 10. VI. 2012, R. Ogawa leg.; 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38'31"S,

121°05’42”E–3°38’17”S, 121°11’34”E, 16. XII. 2013, R. Ogawa leg.; 4♂, Puncak Palopo, Palopo-city, Luwu, S. Sulawesi, 23–26. IV. 2010, R. Ogawa leg.; 1♂, Tompo Bulu, Balocci, Pangkep, Sulawesi Selatan, 13–14. II. 2013, J. Yamasako leg.

Distribution. Indonesia: throughout Sulawesi..

Comments. This species is included in *tricolor* group *sensu lato*, proposed by Löbl (2012).

Scaphisoma sadang Löbl, 1983

Scaphisoma sadang Löbl, 1983: 286.

(Figs. 4–14c, d)

Specimens examined. 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E, 16. XII. 2013, R. Ogawa leg.; 2♂, same data, but ca. 30–400 m, 3°39’10”S, 121°03’00”E–3°38’31”S, 121°05’42”E, 19. IX. 2013, R. Ogawa leg.; 1 ex., Puncak Palopo, Luwu, Palopo-city, S. Sulawesi, 23–26. IV. 2010, R. Ogawa leg.; 5 exs., Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34’28.52”N, 123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 1 ex., same data, but 8. VI. 2012, R. Ogawa leg.; 1♂, Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1000–1400 m, 0°55’36.65”N, 122°03’45.44”E–0°54’59.77”N, 122°04’13.10E, 24. VI. 2012, R. Ogawa leg.; 1 ex., same data; 2 exs., same data, but alt. ca. 1800–2000 m, 0°54’25.07”N, 122°04’20.71”E–0°54’13.72”N, 122°04’38.30”E, 26. VI. 2012, R. Ogawa leg.; 2♂, same data.

Distribution. Indonesia: throughout Sulawesi..

Scaphisoma tricolor Heller, 1917

Scaphosoma tricolor Heller, 1917: 46.

Scaphosoma latum Pic, 1920b: 3.

(Figs. 4–14e, f)

Specimens examined. 2♂, Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1000–1400 m, 0°55’36.65”N, 122°03’45.44”E–0°54’59.77”N, 122°04’13.10E, 24. VI.

2012, R. Ogawa leg.; 4♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34’28.52”N, 123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 5♂, same data, but alt. ca. 800 m, 0°34’28.52”N, 123°11’30.61”E, 8. VI. 2012, R. Ogawa leg.; 2♂, Puncak Palopo, Palopo-city, S. Sulawesi, 26. IV. 2010, R. Ogawa leg.; 2♂, same data, but 23–26. IV. 2010, R. Ogawa leg.; 1♂, Tompo Bulu, Balocci, Pangkep, Sulawesi Selatan, 13–14. II. 2013, J. Yamasako leg.; 3♂, Taka Lalla, Wartansoppeng, Sulawesi Selatan, 11. II. 2013, J. Yamasako leg.; 1♂, Bantimurung, Maros, Sulawesi Selatan, 12. II. 2013, J. Yamasako leg.

Distribution. Japan: Ryukyu archipelago?; Micronesia: Bonin Island; Philippines: Balabac, Luzon, Palawan; Indonesia: Sulawesi?.

Comments. This species is included in *tricolor* group *sensu lato*, proposed by Löbl (2012). The definition of this species is still ambiguous. Little is known about “*Scaphisoma tricolor*” described by Heller (1917) (Löbl 1970, 1981). Nevertheless, the specimens of Sulawesi, characterized by the body coloration of tricolor and the structures of male genitalia, e.g., large aedeagi with strongly asymmetrical apical process of the median lobe and parameres with large ventral and dorsal lobes, are treated as *S. tricolor* in this study. The examined specimens from Sulawesi seem to be included some species characterized by the tip of apical process on the median lobe, the sclerotized portion, and the shape of apical margin of elytra.

***Scaphisoma* sp1**

(Figs. 4–15a, b)

Description. Head and mouthparts almost reddish-brown, except for basal portion of head black. Antennae yellowish-brown. Pronotum on median and basal portion black, lateral side of pronotum and hypomeron orange to reddish-brown, with two small patches on medicolateral side. Elytra almost reddish-brown, except for epipleulon and basal and median portion black. Propygidium and pygidium yellowish-brown. Legs yellowish brown to light orange. Ventral surface almost black, except for hypomeron reddish-brown (Fig. 4–15a). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width slightly narrower than interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some

macrosetae; IV about three times as long as III; each IV and VI about four times as long as III; XI about 1.5 times as long as X; VIII slightly shorter than each VI, VII, IX, and X; III twice as wide as I; VII about 1.5 times as wide as III.

Pronotum wider than long, without an anterior bead. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral portion of metaventrite same as on elytra. Mesocoxa almost as wide as space between them. Mesepimeron about twice as long as wide, paramesepimeron about three times as long as wide. Metanepisternum about four times as long as wide, with punctuation. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I with strigulate microsculpture.

Protarsomeres each I–III 1.3 times as long as IV; V twice as long as IV. Mesotarsomeres I twice as long as each II, III, and V; each II, III and V twice as long as IV. Approximate ratio of each metatarsomeres length almost same as mesotarsomeres.

Male. Protarsomeres I–III with tenent setae, enlarged. Aedeagus 0.75 mm long; parameres symmetrical, enlarged at subapical portion from dorsal view; internal sac with a spiral sclerite, spinning twice (Fig. 4–15b).

Female. Protarsomeres I–III without tenant setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 2.27–2.53 mm. PW: 1.33–1.58 mm; EW: 1.47–1.73 mm. HW: 0.67–0.78 mm. ID: 0.24–0.29 mm. PL/PW: 0.66–0.72, EL/EW: 0.86–0.94. Approximate ratio of each antennal length (width) as follows (n = 1); 3.9 (1.8) : 2.6 (1.4) : 1.0 (0.8) : 3.0 (0.5) : 4.1 (0.6) : 4.0 (0.7) : 4.7 (1.2) : 3.6 (0.8) : 4.7 (0.8) : 4.8 (0.8) : 7.9 (0.8).

Specimens examined. 1♂, Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1000m, 0°55’36.65”N, 122°03’45.44”E, 27. VI. 2012, R. Ogawa leg.; 3♂1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300m, 0°34’28.52”N,

123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 1♂, same data, but ca. alt. 800m, 0°34’28.52”N, 123°11’30.61”E, 8. VI. 2012; 1♀, same data, but alt. ca. 800–1500m, 0°34’28.52”N, 123°11’30.61”E–0°35’18”N, 123°13’22”E, O’97, 22. II. 2013, R. Ogawa leg.

Distribution. Indonesia: northern Sulawesi.

Comments. This species is very similar to *Scaphisoma cruciatum* Champion, 1927 by the body coloration, but it is easily distinguished from the latter by the length of antennomere XI and the body size relatively larger.

***Scaphisoma* sp2**

(Figs. 4–15c, d)

Description. Head and mouthparts almost yellowish-brown. Antennae almost yellowish-brown, but antennomeres VI–XI blackish. Pronotum almost yellowish-brown sometimes median portion blackish forming square, with two small patches on medicolateral side. Elytra, propygidium, and pygidium almost dark brown to black. Legs yellowish brown to light orange. Ventral surface almost black, except for hypomeron, meso- and metacoxae, and apex of abdomen yellowish-brown (Fig. 4–15c). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about 0.7 times as wide as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III + IV almost as long as V; V 4.5 times as long as III; VI six times as long as III; XI five times as long as III; VIII slightly narrower than each VII, IX–XI; VIII almost as long as each X and XI; each X and XI shorter than IX.

Pronotum wider than long, without an anterior bead. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral

portions of metaventrite same as on elytra. Mesocoxa almost as wide as space between them. Mesepimeron about twice as long as wide. Metanepisternum about six times as long as wide, with punctuation. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventrite I with strigulate microsculpture.

Protarsomeres I 1.3 times as long as each II and III; each II and III twice as long as IV; V three times as long as IV. Mesotarsomeres I three times as long as each II and III; each II and III 1.2 times as long as IV; V 2.2 times as long as IV. Metatarsomeres I three times as long as each II and V; each II and V 1.3 times as long as III; III 1.3 times as long as IV; IV five times as long as I.

Male. Protarsomeres I–III with tenent setae, strongly enlarged. Anterior margin of profemora projected at median portion. Mesotibiae curved, with a small hump at basal one third. Aedeagus 1.17 mm long; parameres symmetrical, curved; apex of median lobe pointed toward base from lateral view; internal sac with two pairs of sclerite at apex (Fig. 4–15d).

Female. Unexamined.

Measurements. Length (PL+EL): 2.69–2.87 mm. PW: 1.62–1.71 mm; EW: 1.82–1.89 mm. HW: 0.71–0.78 mm. ID: 0.18–0.20 mm. PL/PW: 0.66–0.70, EL/EW: 0.87–0.92. Approximate ratio of each antennal length (width) as follows (n = 1); 4.3 (1.8) : 2.7 (1.6) : 1.0 (0.9) : 4.8 (0.6) : 6.3 (0.6) : 6.4 (0.6) : 6.3 (1.0) : 4.9 (0.7) : 6.2 (1.0) : 5.2 (1.0) : 5.1 (1.0).

Specimens examined. 3♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300–1500m, 0°34’36.05”N, 123°13’22.71”E–0°35’18.14”N, 123°11’58.59”E, 28. I. 2011, R. Ogawa leg.; 1♂, same data, but 10. VI. 2012; 1♂, same data, but alt. ca. 1300m, 0°34’36.05”N, 123°13’22.71”E; 3♂, Mt. Pontolo (Gunung Pontolo) N. Sulawesi, alt. ca. 1000–1400m, 0°55’36.65”N, 122°03’45.44”E–0°54’59.77”N, 122°04’13.10E, 24. VI. 2012, R. Ogawa leg.

Distribution. Indonesia: northern Sulawesi.

Comments. This species may be similar to *S. latitarse*, but it is easily distinguished from the latter by the pronotum yellowish-brown, male mesotibiae with a small hump, and the structure of male genitalia.

***Scaphisoma* sp3**

(Figs. 4–15e, f)

Description. Head and mouthparts almost yellowish-brown. Antennae almost yellowish-brown, but antennomeres VI–XI blackish. Pronotum almost yellowish-brown with two small patches on medicolateral side; apical margin black; basal portion with transversally two black bands, extending apically from edge of their bands, but not reaching to apical margin. Elytra almost yellowish-brown, each with two black fasciae around basal and apical portion; apical fasciae extending at approximately a right angle from humeral area to sutural striae; basal fasciae quadrangular, extending along sutural striae. Propygidium and pygidium paler than elytra. Legs yellowish-brown to light orange. Ventral surface almost dark reddish-brown to black, except for hypomeron, procoxae, and apex of abdomen yellowish-brown (Fig. 4–15e). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width almost as wide as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III + IV almost as long as V; V 5.5 times as long as III; VI five times as long as III; VIII four times as long as III; XI five times as long as III; VIII narrower than each V–VII and IX–XI; VIII shorter than IX–XI.

Pronotum distinctly wider than long, without anterior bead, lateral keel visible from dorsal view. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as long as wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel visible from dorsal view. Punctuation distinctly coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral portions of metaventrite finer than on elytra. Mesocoxa almost as wide as space between them. Mesepimeron about six times as long as wide. Metanepisternum about six times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as

metacoxal process. Ventrite I with strigulate microsculpture.

Protarsomeres each I–III 1.5 times as long as IV; V three times as long as IV. Mesotarsomeres I 1.5 times as long as each II and III; each II and III 1.5 times as long as IV; V three times as long as IV. Metatarsomeres each I and V twice as long as each II–IV.

Male. Protarsomeres I–III with tenent setae, slightly enlarged. Aedeagus 1.03 mm long; parameres symmetrical, strongly sinuate from dorsal view, strongly curved and enlarged from lateral view; median lobe strongly sinuate along ventral margin from lateral view; internal sac with a pair of sclerite at apex, fine scale-like and denticulate structures (Fig. 4–15f).

Female. Protarsomeres I–III without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 2.16–2.22 mm. PW: 1.24–1.29 mm; EW: 1.47–1.49 mm. HW: 0.60–0.62 mm. ID: 0.20–0.22 mm. PL/PW: 0.57–0.59, EL/EW: 0.97–1.00. Approximate ratio of each antennal length (width) as follows (n = 1); 3.7 (1.6) : 2.7 (1.4) : 1.0 (0.7) : 3.6 (0.5) : 5.7 (0.6) : 5.3 (0.6) : 5.6 (0.5) : 4.2 (0.5) : 5.4 (0.9) : 5.1 (0.9) : 5.0 (0.9).

Specimens examined. 1♂1♀, Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1000–1400m, 0°55’36.65”N, 122°03’45.44”E–0°54’59.77”N, 122°04’13.10E, 24. VI. 2012, R. Ogawa leg.

Distribution. Indonesia: northern Sulawesi.

Comments. This species may be similar to *S. fernshawense* Blackburn by the body color, but it is distinguished from the latter by the shape of parameres and the structure of internal sac.

***Scaphisoma* sp4**

(Figs. 4–15g, h)

Description. Head and mouthparts almost yellowish-brown, except for basal portion of head black. Antennae almost yellowish-brown, but antennomeres V–XI blackish. Pronotum almost yellowish-brown with two small patches on medicolateral side; apical margin black; basal portion with transversally two black bands, extending apically from

edge of their bands, but not reaching to apical margin. Elytra almost yellowish-brown, except for along sutural stria, two spots of elytral disc, and basal and apical portion black; median portion of black fasciae along sutural striae expanded. Propygidium and pygidium paler than elytra. Legs yellowish-brown to light orange. Ventral surface yellowish-brown (Fig. 4–15g). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width slightly narrower than interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III + IV almost as long as V; V five times as long as III; VIII four times as long as III; VIII narrower than each IV–VII and IX–XI; VIII shroter than IX–XI.

Pronotum distinctly wider than long, without anterior bead, lateral keel invisible from dorsal view. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as long as wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel invisible from dorsal view. Punctuation slightly coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral portions of metaventrite fine and sparse. Mesocoxa almost as wide as space between them. Mesepimeron about six times as long as wide. Metanepisternum about six times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventral surface finely and sparsely punctuate, with strigulate microsculpture.

Protarsomeres I 1.2 times as long as II; I 2.5 times as long as IV; II 1.2 times as long as III; III 1.2 times as long as IV; V three times as long as IV. Mesotarsomeres I 1.3 times as long as II; I 1.9 times as long as each III and IV; II 1.3 times as long as each III and IV; V twice as long as each III and IV. Metatarsomeres I twice as long as each II and III; each II and III 1.7 times as long as IV; V twice as long as IV; I three times as long as IV.

Male. Apex of elytra truncated. Apical margin of mesofemur with a small hump.

Basal portion of mesotibiae sinuate. Metatibiae strongly curved (Fig. 4–15g). Protarsomeres I–III and mesotarsomeres I and II with tenent setae, strongly enlarged. Aedeagus 1.42 mm long; parameres symmetrical, strongly sinuate from dorsal view, strongly curved and expanded from lateral view; apex of median lobe pointed toward base from lateral view; internal sac with fine scale-like and denticulate structures (Fig. 4–15h).

Female. Apex of elytra slightly rounded. Protarsomeres I–III and mesotarsomeres I and II without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 2.49–2.80 mm. PW: 1.27–1.58 mm; EW: 1.40–1.73 mm. HW: 0.60–0.69 mm. ID: 0.22–0.27 mm. PL/PW: 0.61–0.71, EL/EW: 1.00–1.17. Approximate ratio of each antennal length (width) as follows (n = 1); 4.2 (1.6) : 2.6 (1.4) : 1.0 (0.9) : 4.3 (0.7) : 5.1 (0.7) : 4.9 (0.7) : 4.8 (1.3) : 3.9 (0.8) : 4.6 (1.2) : 4.4 (1.1) : 4.8 (1.2).

Specimens examined. 21♂, Mt. LompoBatang, S. C. Sulawesi, 25. XII. 1999, K. Ando leg.; 28♀, same data.

Distribution. Indonesia: southern Sulawesi.

Comments. This species may be similar to *S. perelegans* Blackburn by the body coloration and *S. albertisi* Reitter by the structure of male genitalia, but it is easily distinguished from them by the structure of male genitalia. Also, this species closely resembles *S. sapitiense* Pic, but it is difference from the latter by the inner margin of elytra not pointed and male metatibiae strongly curved.

***Scaphisoma* sp5**

(Figs. 4–16a, b)

Description. Head and mouthparts yellowish-brown. Antennae almost yellowish-brown, but antennomeres VI–XI blackish. Pronotum almost yellowish-brown with two small patches on medicolateral side; apical margin black; basal portion with transversally two black bands, extending apically from edge of their bands, but not reaching to apical margin. Elytra almost yellowish-brown, except for along sutural stria, basal two-third of lateral sides, and basal portion black. Propygidium and pygidium paler than elytra. Legs yellowish-brown to light orange. Ventral surface almost black, except for pro- and

mesocoxae, hypomeron, and abdomen yellowish-brown (Fig. 4–16a). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about 1.2 times as wide as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III + IV slightly longer than V; IV four times as long as III; VII five times as long as III; IV twice as wide as VII and IX–XI; width of VIII narrower than each V–VII and IX–XI; length of VIII shroter than each VII and IX–XI.

Pronotum distinctly wider than long, without anterior bead, lateral keel invisible from dorsal view. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as long as wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel invisible from dorsal view. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral portions of metaventrite fine and sparse. Mesocoxa almost as wide as space between them. Mesepimeron about three times as long as wide. Metanepisternum about six times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventral surface finely and sparsely punctuate, with strigulate microsculpture.

Protarsomeres each I–III 1.3 times as long as IV; V three times as long as IV. Mesotarsomeres each I and V 1.6 times as long as each II–IV. Metatarsomeres I 1.2 times as long as each II and V; I 1.8 times as long as IV; each II and V slightly longer than III; each II and V 1.4 times as long as IV.

Male. Protarsomeres I–III with tenent setae, slightly enlarged. Aedeagus 0.87 mm long; parameres symmetrical, slightly sinuate along inner margin, strongly bended at apex; internal sac with fine scale-like and denticulate structures (Fig. 4–16b).

Female. Apex of elytra slightly rounded. Protarsomeres I–III without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 2.33–2.49 mm; PW: 1.29–1.36 mm; EW:

1.40–1.60 mm. HW: 0.62–0.67 mm. ID: 0.18–0.20 mm. PL/PW: 0.69–0.77, EL/EW: 0.90–1.02. Approximate ratio of each antennal length (width) as follows (n = 1); 3.8 (1.6) : 2.7 (1.4) : 1.0 (0.8) : 3.9 (0.6) : 4.4 (0.7) : 4.6 (0.8) : 5.1 (1.2) : 4.0 (0.9) : 5.3 (1.0) : 4.7 (1.1) : 5.0 (1.2).

Specimens examined. 4♂, Mt. (Gunung) Mekongga, North Kolaka, ca. 2000m, 0°54’13.72”N, 122°04’38.30”E, O76, 20–21. IV. 2014, Fajardin leg.

Distribution. Indonesia: southeastern Sulawesi.

Comments. This species may be similar to *S. favens* Löbl by the parameres of male genitalia and *S. clavigerum* Löbl by the body coloration, but it is easily distinguished from them by the structure of inner sac.

***Scaphisoma* sp6**

(Figs. 4–16c, d)

Description. Head brown; mouthparts yellowish-brown. Antennae almost yellowish-brown, but antennomeres VI–XI blackish. Pronotum brown. Elytra almost paler brown, except for each two fasciae around basal and apical portion cream to yellowish-brown. Propygidium and pygidium cream to yellowish-brown. Legs cream to yellowish-brown. Ventral surface almost dark brown, except for pro- and mesocoxae and apex of abdomen yellowish-brown, hypomeron brown (Fig. 4–16c). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about 0.8 times as wide as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III + IV slightly shorter than V; IV twice as long as III; V 3.5 times as long as III; XI 5.5 times as long as III; length of VIII shorter than each VII and IX–XI; VI almost as long as each IX and X.

Pronotum distinctly wider than long, without anterior bead, lateral keel visible from dorsal view. Punctuation coarser than on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly longer than wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel visible from dorsal view. Punctuation strongly coarser than on pronotum, obliquely

and gradually fine toward posterior, coarse along epipleural line. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae; area between sutural striae and elytral sutura coarsely punctuate.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral portions of metaventrite fine and sparse, on median portion coarse and sparse. Mesocoxa almost as wide as space between them. Mesepimeron about eight times as long as wide. Metanepisternum about four times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventral surface with strigulate microsculpture. Metacoxal area slightly extended and vertically.

Protarsomere V 1.5 times as long as each I–IV. Mesotarsomere I 1.5 times as long as each II and III; each II and III 1.5 times as long as IV; V 1.8 times as long as IV. Metatarsomere I 1.6 times as long as each II and III; each II and III 1.2 times as long as IV; V 1.5 times as long as IV.

Male. Protarsomeres I–III and mesotarsomeres I and II with tenent setae, not enlarged. Aedeagus 0.47 mm long; parameres symmetrical, curved toward body axis, enlarged at basal portion; internal sac with fine scale-like and denticulate structures (Fig. 4–16d).

Female. Protarsomeres I–III and mesotarsomere I and II without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 1.47–1.64 mm; width (PW, EW): 0.89–1.02 mm, 1.04–1.11 mm. HW: 0.49–0.51 mm. ID: 0.18–0.20 mm. PL/PW: 0.59–0.65, EL/EW: 0.85–0.94. Approximate ratio of each antennal length (width) as follows (n = 1); 3.4 (1.8) : 2.4 (1.4) : 1.0 (0.6) : 2.2 (0.4) : 3.7 (0.5) : 3.3 (0.4) : 4.4 (0.8) : 3.2 (0.8) : 4.4 (1.0) : 4.2 (1.0) : 5.5 (0.9).

Specimens examined. 1♂, Mt. Tilongkabila (Gunung Tilongkabila), Gorontalo, alt. ca. 800–1500m, 0°34’28”N, 123°11’30”E–0°35’18”N, 123°13’22”E, O’92, 22. II. 2013, R. Ogawa leg.; 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500m, 3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E, O’70, 16. XII. 2013, R. Ogawa leg.

Distribution. Indonesia: northern and southeastern Sulawesi.

Comments. This species may be belonged to *rouyeri* species-group and be similar to S. delictum, but it is easily distinguished from *S. delictum* Löbl by the shape of parameres and the structure of male genitalia.

***Scaphisoma* sp7**

(Figs. 4–16e, f)

Description. Head black; mouthparts brown. Antennae almost yellowish-brown, but antennomeres VI–XI blackish. Pronotum, elytra, and propygidium black. Pygidium brown to yellowish-brown. Femora brown, tibiae and tarsus yellowish-brown. Ventral surface black, except for pro-, meso-, and metacoxae dark brown (Fig. 4–16e). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width almost as wide as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III + IV longer than V; IV three times as long as III; VII five times as long as III; VIII four times as long as III; XI six times as long as III; length of VIII shorter than each VII and IX–XI; width of VIII narrower than each VII and XI.

Pronotum distinctly wider than long, without anterior bead, lateral keel invisible from dorsal view. Punctuation almost as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel visible from dorsal view. Punctuation distinctly coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral portions of metaventrite fine and sparse. Mesocoxa almost as wide as space between them. Mesepimeron about twice as long as wide. Metanepisternum about three times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventral surface with strigulate microsculpture.

Protarsomere V twice as long as each I–IV. Mesotarsomere I 1.5 times as long as

II; II 1.3 times as long as each III and IV; V 1.5 times as long as each III and IV. Metatarsomeres each I and V twice as long as each II, III, and IV.

Male. Protarsomeres I–III with tenent setae, not enlarged. Aedeagus 0.29 mm long; parameres symmetrical, sinuate along inner margin; internal sac with fine scale-like and denticulate structures (Fig. 4–16f).

Female. Protarsomeres I–III without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 1.22–1.40 mm; width (PW, EW): 0.73–0.87 mm, 0.82–0.93 mm. HW: 0.40–0.47 mm. ID: 0.13–0.16 mm. PL/PW: 0.59–0.71, EL/EW: 0.88–0.95. Approximate ratio of each antennal length (width) as follows (n = 1); 4.1 (2.1) : 2.9 (1.8) : 1.0 (1.0) : 3.0 (0.7) : 3.5 (0.8) : 3.8 (1.0) : 4.9 (1.5) : 4.0 (1.2) : 5.1 (1.2) : 5.2 (1.2) : 5.9 (1.4).

Specimens examined. 3♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300–1500m, 0°35’18.14”N–0°35’18.37”N 123°13’22.71”E–123°13’22.61”E, 10. VI. 2012, R. Ogawa leg.; 1♂, Puncak Palopo, Palopo-city, S. Sulawesi, 23–26. IV. 2010, R. Ogawa leg.; 1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300m, 0°35’18.14”N, 123°13’22.71E, FIT, set up on 9. VI. 2012, collected in 11. VI. 2012, R. Ogawa leg.

Distribution. Indonesia: northern and southern Sulawesi.

Comments. This species is very similar to *S. michaeli* Löbl, but it is easily distinguished from the latter by the body size smaller than the latter, the length of antennomere XI, and the structure of male genitalia.

***Scaphisoma* sp8**

(Figs. 4–16g, h)

Description. Mouthparts brown. Antennomeres I and II yellowish-brown, III–XI blackish. Dorsal surface black with iridescent luster, but apical pygidium yellowish-brown. Femora brown, tibiae and tarsus yellowish-brown. Ventral surface black with iridescent luster, except for procoxae brown (Fig. 4–16g). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about 0.7 times as wide as interocular distance. Punctuation

sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III + IV shorter than V; IV three times as long as III; XI five times as long as III; length of VIII shorter than each V–VII and IX–XI; width of VIII narrower than each VII and IX–XI.

Pronotum wider than long, without anterior bead, lateral keel invisible from dorsal view. Punctuation almost as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel invisible from dorsal view. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Punctuation on lateral portions of metaventrite fine and sparse. Mesocoxa almost as wide as space between them. Mesepimeron about four times as long as wide. Metanepisternum about six times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Ventral surface with strigulate microsculpture.

Protarsomeres each I–III 1.5 times as long as IV; V three times as long as IV. Mesotarsomeres each I and V 1.2 times as long as II; each I and II twice as long as IV; II 1.2 times as long as III; III 1.5 times as long as IV. Metatarsomeres each I and V 1.4 times as long as II; ; II 1.2 times as long as III; III 1.3 times as long as IV.

Male. Protarsomeres I–III and mesotarsomeres I–III with tenent setae, moderately enlarged. Aedeagus 0.8 mm long; parameres symmetrical, apical portion slightly enlarged; apex of median lobe pointed from lateral view; internal sac with fine scale-like and denticulate structures (Fig. 4–16h).

Female. Protarsomeres I–III and mesotarsomeres I–III without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 1.73–1.98 mm. PW: 0.98–1.11 mm; EW: 1.11–1.27 mm. HW: 0.49–0.58 mm. ID: 0.20–0.24 mm. PL/PW: 0.68–0.75, EL/EW: 0.89–0.98. Approximate ratio of each antennal segment in length (width) (n = 1) = 3.9 (1.4) : 2.4 (1.3) : 1.0 (0.7) : 3.0 (0.6) : 5.4 (0.7) : 4.3 (0.7) : 5.5 (0.9) : 3.6 (0.7) : 5.4

(0.9) : 4.8 (0.8) : 5.0 (1.0).

Specimens examined. 6♂1♀, Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1000–1400m, 0°55’36.65”N, 122°03’45.44”E–0°54’59.77”N, 122°04’13.10E, 24. VI. 2012, R. Ogawa leg.; 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300m, 0°34’28.52”N, 123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 2♀, Pegunungan Tilongkabila, Bogoni Nani Warta Bone N.P., N. Sulawesi: Prov. Gorontalo, alt. 1200m, (malaise trap), 31. I–16. II. 2010, K. Takasuka leg.; 3♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 30–400m, O’96, O’80, 3°39’10”S, 121°03’00”E–3°38’31”S, 121°05’42”E, 19. IX. 2013, R. Ogawa leg.; 3♂, Puncak Palopo, Palopo-city, S. Sulawesi, 27. IV. 2010, R. Ogawa leg.; 1♂, Mt. Bulu Dua, Watansoppeng, S. Sulawesi, 14. II. 2013, Kiyoshi ANDO leg.

Distribution. Indonesia: throughout Sulawesi..

Comments. This species may be similar to *S. latitarse* by the body size and coloration, but it is easily distinguished from the latter by the body with iridescent luster and the structure of male genitalia.

4. 4 Genus *Birocera*

Birocera Löbl, 1970 [gender: feminine]

Birocera Löbl, 1970a: 130; type species: *Omalocera* [sic] *punctatissima* Reitter, 1880.

Diagnosis. Similar to the genus *Bironium* in most respects, but distinctly differs in the following characters: body slightly covex, mesepimeron present, and tibiae and femora not conspicuously long.

Birocera derougemonti Löbl, 1983

Birocera derougemonti Löbl, 1983: 292.

(Figs. 4–17a, b)

Specimens examined. 1♂ (Holotype), CELEBES, Makale, 16. VIII. 1982, MHNG ENTO 00005415 (MHNG); 1♂, Puncak Palopo, Palopo-city, S. Sulawesi, 27. IV. 2010, R. Ogawa leg.

Distribution. Indonesia: southern Sulawesi.

Birocera punctattisima (Reitter, 1880)

Omalocera punctatissima Reitter, 1880: 43.

(Figs. 4–17c, d)

Specimens examined. 1♂, PHILIPPINES: LEYTE VISCA N Baybay, cultiv. land, 3. 3. 91, 1991, Schawaller & al. leg. (MHNG); 1♂, Indonesia: Sulawesi Utara, Dumoga-Bone N.P. Plot B, ca 300m, Lowland forest, 6–13. II. 1985, Malaise trap, R. Ent. Soc. Lond. PROJECT WALLACE B. M. 1985–10, 31. 27 [handwritten] (BMNH); 1♂, Indonesia: Sulawesi Utara, Dumoga-Bone N.P. Plot A, ca 200m, Lowland forest, II. 1985, foliage of fallen tree [handwritten], R. Ent. Soc. Lond. PROJECT WALLACE B.M. 1985–10, 31|–27 [pink], Head+Pronotum missing, det. R.G. Booth, 2013[a part in handwritten] (BMNH); 1♂, Indonesia: Sulawesi Utara, Dumoga-Bone N.P. Plot A, ca 200m, Lowland forest, II. 1985, foliage of fallen tree [handwritten], R. Ent. Soc. Lond. PROJECT WALLACE B.M. 1985‑10 (BMNH).

Distribution. Philippines: Indonesia: northern Sulawesi.

Comments. This species is very similar to *B. derougemonti* by the basal stria of pronotum absent, it is easily distinguished from the latter by the the denser punctuation on pronotum and elytra.

4. 5 Genus *Bironium*

Bironium Csiki, 1909 [gender: neuter]

Bironium Csiki, 1909: 341; type species: *Bironium longipes* Csiki, 1909.

Heteroscapha Achard, 1914: 394; type species: *Heteroscapha feai* Achard, 1914. Synonymy: Löbl, 1971.

Scutotoxidium Pic, 1915b: 30; type species: *Scutotoxidium nigrolineatum* Pic, 1915. Synonymy: Löbl, 1971.

Arachnoscaphula Heller, 1917: 48; type species: *Arachnoscaphula trisulcata* Heller, 1917. Synonymy: Löbl, 1971.

Diagnosis. Body oval, convex. Antenna filiform, long; antennomere III slender, straight; antennomeres each VII–XI covered with microsetae. Anterior margin of pronotum with a bead. Posterior angle of pronotum not pointed (obtuse); pronotum without sub-apical striae. Eyes entire. Prothoracic corbiculum absent. Secondary lines of mesoventrite absent. Anterior portion of proventrite greatly reduced. Elytra with entire basal stria joined with lateral and sutural stria. Mesepimeron absent. Abdominal ventrite I without metacoxal bead. Femora and tibiae conspicuously long. Profemoral ctenidium absent. Meso- and metacoxae separated.

***Bironium* sp1**

(Figs. 4–18a–d, 4–19a–d)

Description. Head almost black, clypeus and frons brown. Pronotum and elytra dark brown to black. Ventral surface brown to black; tibiae and tarsus brown to reddish-brown; femora darker than tibiae (Fig. 4–18a–d). Propygidium and pygidium dark brown. Antennomeres I, II and IX–XI yellowish-brown; III–VIII dark brown. Head, pronotum and elytra sparsely and finely pubescent.

Head with interocular distance almost as eye width; punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae at apical portion; each segments of VI and VII about 1.5 times as long as III; III almost as long as I, X and XI (Fig. 4–19d).

Pronotum wider than long, with an anterior bead; punctuation sparse and fine, as on head. Scutellum about twice as wide as long, with exposed apex.

Elytra almost as long as wide, widest at basal third, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin; discal puntctuation coarse forming oblique, more or less regular rows. Surface around outer impressed punctures weakly undulated. Sutural striae extending outwards along basal margin to form basal striae, not reaching humeral area.

Propygidium and pygidium finely punctate.

Hypomeron and lateral portion of mesoventrite smooth. Lateral portion of metaventrite coarsely punctate, medial portion finely and sparsely punctate. Mesocoxa almost as wide as space between them. Metanepisternum about ten times as long as

wide. Metepimeron almost as long as wide. Metacoxa about 1.5 times as wide as metacoxal process. Ventrite I finely punctate; median portion convex.

Protarsomeres I almost as long as V; I about 2.0 times as long as each II and III; each II and III about 1.1 to 1.3 times as long as IV. Mesotarsomeres I about 5.0 times as long as II; II about 1.5 times as long as III; V about 5.0 times as long as IV. Approximate ratio of each metatarsomeres length almost same as mesotarsomeres.

Male. Protarsomeres I–III without tenent setae, hardly enlarged. Male tibiae longer than female. Aedeagus about 0.62 mm long; parameres symmetrical, arcuate in dorsal view, almost straight in lateral view, sharpened apically (Fig. 4–19a, b); internal sac with central sclerotized plate extended proximally by two processes, semicircular basal margin and membranes consisting of finely striate structures.

Female. Protarsomeres I–III without tenent setae, almost same as male. Ovipositor simple; bursa copulatrix not sclerotized (Fig. 4–19c). Spermatheca as Fig. 4–19c.

Measurements (n = 2). Length (PL+EL): 3.24–3.38mm; width (PW, EW): 1.64–1.78mm, 1.84–2.02mm. HW: 0.73–0.76mm. ID: 0.27–0.29mm. PL/PW: 0.78–0.84. EL/EW: 0.99–1.01. Approximate ratio of each antennal length (width) as follows (n = 1); 1.2 (0.3) : 0.8 (0.3) : 1.0 (0.2) : 1.2 (0.2) : 1.3 (0.2) : 1.5 (0.2) : 1.5 (0.2) : 1.4 (0.1) : 1.4 (0.1) : 1.2 (0.2) : 1.2 (0.2).

Specimens examined. 1♂, Puncak Palopo, Palopo-city, S. Sulawesi, Indonesia, 27. IV. 2010, R. Ogawa leg.; 1♀, same data.

Distribution. Indonesia: southern Sulawesi.

Comments. This species is very similar to *Bironium sumatranum* (Achard, 1920) by the body shape such the structure of streak on body surface, but it is easily distinguished from the latter by discal punctures of elytra.

4. 6 *Baeocera* group

The monophyly of the molecular data of this group is unclear as shown in Chapter 3, but this group has been morphologically supported by seven synapomorphies (Leschen & Löbl 2005): maxillary palpus aciculate, eyes entire, prothoracic corbiculum present, procoxal cavity setose, mesocoxal lines parallel to coxa, scutellum concealed in dorsal view, and metacoxae contiguous (some characters are reversed in some genera).

4. 6. 1 Genus *Baeocera*

Baeocera Erichson, 1845 [gender: feminine]

Baeocera Erichson, 1845: 4; type species: *Baeocera falsata* Achard, 1920, see Löbl, 1977: 101, Melville, 1982 (Opinion1221: 175).

Cyparella Achard, 1924: 28; type species: *Scaphisoma rufoguttatum* Fairmaire, 1898. Synonymy: Löbl, 1987.

Eubaeocera Cornell, 1967: 2; type species: *Baeocera abdominalis* Casey, 1900. Synonymy: Löbl, 1977.

Sciatrophes Blackburn, 1903: 100; type species: *Sciatrophes latens* Blackburn, 1903. Synonymy: Löbl, 1978.

Amaloceroschema (as subgenus of *Baeocera*) Löbl, 1967: 1; type species: *Baeocera freudei* Löbl, 1967. Synonymy: Ogawa & Löbl, 2013.

Diagnosis. Maxillary palpomere IV aciculate. Antennomeres III and IV elongate; VII to X asymmetrical. Mandible unidentate; mola with brush. Galea narrow (longer than wide); brush apical and paniculate. Surface of mentum setose. Anterior margin of pronotum with a bead. Hypomeron without fovea. Prothoracic corbiculum present. Mesocoxal lines present on metaventrite. Metendosternum with stem present. Secondary lines of mesoventrite absent. Abdominal ventrite I without metacoxal bead. Profemoral ctenidium present. Mesotibia with two ventral spines. Metacoxae separated. Empodium unisetose.

Key to the Sulawesian species of *Baeocera*

1 Antennomere XI twice as long as III. Punctuation of metaventrite strongly coarse. Parameres symmertry. 2

– Antennomere XI four times as long as III. Punctuation of metaventrite fine. Parameres asymmetry. ..... ***B*. sp1**

2 Body color black. Punctuation of ventrite I strongly coarse. ..... ***B. derougemonti*** Löbl

– Body color paler reddish-brown. Punctuation of ventrite I weakly coarse. ..... ***B*. sp2**

Baeocera derougemonti Löbl, 1983

(Figs. 4–20a, b)

Specimens examined. 1♂ and 1ex, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 100–500 m, 0°33’10.96”N, 123°10’34.40”E–0°34’04.03”N, 123°11’15.42”E, 20. II. 2013, R. Ogawa leg.; 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E, 16. XII. 2013, R. Ogawa leg.

Distribution. Indonesia: throughout Sulawesi (southern Sulawesi: Löbl 1983).

***Baeocera* sp1**

(Figs. 4–20c, d)

Description. Mouthparts dark reddish-brown. Head black. Antennomeres I–V yellowish-brown, VI–XI blackish. Dorsal surface dark brown to black, but apex of elytra and pygidium dark yellowish-brown. Legs reddish-brown. Ventral surface almost black, except for hypomeron and each coxa dark reddish-brown (Fig. 4–20c). Head, pronotum, and elytra sparsely and finely pubescent.

Head with interocular distance 1.5 times as wide as eye width. Punctuation coarse and sparse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III slightly shorter than IV; V 1.5 times as long as III; VIII twice as long as III; XI 2.5 times as long as III; XI four times as long as III; length of VIII shorter than each VII and IX–XI; width of VIII narrower than each VI, VII, and IX–XI.

Pronotum wider than long, with anterior bead, lateral keel invisible from dorsal view. Punctuation almost as on head. Scutellum almost as long as wide, with exposed apex.

Elytra wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel invisible from dorsal view. Punctuation almost as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and joined with lateral striae.

Propygidium and pygidium coarsely and sparsely punctuate, with microsculpture.

Hypomeron and lateral portion of mesoventrite smooth. Lateral portions of metaventrite finely and sparsely punctuate. Mesocoxa almost as wide as space between them. Mesepimeron about five times as long as wide. Metanepisternum about six times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process.

Protarsomere I 1.5 times as long as each II–IV; V three times as long as I. Mesotarsomeres each I and V three times as long as each III and IV; II 1.5 times as long as each III and IV. Metatarsomeres I twice as long as II; I four times as long as each III and IV; V three times as long as each III and IV.

Male. Protarsomeres I–III with tenent setae, moderately enlarged. Aedeagus 0.56 mm long; parameres asymmetrical, left paramere thin and slightly enlarged at apical portion, right paramere thick; structure of internal sac complex (Fig. 4–20d).

Female. Undetected.

Measurements. Length (PL+EL): 1.96 mm. PW: 1.24 mm; EW: 1.36 mm. HW: 0.49 mm. ID: 0.22 mm. PL/PW: 0.71, EL/EW: 0.79. Approximate ratio of each antennal segment in length (width) (n = 1) = 2.0 (1.0) : 1.7 (0.8) : 1.0 (0.4) : 1.3 (0.4) : 1.5 (0.5) : 1.3 (0.8) : 2.3 (0.9) : 1.9 (0.7) : 2.5 (0.8) : 2.6 (0.8) : 4.0 (0.8).

Specimen examined. 1♂, Puncak Palopo, Sulawesi Selatan, Alt. ca. 800m, S 02°57', E 120°05', O'56, 30. I–4. II. 2013, J. Yamasako leg.

Distribution. Indonesia: southern Sulawesi.

Comments. This species may be belonged to *monstrosa* species-group and is similar to *B. nakanei* (Löbl) and *B. monstrosa* Löbl, but it is easily distinguished from them by the shape of paremeres and the structure of internal sac.

***Baeocera* sp2**

(Figs. 4–20e, f)

Description. Head and mouthparts paler brown to reddish-brown. Antennomeres I–V yellowish-brown, VI–XI blackish. Dorsal and ventral surface paler reddish-brown (Fig. 4–20e). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width 1.3 times as wide as interocular distance. Punctuation coarse

and sparse. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III shorter than IV; each V and VI 1.5 times as long as III; IX twice as long as III; XI 2.2 times as long as III; width of VIII narrower than each VII and IX–XI.

Pronotum distinctly wider than long, with anterior bead, lateral keel invisible from dorsal view. Punctuation almost as on head. Scutellum almost as long as wide, with exposed apex.

Elytra wider than long, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel invisible from dorsal view. Punctuation strongly coarser than as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium finely and sparsely punctuate, pygidium coarsely and sparsely punctuate, with microsculpture.

Hypomeron and lateral portion of mesoventrite smooth. Punctuation of metaventrite almost as on elytra. Mesocoxa almost as wide as space between them. Mesepimeron about three times as long as wide. Metanepisternum about six times as long as wide. Metepimeron almost as long as wide. Metacoxa almost as wide as metacoxal process. Punctuation on ventrite I almost as pronotum.

Protarsomere V 2.5 times as long as each I–IV. Mesotarsomeres each I and V three times as long as each II–IV. Metatarsomeres I three times as long as each II–IV; V twice as long as each II–IV.

Male. Protarsomeres I–III with tenent setae, not enlarged. Aedeagus 0.32 mm long; parameres symmetrical, almost straight; internal sac very complex, with robust flagellum (Fig. 4–20f).

Measurements. Length (PL+EL): 1.04–1.22 mm; width (PW, EW): 0.69–0.76 mm, 0.73–0.84 mm. HW: 0.56–0.58 mm. ID: 0.16 mm. PL/PW: 0.58–0.65, EL/EW: 0.87–0.88. Approximate ratio of each antennal segment in length (width) (n = 1) = ? (?) : 1.8 (0.9) : 1.0 (0.4) : 1.3 (0.4) : 1.6 (0.3) : 1.6 (0.4) : 1.8 (0.5) : 1.8 (0.4) : 1.9 (0.7) : 1.8 (0.8) : 2.2 (0.8).

Specimens examined. 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E, 16. XII. 2013, R. Ogawa leg.; 1♀, same data, but O’68.

Distribution. Indonesia: southeastern Sulawesi.

Comments. This species may be belonged to *lenta* species-group and is very similar to *B. caliginosa* Löbl by the body coloration and the shape of body, but it is easily distinguished from the latter by the body size smaller than the latter, antennomere VIII about twice as long as III, and the structure of male genitalia.

4. 6. 2 Genus *Scaphobaeocera*

Scaphobaeocera Csiki, 1909 [gender: feminine]

Scaphobaeocera Csiki, 1909: 341; type species: *Scaphobaeocera papuana* Csiki, 1909.

Baeotoxidium Löbl, 1971: 990; type species: *Baeotoxidium lanka* Löbl, 1971.

Synonymy: Leschen & Löbl, 2005.

Diagnosis. Similar to the genus *Baeocera* in most respects, but distinctly differs in the following characters: body compressed laterally, usually having microsculpture and iridescent luster; metaventrite with setiferous patch.

***Scaphobaeocera* sp1**

(Figs. 4–21a, b)

Description. Mouthparts almost yellowish-brown. Antennomeres I–VI yellowish-brown, VII–XI blackish. Dorsal surface dark brown to black with iridescent luster, but apex of elytra and pygidium yellowish-brown. Femora almost brown; profemora dark brown to black from basal one third; meso- and metafemora dark brown to black from basal two third; tibiae and tarsus yellowish-brown. Ventral surface black with iridescent luster, except for procoxae brown and apex of abdomen yellowish-brown (Fig. 4–21a). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width almost as wide as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III slightly shorter than IV; XI four times as long as III; length of VIII shorter than each V, VII, and IX–XI; width of VIII narrower than each VII and IX–XI.

Pronotum almost as long as wide, with anterior bead, lateral keel invisible from

dorsal view. Punctuation almost as on head. Scutellum almost as long as wide, with exposed apex.

Elytra slightly longer than wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel invisible from dorsal view. Punctuation almost as on pronotum. Sutural striae reaching to basal margin, not forming basal striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portions of metaventrite finely and sparsely punctuate, median portion coarsely and sparsely punctuate with setae. Mesocoxa twice as wide as space between them. Mesepimeron about six times as long as wide. Metanepisternum about four times as long as wide. Metepimeron almost as long as wide. Metacoxa about three times as wide as metacoxal process. Ventral surface with strigulate microsculpture.

Protarsomere V 2.2 times as long as each I–IV. Mesotarsomeres I twice as long as II; I three times as long as each III and IV; II 1.5 times as long as each III and IV; V1.5 times as long as each III and IV. Metatarsomeres I twice as long as II; I 4.5 times as long as IV; II 1.5 times as long as III; III 1.5 times as long as IV; V twice as long as IV.

Male. Protarsomeres I–III with tenent setae, not enlarged. Aedeagus 0.32 mm long; parameres symmetrical, almost straight; internal sac with a large spiral sclerite, spinning four times (Fig. 4–21b).

Female. Protarsomeres I–III without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 1.16–1.33 mm; PW: 0.56–0.71 mm; EW: 0.60–0.76 mm. HW: 0.31–0.38 mm. ID: 0.11–0.13 mm. PL/PW: 0.72–1.00, EL/EW: 0.97–1.13. Approximate ratio of each antennal segment in length (width) (n = 1) = ? (?) : 1.8 (1.1) : 1.0 (0.4) : 1.2 (0.4) : 1.5 (0.4) : 1.1 (0.6) : 1.5 (0.8) : 1.1 (0.7) : 1.6 (1.0) : 1.7 (1.0) : 3.9 (1.0).

Specimens examined. 3♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 1300–1500 m, 0°35’18.14”N–0°35’18.37”N 123°13’22.71”E–123°13’22.61”E, 10. VI. 2012, R. Ogawa leg.; 1♀, same data above, but ca. 800–1300 m, 0°34’28.52”N, 123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 1♀, same data, but ca. 500–800 m, 0°34'04.62N–0°34'28.52N, 123°11'15.42E–123°11'30.61E,

26–27. I. 2011, R. Ogawa leg.; 1♂, Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1800–2000 m, 0°54’25.07”N, 122°04’20.71”E–0°54’13.72”N, 122°04’38.30”E, 26. VI. 2012, R. Ogawa leg.

Distribution. Indonesia: northern Sulawesi.

Comments. This species may be similar to *S. siamense* Löbl, but it is easily distinguished from the latter by the body color black, antennomere XI four times as long as III, and the shape of a spiral sclerite.

***Scaphobaeocera* sp2**

(Figs. 4–21c, d)

Description. Mouthparts brown to yellowish-brown. Head black. Antennomeres I–V yellowish-brown, VII–XI blackish. Pronotum black. Elytra dark brown to black with iridescent luster, but apex of elytra. Propygidium brown, pygidium yellowish-brown. Femora almost dark brown to black, except for basal one third yellowish-brown; tibiae and tarsus yellowish-brown. Ventral surface black with iridescent luster, except for apex of abdomen yellowish-brown (Fig. 4–21c). Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width almost as wide as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; III distinctly shorter than IV; V 1.5 times as long as III; XI twice as long as III; length of VIII shorter than each IV–VII and IX–XI; width of VIII narrower than each VII and IX–XI.

Pronotum wider than long, with anterior bead, lateral keel invisible from dorsal view. Punctuation almost as on head. Scutellum almost as long as wide, with exposed apex.

Elytra longer than wide, widest at basal third to fourth, lateral margins gradually narrowed apically, minutely serrate at inner part of posterior margin, lateral keel invisible from dorsal view. Punctuation coarser than on pronotum. Sutural striae reaching to basal margin, not forming basal striae.

Propygidium and pygidium with strigulate microsculpture.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portions of

metaventrite finely and sparsely punctuate, median portion coarsely and sparsely punctuate with setae. Mesocoxa 1.5 times as wide as space between them. Mesepimeron about six times as long as wide. Metanepisternum about six times as long as wide. Metepimeron twice as long as wide. Metacoxa about three times as wide as metacoxal process. Ventral surface with strigulate microsculpture.

Protarsomere each I and II 1.2 times as long as III; each I and II twice as long as IV; III 1.2 times as long as IV; V three times as long as IV. Mesotarsomeres I twice as long as each II, III, and IV; I 2.5 times as long as IV; each II, III, and IV 1.3 times as long as IV; II 1.5 times as long as each III and IV; V1.5 times as long as each III and IV. Metatarsomeres I twice as long as each II and V; I 4.5 times as long as IV; each II and V 1.2 times as long as III; III 1.2 times as long as IV.

Male. Protarsomeres I–III with tenent setae, moderately enlarged. Aedeagus 0.62 mm long; parameres symmetrical, almost straight, but subapical portion slightly enlarged from lateral view; internal sac with a large spiral sclerite, spinning one time (Fig. 4–21d).

Female. Protarsomeres I–III without tenent setae, not enlarged. Female genitalia unexamined.

Measurements. Length (PL+EL): 1.38–1.56 mm; PW: 0.69–0.78 mm; EW: 0.71–0.80 mm. HW: 0.40–0.42 mm. ID: 0.13–0.16 mm. PL/PW: 0.70–0.79, EL/EW: 1.15–1.31. Approximate ratio of each antennal segment in length (width) (n = 1) = ? (?) : 1.7 (0.9) : 1.0 (0.4) : 1.4 (0.3) : 1.6 (0.4) : 1.3 (0.4) : 1.7 (0.6) : 1.1 (0.5) : 1.9 (0.7) : 1.9 (0.8) : 2.2 (0.9).

Specimens examined. 5♂, Mt. Lompobatang, Malino, S. Sulawesi, alt. ca. 1700 m, 5°23’44.20”N, 119°55’22.27”E, 20. I. 2011, R. Ogawa leg.; 5 exs, same data; 1♂, Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1800–2000 m, 0°54’25.07”N, 122°04’20.71”E–0°54’13.72”N, 122°04’38.30”E, 26. VI. 2012, R. Ogawa leg.; 1ex, same data; 1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300–1500 m, 0°35’18.14”N, 123°13’22.71”E–0°35’18.37”N, 123°13’22.61”E, 10. VI. 2012, R. Ogawa leg.

Distribution. Indonesia: northern and southern Sulawesi.

Comments. This species may be similar to *S. lanka* (Löbl) and *S. papuana* Csiki by the structure of male genitalia, but it is easily distinguished from them by the body size,

the shape of parameres, and the structure of a spiral sclerite.

4. 6. 3 Genus *Xotidium*

Xotidium Löbl, 1992 [gender: neuter]

Xotidium Löbl, 1992: 573; type species: *Xotidium uniforme* Löbl, 1992.

Diagnosis. Body narrow. Maxillary palpomere IV aciculate. Labial palpus two segmented, apical segment very slender. Antenna filiform; antennomere III slender, straight; antennomeres each VII–XI covered with microsetae. Mandible multidentate apically; mola with brush. Galea broad, without subapical short bristles. Anterior margin of pronotum with a bead. Posterior angle of pronotum not pointed (obtuse), lateral margin not sinuate, sub-basal stria absent. Eyes weakly emarginate. Prothoracic corbiculum absent. Secondary lines of mesoventrite present. Anterior portion of proventrite greatly reduced. Elytra with entire basal stria joined with lateral and sutural stria. Mesepimeron absent. Abdominal ventrite I without metacoxal bead. Profemoral ctenidium absent. Meso- and metatibiae with single long spur. Meso- and metacoxae adjacent.

***Xotidium* sp1**

(Figs. 4–22a, b)

Description. Dorsal and ventral surface almost black, except for abdomen dark reddish-brown (Fig. 4–22a). Antennae almost yellowish-brown, but antennomeres VI–XI blackish. Propygidium and pygidium paler than other ventrite I–III. Legs reddish-brown; tarsus paler than tibiae and femur. Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width almost as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; V longer than each III and IV; XI twice as long as III; lateral side of each VII, IX, and X gradually expanded and later sharply narrowed apically.

Pronotum slightly wider than long, with an anterior bead. Punctuation sparse and fine, as on head. Scutellum almost as long as wide, with exposed apex.

Elytra almost as long as wide, widest at basal one-sixth, lateral margins sharply narrowed apically, minutely serrate at inner part of posterior margin. Punctuation fine and sparse as on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and joined with lateral striae.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite finely and sparsely punctate. Mesocoxa adjacent. Metanepisternum about four times as long as wide, without a longitudinal line. Metepimeron almost as long as wide. Metacoxa about six times as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres I twice as long as each II–IV; V 2.5 times as long as each II–IV. Mesotarsomeres I 2.5 times as long as II; II 1.2 times as long as each III and IV; V 2.5 times as long as each III and IV. Metatarsomeres I about three times as long as each II and III; each II and III 1.1 times as long as IV; V about twice as long as IV.

Male. Protarsomeres I–III with tenent setae, not enlarged. Aedeagus about 0.6 mm long; parameres symmetrical, slightly widened at apical portion; internal sac with a sclerite as flagellum, straight, evenly wide (Fig. 4–22b).

Female. Unexamined.

Measurements. Length (PL+EL): 1.33–1.44mm; width (PW, EW): 0.76–0.80mm, 0.80–0.84mm. HW: 0.33–0.36mm. ID: 0.16–0.18mm. PL/PW: 0.71–0.75, EL/EW: 0.97–1.03. Approximate ratio of each antennal segment in length (width) (n = 1) = ? (?) : 1.3 (0.7) : 1.0 (0.3) : 1.1 (0.2) : 1.4 (0.3) : 1.6 (0.3) : 1.7 (0.4) : 1.6 (0.2) : 1.9 (0.4) : 1.7 (0.4) : 2.2 (0.5).

Specimens examined. 3♂, [BONEBOLANGO: INDONESIA] Mt Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300–1500m, 0°35’18.14”N, 123°13’22.71”E–0°35’18.37”N, 123°13’22.61”E, 10. VI. 2012, R. Ogawa leg.; 3 exs, same data above; 1♂, same data above but alt. ca. 800–1300m, 0°34’28.52”N, 123°11’30.61”E–0°35’18.14”N, 123°13’22.71E, 9. VI. 2012, R. Ogawa leg.; 1 ex, same data above. 1 ex, Mt. Pontolo, N. Sulawesi, alt. ca. 1400–1800m, 0°54’59.77”N, 122°04’13.10E–0°54’25.07”N, 122°04’20.73”E, 25. VII. 2012, R. Ogawa leg.

Distribution. Indonesia: northern Sulawesi.

Comments. This species is similar to *X. uniforme* and *X. montanum*, but it is easily

distinguished from *X. uniforme* by the structure of inner sac and from *X. montanum* by the body coloration.

4. 7 Genus *Scaphoxium*

Scaphoxium Löbl, 1979 [gender: neuter]

Scaphoxium Löbl, 1979: 118; type species: *Toxidium madurense* Pic, 1920.

Diagnosis. Body compressed laterally. Maxillary palpomere IV aciculate. Labial palpus four segmented, apical segment short. Antenna filiform; antennomere III slender, curved; antennomeres each VII–XI covered with microsetae. Mandible bidentate apically; mola with brush. Galea broad, without subapical short bristles. Anterior margin of pronotum with a bead. Posterior angle of pronotum prolonged, lobed from ventral view; pronotum without sub-apical striae. Eyes weakly emarginate. Prothoracic corbiculum absent. Secondary lines of mesoventrite absent. Anterior portion of proventrite greatly reduced. Elytra with shortened sutural striae. Mesepimeron absent. Abdominal ventrite I without metacoxal bead. Profemoral ctenidium absent. Meso- and metatibiae with single long spur. Meso- and metacoxae adjacent.

***Scaphoxium* sp1**

(Figs. 4–22c, d)

Description. Dorsal and ventral surface almost reddish brown, except for paler abdomen (Fig. 4–22c). Antennae almost yellowish-brown, but antennomeres VI–XI blackish. Propygidium and pygidium paler than dorsal colaration. Legs reddish-brown; tarsus paler than tibiae and femur. Head, pronotum, and elytra sparsely and finely pubescent.

Head with eye width about 0.7 times as interocular distance. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some macrosetae; VIII almost as long as each V and VI; XI twice as long as each III and IV; III slightly curved.

Pronotum almost as long as wide, without an anterior bead, lateral keel invisible from dorsal view. Punctuation sparse and fine, as on head. Scutellum concealed.

Elytra almost as long as wide, widest at basal one-sixth, lateral margins sharply

narrowed apically, minutely serrate at inner part of posterior margin. Punctuation fine and sparse as on pronotum. Sutural striae not reaching to basal margin, interrupted at posterior of pronotum.

Propygidium and pygidium with microsculptures.

Hypomeron with lateral portion of mesoventrite smooth. Lateral portion of metaventrite finely and sparsely punctate, with flat and smooth apical portion moderately concave; apico-medial portion coarsely and sparsely punctate. Mesocoxa adjacent. Mesepimeron about six times as long as wide. Metanepisternum about ten times as long as wide, without a longitudinal line. Metepimeron almost as long as wide. Metacoxa almost adjacent, six to eight times as wide as metacoxal process. Ventrite I sparsely and finely punctate, with microsculptures.

Protarsomeres I 1.5 times as long as II; II twice as long as each III and IV. Mesotibiae covered with spines from basal one-third to apex. Mesotarsomeres I 1.6 times as long as each II–IV. Posterior margin of metafemur sinuate. Metatibiae covered with spines from median to apex. Metatarsomeres I 2.3 times as long as each II–IV; V 1.3 times as long as each II–IV.

Male. Aedeagus about 0.39 mm long; parameres symmetrical, narrowed from subapical portion to apex; internal sac with four sclerites, two sclerites forming hook, remaining two sclerites straight (Fig. 4–22d).

Female. Unexamined.

Measurements. Length (PL+EL): 1.27–1.38 mm. PW: 0.62–0.67 mm; EW: 0.67–0.76 mm. HW: 0.33–0.36 mm. ID: 0.13–0.16 mm. PL/PW: 0.77–0.96, EL/EW: 0.97–1.23. Approximate ratio of each antennal segment in length (width) (n = 1) = ? (?) : 1.9 (0.6) : 1.0 (0.3) : 1.1 (0.4) : 1.4 (0.4) : 1.4 (0.4) : 1.8 (0.6) : 1.4 (0.5) : 1.9 (0.6) : 1.7 (0.6) : 2.2 (0.5).

Specimens examined. 1♂, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E, 16. XII. 2013, R. Ogawa leg.; 2♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 500–800 m, 0°34'04.62N, 0°34'28.52N–123°11'15.42E, 123°11'30.61E, O’62, O’63, 26–27. I. 2011, R. Ogawa leg.; 2exs., Mt. Lompobatang, Malino, S. Sulawesi, alt. ca. 1700 m, 5°23’44.20”N, 119°55’22.27”E, 20. I. 2011, R. Ogawa leg.

Distribution. Indonesia: throughout Sulawesi..

Comments. This species is very similar to *S. avidum* Löbl, but it is easily distinguished from the latter by the male protibiae not enlarged and the structure of male genitalia.

4. 8 Genus *Scaphicoma*

Scaphicoma Motschulsky, 1863 [gender: feminine]

http://species-id.net/wiki/Scaphicoma

Scaphicoma Motschulsky, 1863: 435; type species: *Scaphicoma flavovittata* Motschulsky, 1863.

Lepteroscapha Achard, 1921: 88; type species: *Lepteroscapha pallens* Achard, 1921. Synonymy: Löbl, 1971; by subsequent designation: Ogawa & Löbl, 2014: 2.

Diagnosis. Body strongly compressed laterally. Maxillary palpomere IV aciculate. Labial palpus four segmented, apical segment long curved. Antenna filiform, long; antennomere III slender, straight; antennomeres each VII–XI covered with microsetae. Mandible bidentate subapically, but apex unidentate; mola with brush. Galea broad, without subapical short bristles. Anterior margin of pronotum with a bead. Posterior angle of pronotum not pointed (obtuse); pronotum without sub-apical striae. Eyes notched. Prothoracic corbiculum absent. Secondary lines of mesoventrite absent. Anterior portion of proventrite greatly reduced. Elytra with entire basal stria joined with lateral and sutural stria. Mesepimeron absent. Abdominal ventrite I without metacoxal bead. Legs long. Profemoral ctenidium present. Meso- and metatibiae shorter than tarsus, with long spurs at apex. Meso- and metacoxae adjacent.

Key to the Sulawesian species of *Scaphicoma*

1 Body unicolorous (Figs. 4–23a, b, 4–28a). 3

– Body bicolorous (Figs. 4–23c, 4–28b). 2

2 Elytra each with two black fasciae. Parameres symmetrical. Internal sac with two-pronged spear shaped sclerite. ..... ***S. quadrifasciata*** sp. n.

– Elytra almost black, with a posterior fasciae dark reddish-brown. Parameres asymmetrical. Internal sac on basal portion covered with scale-like sclerites, and with a straight sclerite. ..... ***S.* sp2**

3 Body yellowish-brown to reddish-brown. Parameres asymmetrical. 4

– Body dark reddish-brown. Parameres symmetrical. Internal sac with two-pronged spear shaped sclerite. ..... ***S. bidentia*** sp. n.

4 Body 2.55–2.75 mm long. Internal sac covered with scale-like sclerites on basal portion, and with a pair of sclerites..... ***S. subflava*** sp. n.

– Body 2.31–2.36 mm long. Internal sac covered with fine scale-like and denticulate structures, and with a straight sclerite. ..... ***S.* sp1**

Scaphicoma subflava Ogawa & Löbl sp. n.

http://zoobank.org/

http://species-id.net/wiki/Scaphicoma_subflava

(Figs. 4–23a, 4–24a–e, 4–27a–h)

Diagnosis. Most of body yellowish-brown. Body size relatively moderate. Antennomere XI about 1.6 times as long as VIII; IV and V each shorter than VI. Protarsomeres I–III and V each about two times as long as IV. Mesotarsomeres I about 1.2 times as long as II and III; V about 1.5 times as long as IV. Metatarsomeres I about 1.5 times as long as II and III; II and III each about 1.5 times as long as IV and V. Male sternite VII with middle of apical margin strongly concave. Parameres asymmetrical. Internal sac on basal portion covered with scale-like sclerites, and with pair of sclerites on apical portion . Bursa copulatrix sclerotized.

Description. Body, shining. Most of body including head, pronotum and elytra yellowish-brown, except for darkened mesoventrite. Antennae yellowishbrown, except of antennomeres VII–XI dark yellowish-brown (Fig. 4–23a). Head, pronotum and elytra sparsely and finely pubescent.

Head with interocular distance almost as eye width. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some microsetae; VI about two times as long as III; IV and V each shorter than VI; VII almost as VIII; XI about 1.6 times as long as VIII (Fig. 4–24e).

Pronotum almost as wide as long, lateral keel invisible in dorsal view. Punctuation sparse and fine, as on head (Fig. 4–27c, d). Scutellum concealed. Elytra longer than wide, widest at basal 1/6, gradually narrowed to apex, with minute serration at inner

part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium densely and finely punctate. Pygidium sparsely and finely punctate, slightly emarginated at apex.

Hypomeron finely punctate. Lateral portion of mesoventrite coarsely and sparsely punctate; medial portion finely and sparsely punctate, with fine pubescence. Lateral portion of metaventrite from base to basal 1/3 sparsely and coarsely punctate, with apical portion moderately concave (Fig. 4–27g, h). Mesocoxa almost six times as wide as space between them; mesocoxal area moderately broadened. Metepimeron almost as long as wide, with microsculpture. Metacoxa about eight times as wide as metacoxal process. Metanepisternum about six times as long as wide. Lateral portion of ventrite I from base to basal 1/3 densely and coarsely punctate. Ventrite VI strongly pointed at apicomedian portion.

Meso- and metafemora with microsculpture, sparsely and coarsely punctate (Fig. 4–27a). Protarsomeres I–III and V each about two times as long as IV. Mesotarsomeres I about 1.2 times as long as II and III; V about 1.5 times as long as IV. Metatarsomeres I about 1.5 times as long as II and III; II and III each about 1.5 times as long as IV and V.

Male. Ventrite V strongly emarginated at apex. Protarsomeres I–III with tenent setae, enlarged (Fig. 4–27b). Aedeagus about 0.91 mm long; parameres asymmetrical; internal sac on basal portion covered with scale-like sclerites, and with a pair of sclerites (Fig. 4–24a, b).

Female. Ventrite V slightly emarginate or truncate. Protarsomeres I–III without tenent setae, not enlarged. Gonostylus elongate. Distal gonocoxite normal and elongate; vagina membranous, without robust sclerites; bursa copulatrix strongly sclerotized. Spermatheca as Fig . 4–24c, d.

Measurements (n = 6). Length (PL+EL): 2.55–2.75 mm; width (PW, EW): 1.04–1.13 mm, 1.09–1.21 mm. HW: 0.55–0.58 mm. ID: 0.16–0.19 mm. PL/PW: 0.95–1.07. EL/EW: 1.30–1.43. Approximate ratio of each antennal length (width) from base to apex as follows (n = 1): 1.7 (0.7) : 0.9 (0.6) : 1.0 (0.2) : 1.6 (0.2) : 1.5 (0.2) : 1.9 (0.2) : 1.5 (0.3) : 1.5 (0.2) : 1.7 (0.3) : 1.9 (0.3) : 2.5 (0.2).

Specimens examined. Holotype, 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N.

Sulawesi, alt. ca. 800m, 0°34'28.52N, 123°11'30.61E, 8. VI. 2012, R. Ogawa leg. (MZBI); Paratypes, 2♀, Same data above (EUMJ); 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34'28.52N–0°35'18.14N, 123°11'30.61E–123°13'22.71E, 9. VI. 2012, R. Ogawa leg. (HUOI); 1♂, Palu, Palopo, C. Sulawesi, 25–27. VIII. 1990, A. Riedel leg. (MHNG).

Distribution. Indonesia: northern and central Sulawesi.

Etymology. This specific name is the Latin subflava adjective meaning somewhat yellowish.

Remarks. This species was illustrated in Leschen & Lobl (2005), thought unidentified. It is very similar to the Javanese *Scaphicoma pallens* (Achard, 1921) by the body color and the shapes of male genitalia, but it is easily distinguished by the distinctive male genitalia with internal sac bearing sclerites.

Scaphicoma bidentia Ogawa & Löbl sp. n.
http://zoobank.org/
http://species-id.net/wiki/Scaphicoma_bidentia
(Figs. 4–23b, 4–25a–e)

Diagnosis. Body dark reddish-brown. Body size relatively small. Antennomere XI about two times as long as VIII; IV and V each almost as VI. Protarsomeres I–III each about 1.2 times as long as IV; V about 1.7 times as long as IV. Mesotarsomeres I and V each about two times as long as II; III about 1.5 times as long as IV. Metatarsomeres I about 2.0 times as long as II; II and III each about 1. 5 times as long as IV; V about 1.7 times as long as IV. Male and female sternite VII with middle of apical margin moderately concave. Paramere symmetrical, weakly enlarged at subapical portion. Internal sac with two-pronged spear shaped sclerite.

Description. Body shining. Head and mouthparts reddish-brown. Antenna yellowish-brown, except for antennomeres VI–XI dark yellowish-brown. Pronotum, elytra and ventral surface dark reddish-brown. Legs, propygidium and pygidium yellowish-brown (Fig. 4–23b). Head, pronotum and elytra sparsely and finely pubescent.

Head with interocular distance almost as eye width. Punctuation sparse and fine.

Antennomeres I–VI with a few macrosetae, VII–XI covered with some microsetae; VI about 1.5 times as long as III; IV and V each almost as VI or shorter; VII almost as VIII or shorter; XI about two times as long as VIII (Fig. 4–25e).

Pronotum almost as wide as long, lateral keel invisible in dorsal view. Punctuation sparse and fine, as on head. Scutellum concealed. Elytra longer than wide, widest at basal 1/6, gradually narrowed to apex, with minute serration at inner part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium and pygidium sparsely and finely punctate.

Hypomeron finely punctate. Lateral portion of mesoventrite coarsely and sparsely punctate; medial portion finely and sparsely punctate, with fine pubescence. Lateral portion of metaventrite from base to basal 1/3 sparsely and coarsely punctate, with apical portion moderately concave. Mesocoxa almost six times as wide as space between them; mesocoxal area moderately broadened. Metepimeron almost as long as wide, with microsculpture. Metacoxa about eight times as wide as metacoxal process. Metanepisternum about six times as long as wide. Lateral portion of ventrite I from base to basal 1/3 densely and coarsely punctate. Ventrite V emarginated at apex. Ventrite VI strongly pointed at apicomedian portion.

Meso- and metafemora with microsculpture, sparsely and coarsely punctate. Protarsomeres I–III each about 1.2 times as long as IV; V about 1.7 times as long as IV. Mesotarsomeres I and V each about two times as long as II; III about 1.5 times as long as IV. Metatarsomeres I about 2.0 times as long as II; II and III each about 1. 5 times as long as IV; V about 1.7 times as long as IV.

Male. Protarsomeres I–III with tenent setae, enlarged. Aedeagus about 0.62 mm long; parameres symmetrical; internal sac with two-pronged spear shaped sclerite (Fig. 4–25 a, b).

Female. Protarsomeres I–III without tenent setae, not enlarged. Gonostylus robust. Distal gonocoxite normal, robust in lateral view; vagina membranous, without robust sclerites; bursa copulatrix not sclerotized. Spermatheca as Fig. 4–25c, d.

Measurements (n = 3). Length (PL+EL): 2.25–2.44 mm; width (PW, EW): 0.89–0.94 mm, 0.93–0.98 mm. HW: 0.46–0.53 mm. ID: 0.16–0.19 mm. PL/PW:

1.00–1.20. EL/EW: 1.42–1.45. Approximate ratio of each antennal length (width) from base to apex as follows (n = 1): 1.4 (0.5) : 0.9 (0.5) : 1.0 (0.2) : 1.4 (0.2) : 1.4 (0.2) : 1.6 (0.2) : 1.3 (0.3) : 1.2 (0.2) : 1.5 (0.3) : 1.6 (0.2) : 2.4 (0.2).

Specimens examined. Holotype, 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 500–800 m, 0°34'04.62N–0°34'28.52N, 123°11'15.42E–123°11'30.61E, 26–27. I. 2011, R. Ogawa leg. (MZBI); Paratypes, 1♀, same data above (EUMJ); 1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34'28.52N–0°35'18.14N, 123°11'30.61E–123°13'22.71E, 9.VI.2012, R. Ogawa leg. (HUOI).

Distribution. Indonesia: northern Sulawesi.

Etymology. This specific name is derived from the Latin bidentia (two-pronged), referring to the shape of sclerites of the internal sac.

Remarks. This species is very similar to the Philippines *Scaphicoma pullex* (Heller, 1917) by the body color and size, and it is also very similar to *Scaphicoma cincta* (Pic, 1920c) from Sumatra by the shape of internal sac of the aedeagus. However, *S. pullex* is easily distinguished from the new species by the Y-shaped sclerite of internal sac and *S. cincta* is also easily distinguished from the new species by the color of elytra and pronotum with black along the edges.

Scaphicoma quadrifasciata Ogawa & Löbl sp. n.
http://zoobank.org/
http://species-id.net/wiki/Scaphicoma_quadrifasciata
(Figs. 4–23c, 4–26a–e)

Diagnosis. Body bicolorous: basic color yellowish-brown, elytra each with black fasciae and black along sutural and lateral margins. Ventral surface with iridescent luster due to microsculptures. Antennomere VI about two times as long as III; IV and V each shorter than VI; XI about 1.6 times as long as VIII. Protarsomeres I–III and V about two times as long as IV. Mesotarsomeres I about 1.8 to 2.0 times as long as II; II, III and V each about 1.2 times as long as IV. Metatarsomeres I about 1.5 to 1.7 times as long as II; II and III each about 1.2 times as long as IV and V; IV almost as long as V. Parameres enlarged at subapical portion and tapering to apex, weakly pointed around subapical

portion in dorsal view.

Description. Body shining. Head, mouthparts and antenna yellowish-brown, except for antennomeres VII–XI dark yellowish-brown. Basic color of dorsal surface yellowishbrown, pronotum ochraceous or darkened on disc, black along margins. Elytra each with two black fasciae and black along suture and lateral margins (Fig. 4–23c). Posterior margins of anterior fasciae extended to apex along sutural striae, not reaching to sutural striae. Posterior fasciae extended to apex, reaching to sutural striae. Propygidium and pygidium from in basal half black, pygidium from mid-length to apex brown. Ventral surface almost black and with iridescent luster due to microsculptures. Coxa, ventrite I and II and femora, tibiae and tarsi yellowish-brown. Head, pronotum and elytra sparsely and finely pubescent.

Head with interocular distance almost as eye width. Punctuation sparse and fine. Antennomeres I–VI with a few macrosetae, VII–XI covered with some microsetae; VI about two times as long as III; IV and V each shorter than VI; VII almost as VIII; XI about 1.6 times as long as VIII (Fig. 4–26e).

Pronotum almost as wide as long, lateral keel invisible in dorsal view. Punctuation sparse and fine, as on head. Scutellum concealed. Elytra longer than wide, widest at basal 1/6, gradually narrowed to apex, with minute serration at inner part of posterior margin. Punctuation coarser than on pronotum. Sutural striae extending outwards along basal margin to form basal striae, reaching humeral area and not joined with lateral striae.

Propygidium sparsely and coarsely punctate. Pygidium with sparse, fine and also coarse punctures.

Hypomeron finely punctate. Lateral portion of mesoventrite coarsely and sparsely punctate; medial portion finely and sparsely punctate, with fine pubescence. Lateral portion of metaventrite from base to basal 1/3 sparsely and coarsely punctate, with apical portion moderately concave. Mesocoxa almost six times as wide as space between them, mesocoxal area moderately broadened. Metanepisternum about six times as long as wide. Metepimeron almost as long as wide, with microsculptures. Metacoxa about eight times as wide as metacoxal process. Lateral portion of ventrite I from base to basal 1/3 densely and coarsely punctate. Ventrite V moderately emarginated at apex. Ventrite VI strongly pointed at apical median portion.

Meso- and metafemora with microsculpture, sparsely and coarsely punctate. Protarsomeres I–III and V each about two times as long as IV. Mesotarsomeres I about 1.8 to 2.0 times as long as II; II, III and V each about 1.2 times as long as IV. Metatarsomeres I about 1.5 to 1.7 times as long as II; II and III each about 1.2 times as long as IV and V; IV almost as long as V.

Male. Protarsomeres I–III with tenent setae, weakly enlarged. Aedeagus about 0.6 mm long; parameres symmetrical, enlarged at subapical portion, tapering to apex, weakly pointed around subapical portion in dorsal view; internal sac with two-pronged spear shaped sclerite, fine scale-like and denticulate structures (Fig. 4–26a, b).

Female. Protarsomeres I–III without tenent setae, not enlarged. Ovipositor simple; bursa copulatrix not sclerotized. Spermatheca as Fig. 4–26c, d.

Measurements (n = 5). Length (PL+EL): 2.47–2.59 mm; width (PW, EW): 1.00–1.03 mm, 1.09–1.10 mm. HW: 0.51–0.54 mm. ID: 0.18–0.21 mm. PL/PW: 0.95–0.99. EL/EW: 1.36–1.46. Approximate ratio of each antennal length (width) from base to apex as follows (n = 1): 1.6 (0.6) : 1.0 (0.6) : 1.0 (0.2) : 1.6 (0.2) : 1.7 (0.2) : 1.9 (0.2) : 1.5 (0.3) : 1.6 (0.2) : 1.7 (0.3) : 1.8 (0.3) : 2.6 (0.3).

Specimens examined. Holotype, 1♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300 m, 0°35'18.14N–123°13'22.71E, 10. VI. 2012, R. Ogawa leg. (MZBI); Paratypes, 1♂1♀, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m, 0°34'28.52N, 0°35'18.14N–123°11'30.61E, 123°13'22.71E, 9. VI. 2012, R. Ogawa leg. (EUMJ); 1♂1♀, same data above (HUOI).

Distribution. Indonesia: northern Sulawesi.

Etymology. This specific name is derived from the Latin quadri (four) and fasciata (band), referring to the four black elytral bands.

Remarks. This species is very similar to *Scaphicoma nigrovittata* (Achard, 1921) and *Scaphicoma flavovittata* Motschulsky, 1863 from Sri Lanka by the distinctly bicolorous body. However, both may be distinguished from the new species by the almost black venter of body, the subapically enlarged parameres and by the shape of the sclerites of the internal sac.

***Scaphicoma* sp1**

(Figs. 4–28a, b)

Diagnosis. Similar to *Scaphicoma subflava* in most respects, but differs in the following characters: aedeagus 0.76 mm; parameres asymmetrical; internal sac with a straight sclerite, fine scale-like and denticulate structures (Fig. 4–28b).

Measurements. Length (PL+EL): 2.31–2.36 mm. PW: 1.02–1.04 mm; EW: 1.09–1.11 mm. HW: 0.53 mm. ID: 0.29 mm. PL/PW: 0.87–0.94, EL/EW: 1.24–1.31. Approximate ratio of each antennal length (width) from base to apex as follows (n = 1): 2.2 (0.5) : 0.9 (0.5) : 1.0 (0.2) : 1.4 (0.2) : 1.5 (0.2) : 1.8 (0.2) : 1.4 (0.2) : 1.4 (0.2) : 1.6 (0.2) : 1.6 (0.2) : 2.2 (0.3).

Specimens examined. 2♂, Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800m, 0°34'28.52N, 123°11'30.61E, 8. VI. 2012, R. Ogawa leg. [Paratypes of *Scaphicoma subflava*] (EUMJ).

Distribution. Indonesia: northern Sulawesi.

Comments. This species closely resembles *Scaphicoma subflava* by the coloration and shape of body, but it is easily distinguished from the latter by the structure of male genitalia.

***Scaphicoma* sp2**

(Figs. 4–28c, d)

Diagnosis. Similar to *Scaphicoma subflava* in most respects, but differs in the following characters: body almost black; head brown to reddish-brown; apical portion of pronotum and posterior part of elytra darker than head; procoxae and apical two-third of ventrite I and ventrite II–V yellowish-brown; meso-, metacoxae and basal one-third of ventrite I dark brown (Fig. 4–28c); mesotarsomere V 1.5 times as long as IV; mesotarsomere IV almost as long as V; mesotarsomere I about twice as long as each IV and V; aedeagus 0.94 mm; parameres asymmetrical; internal sac on basal portion covered with scale-like sclerites, and with a straight sclerite (Fig. 4–28d).

Measurements (n = 4). Length (PL+EL): 2.58–2.73 mm; width (PW, EW): 1.16–1.22 mm, 1.20–1.29 mm. HW: 0.56–0.60 mm. ID: 0.29–0.31 mm. PL/PW: 0.87–0.91, EL/EW: 1.26–1.32. Approximate ratio of each antennal length (width) from base to apex as follows (n = 1): 1.5 (0.3) : 0.9 (0.3) : 1.0 (0.2) : 1.6 (0.2) : 1.5 (0.2) : 1.8

(0.2) : 1.5 (0.3) : 1.5 (0.2) : 1.7 (0.3) : 1.7 (0.2) : 2.4 (0.3).

Specimens examined. 4♂2♀, Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m, 3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E, O’65, O10, O32, O33, 16. XII. 2013, R. Ogawa leg.

Distribution. Indonesia: southeastern Sulawesi.

Comments. This species resembles *Scaphicoma subflava* by the structure of male genitalia, but it is easily distinguished from the body coloration and the structure of sclerite on male genitalia.

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Figures

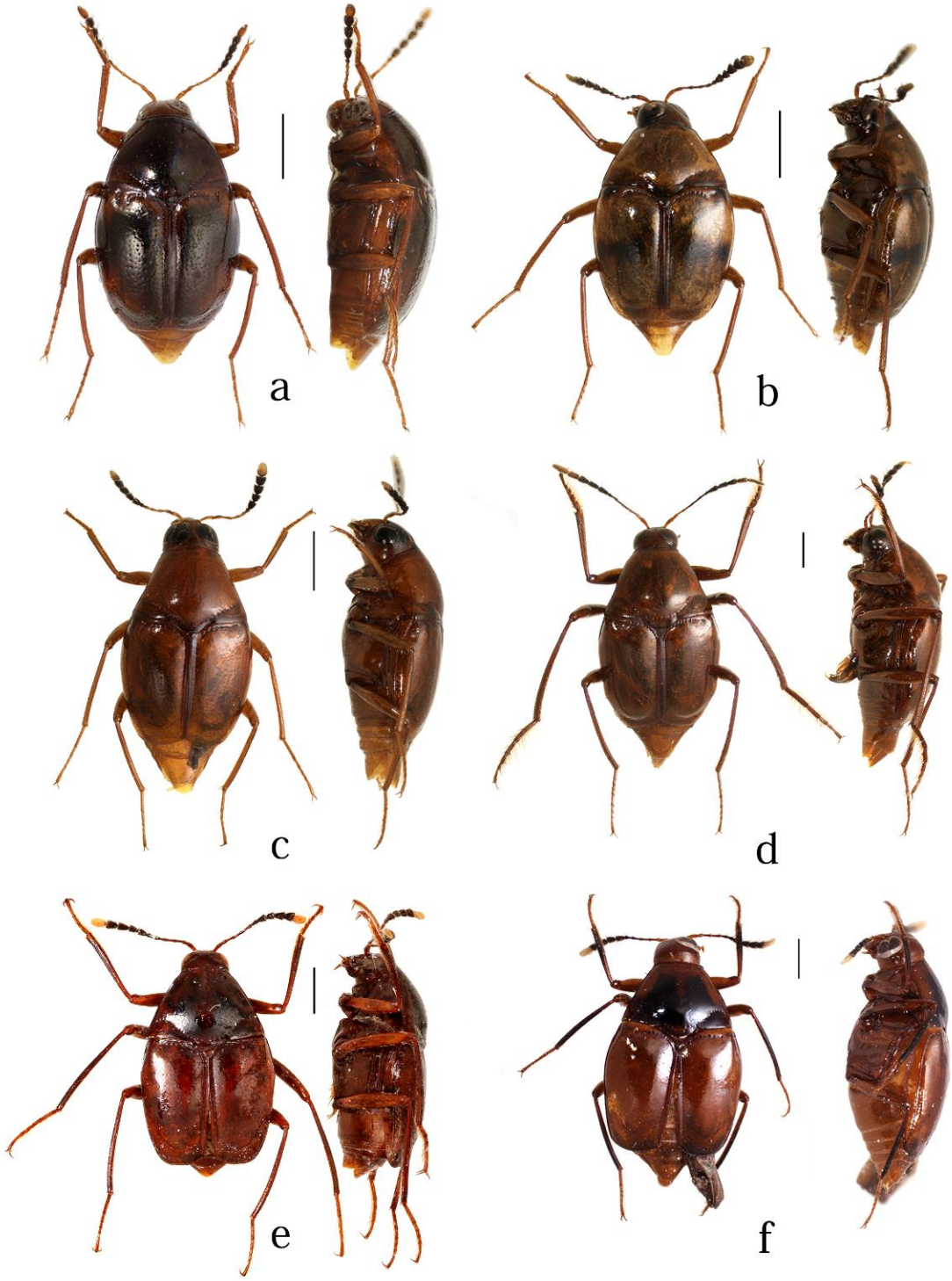

Fig. 4–1. The habitus of *Scaphidium* spp. in dorsal and lateral views. a, *S*. sp1; b, *S*. sp2; c, *S*. sp4; d, *S*. sp3; e, f, *S*. sp5. e, Male; f, female. Scales: 1.0 mm.

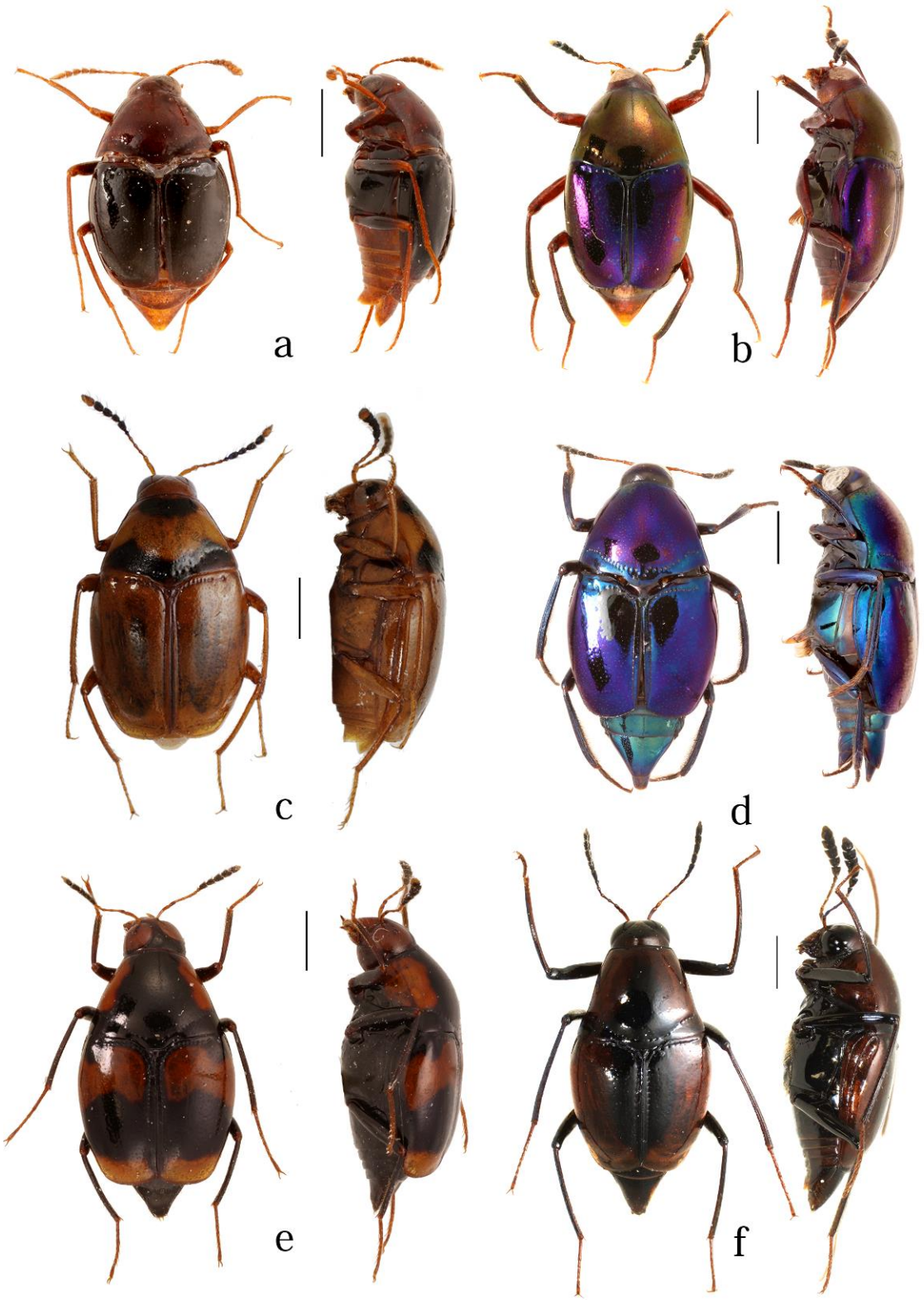

Fig. 4–2. The habitus of *Scaphidium* spp. in dorsal and lateral views. a, *S*. sp6; b, *S*. sp8; c, *S*. sp7; d, *S*. sp9; e, *S. celebense*; f, *S. sondaicum* [Malaysia]. Scales: 1.0 mm.

Fig. 4–3. Holotypes and the labels on the Sulawesian species of *Scaphidium*. a, *S. celebense*; b, *S. medionigrum*; c, *S. sondicum*.

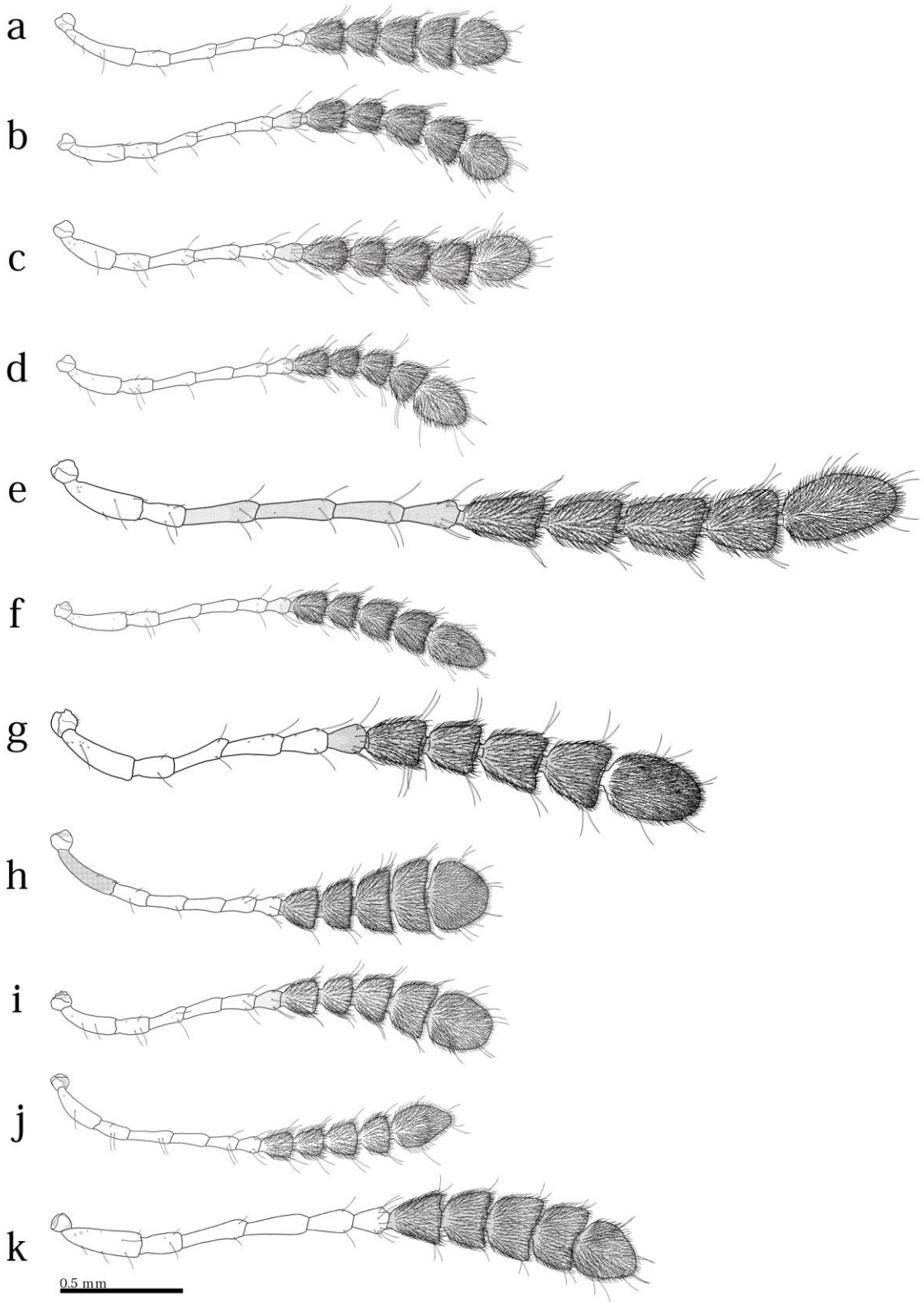

Fig. 4–4. Antenna. a, *Scaphidium celebense*; b, *S.* sp7; c, *S.* sp1; d, *S.* sp2; e, *S.* sp3; f, *S.* sp4; g, *S.* sp5; h, *S.* sp9; i, *S.* sp8; j, *S.* sp6; k, *S. sondaicum*.

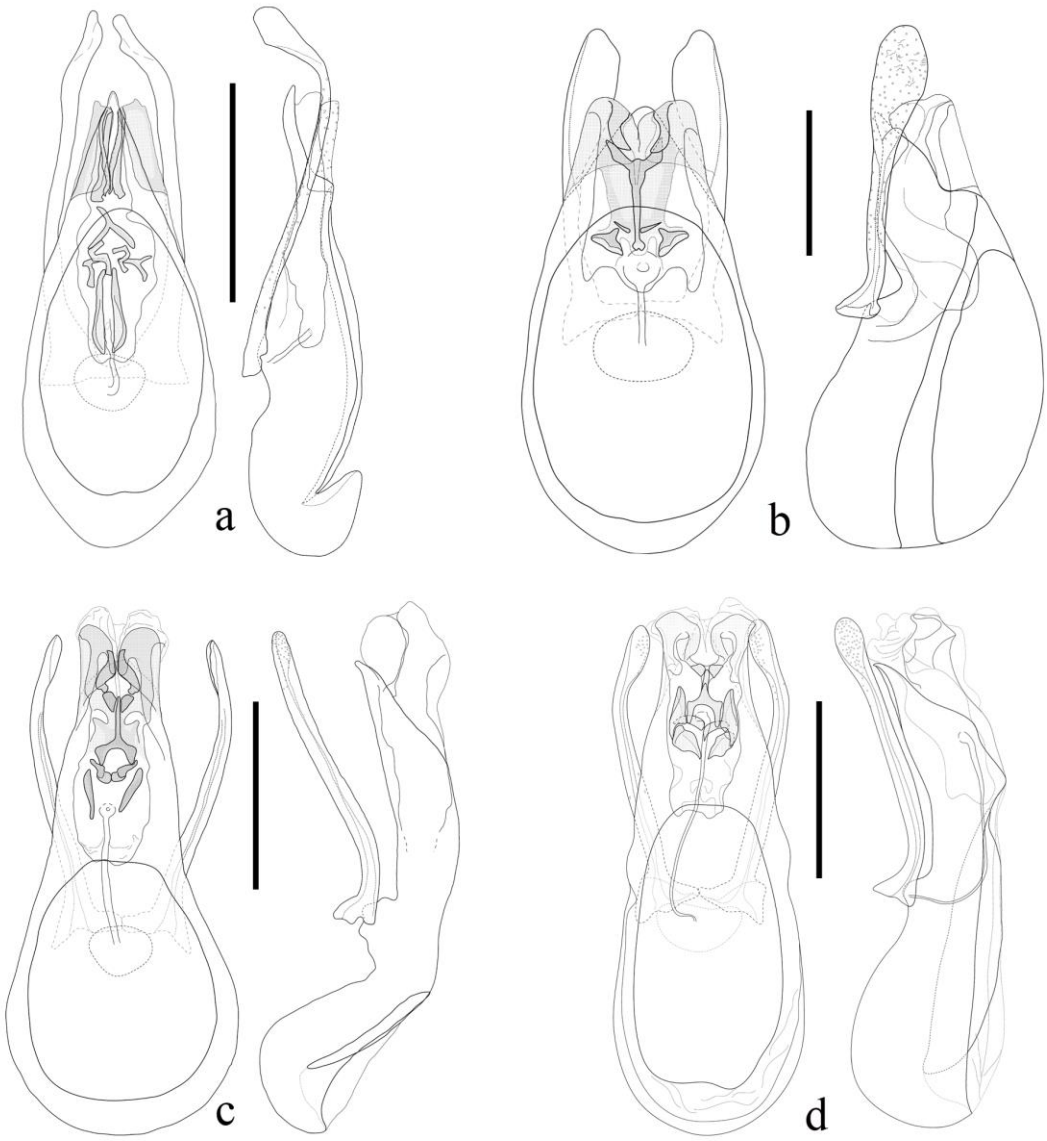

Fig. 4–5. Male genitalia. a, *Scaphidium* sp2; b, *S.* sp3; c, *S.* sp4; d, *S. celebense*. Scales: 0.5 mm.

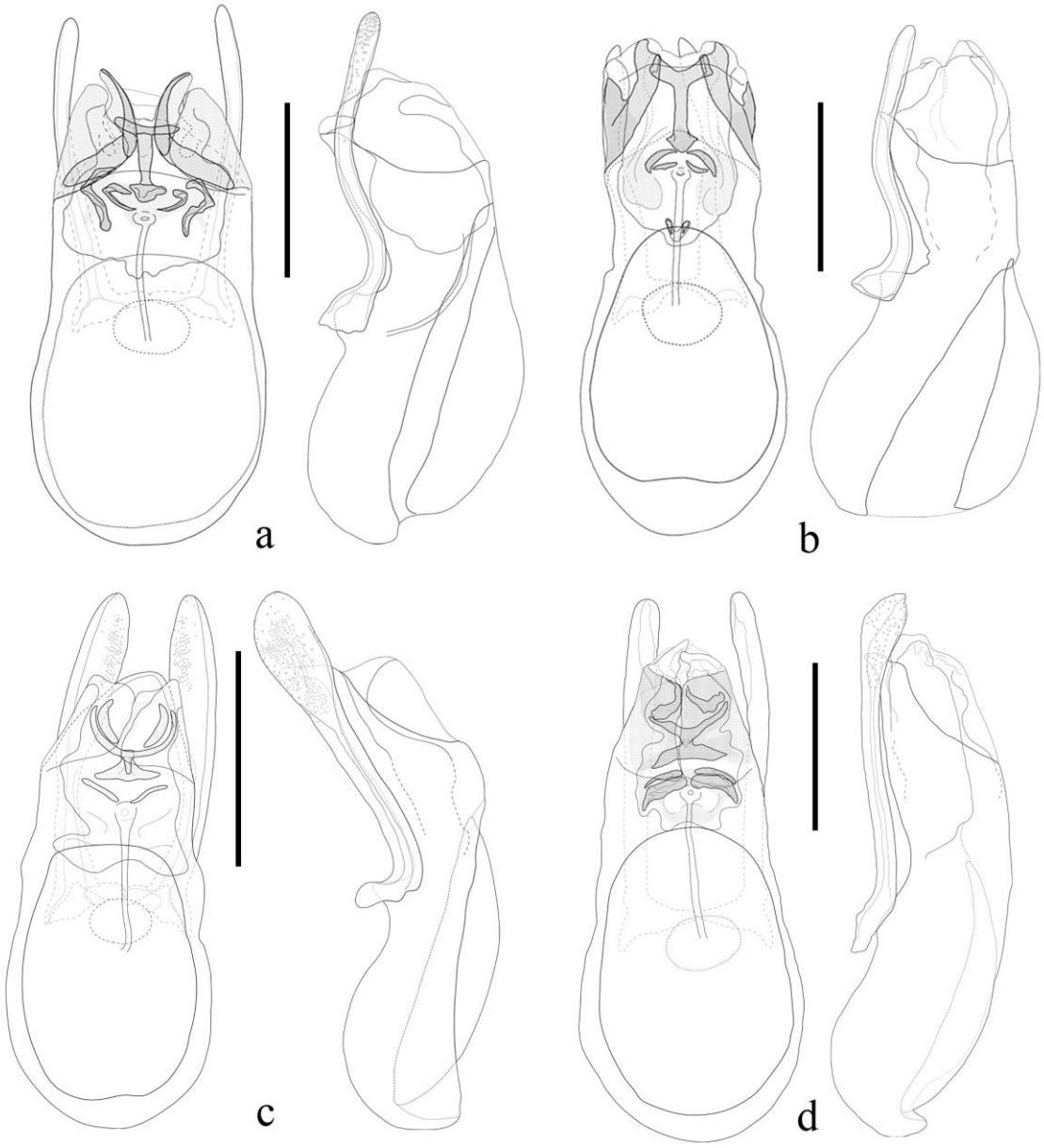

Fig. 4–6. Male genitalia. a, *Scaphidium* sp8; b, *S.* sp9; c, *S.* sp1; d, *S.* sp5. Scales: 0.5 mm.

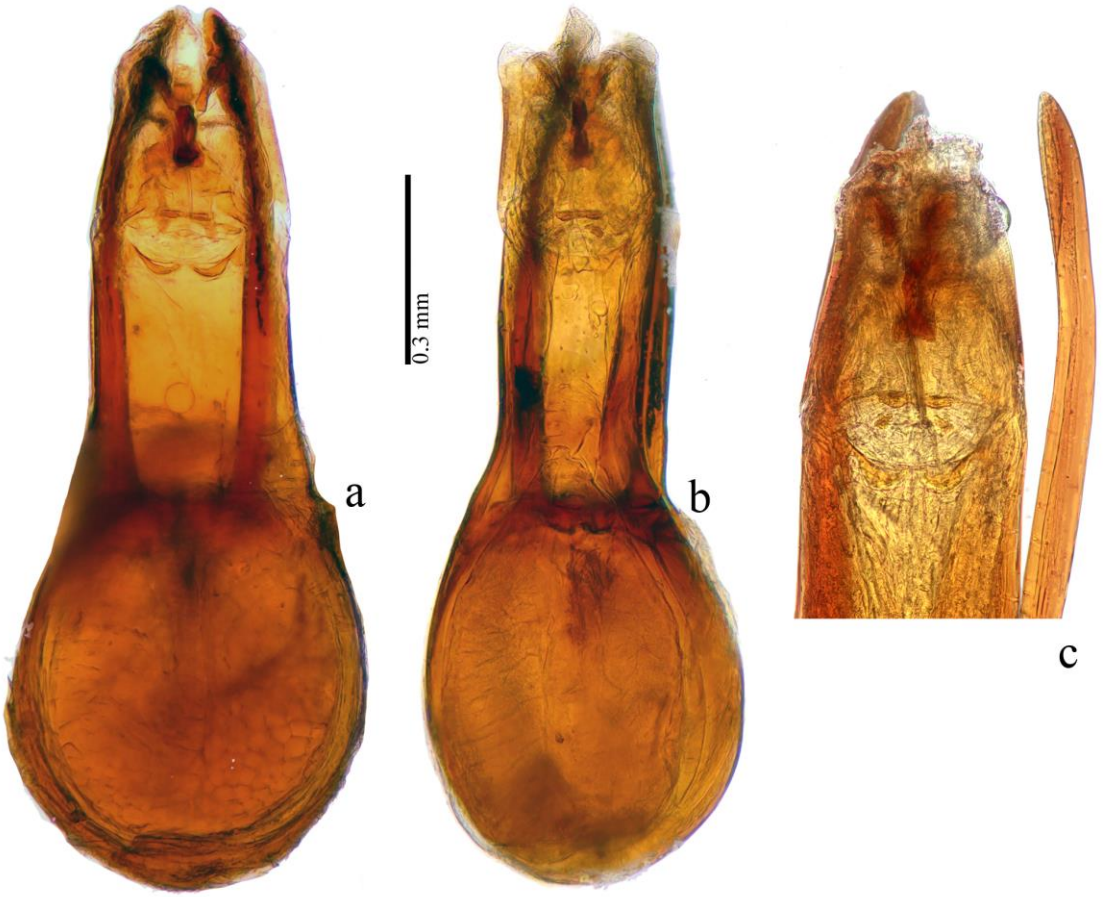

Fig. 4–7. The photos of male genitalia in dorsal view. a, c, *Scaphidium sondaicum*; b, *S. medionigrum*. c, inner sac of male genitalia.

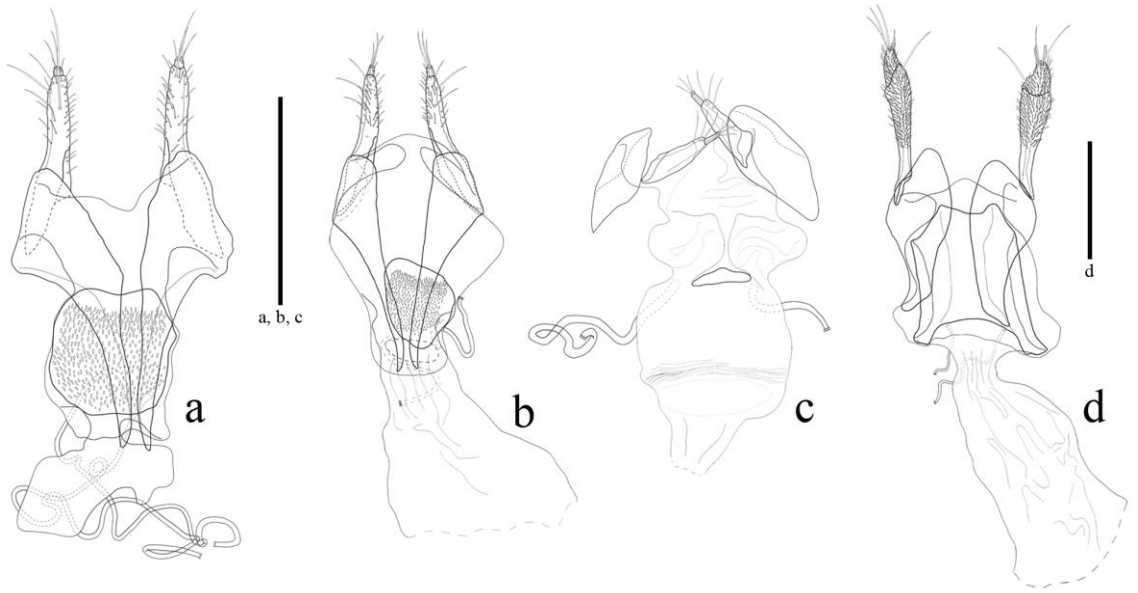

Fig. 4–8. Female genitalia. a, *Scaphidium celebense*; b, *S.* sp4; c, *S.* sp6; d, *S.* sp9. Scales: 0.5 mm.

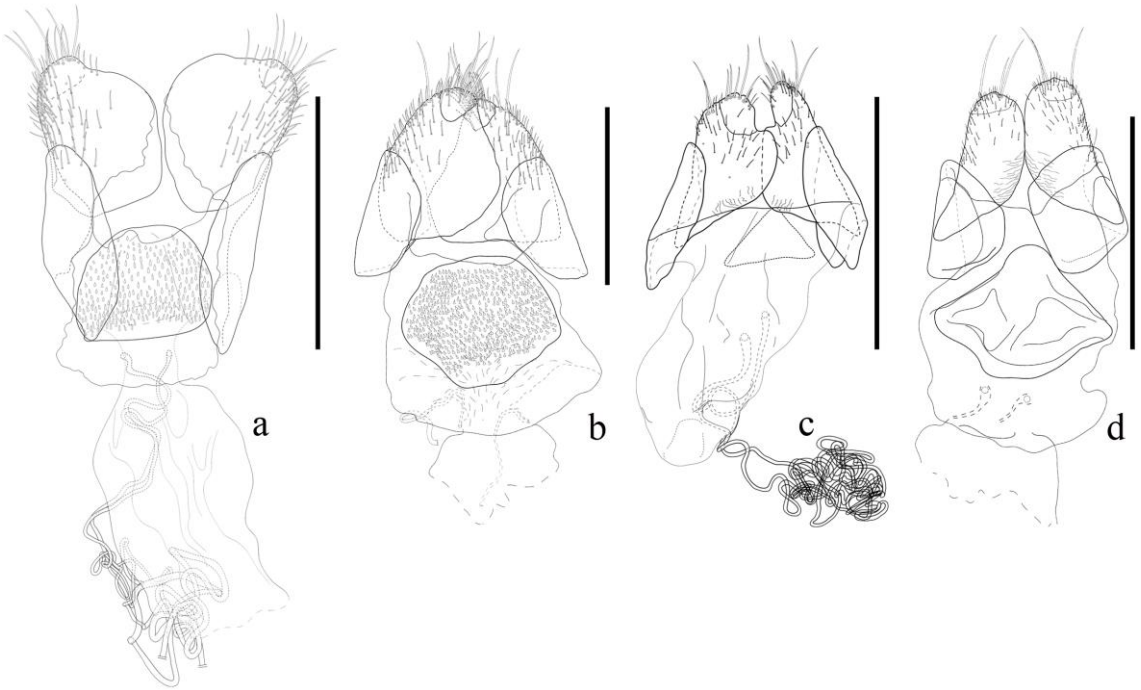

Fig. 4–9. Female genitalia. a, *Scaphidium* sp7; b, *S.* sp5; c, *S.* sp1; d, *S.* sp3. Scales: 0.5 mm.

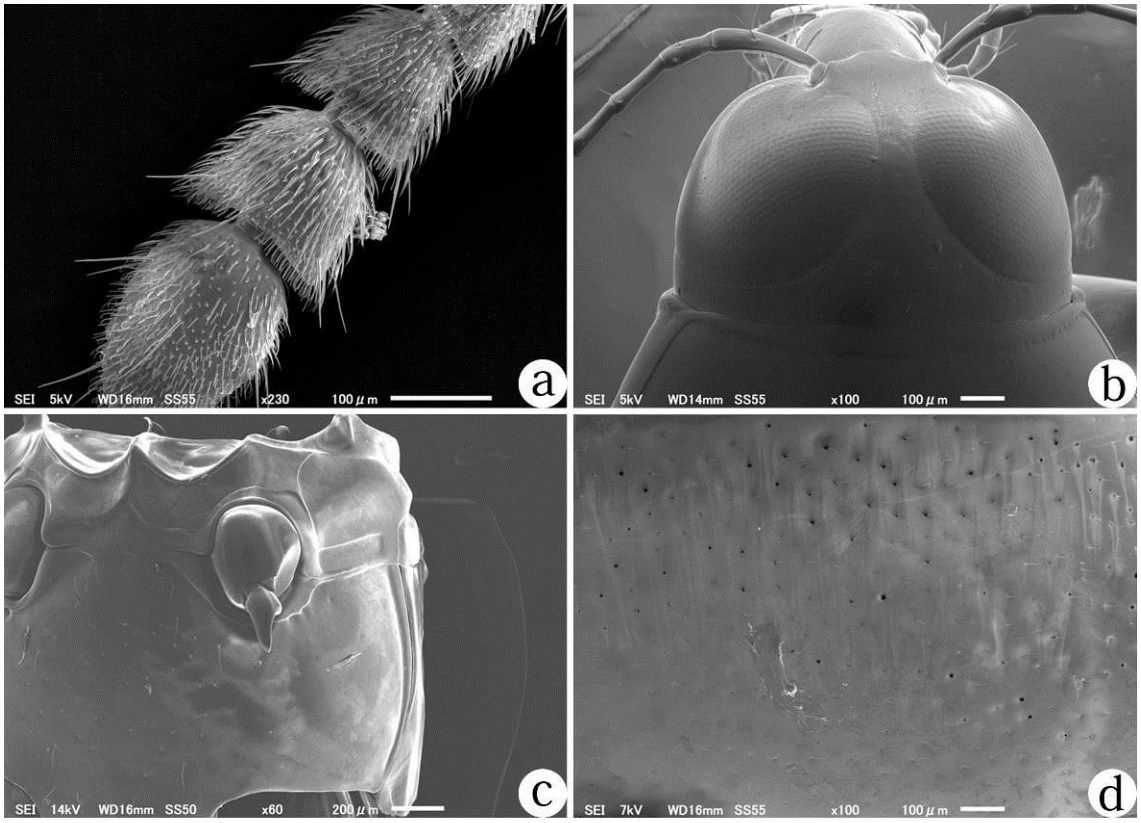

Fig. 4–10. SEM photographs. a, c, d, *Scaphidium* sp4; b, *S. celebense*. a, Anterior part of antenna; b, head; c, meso- and metaventrite; d, disc of elytra. a, b, d, Dorsal view; c, ventral view.

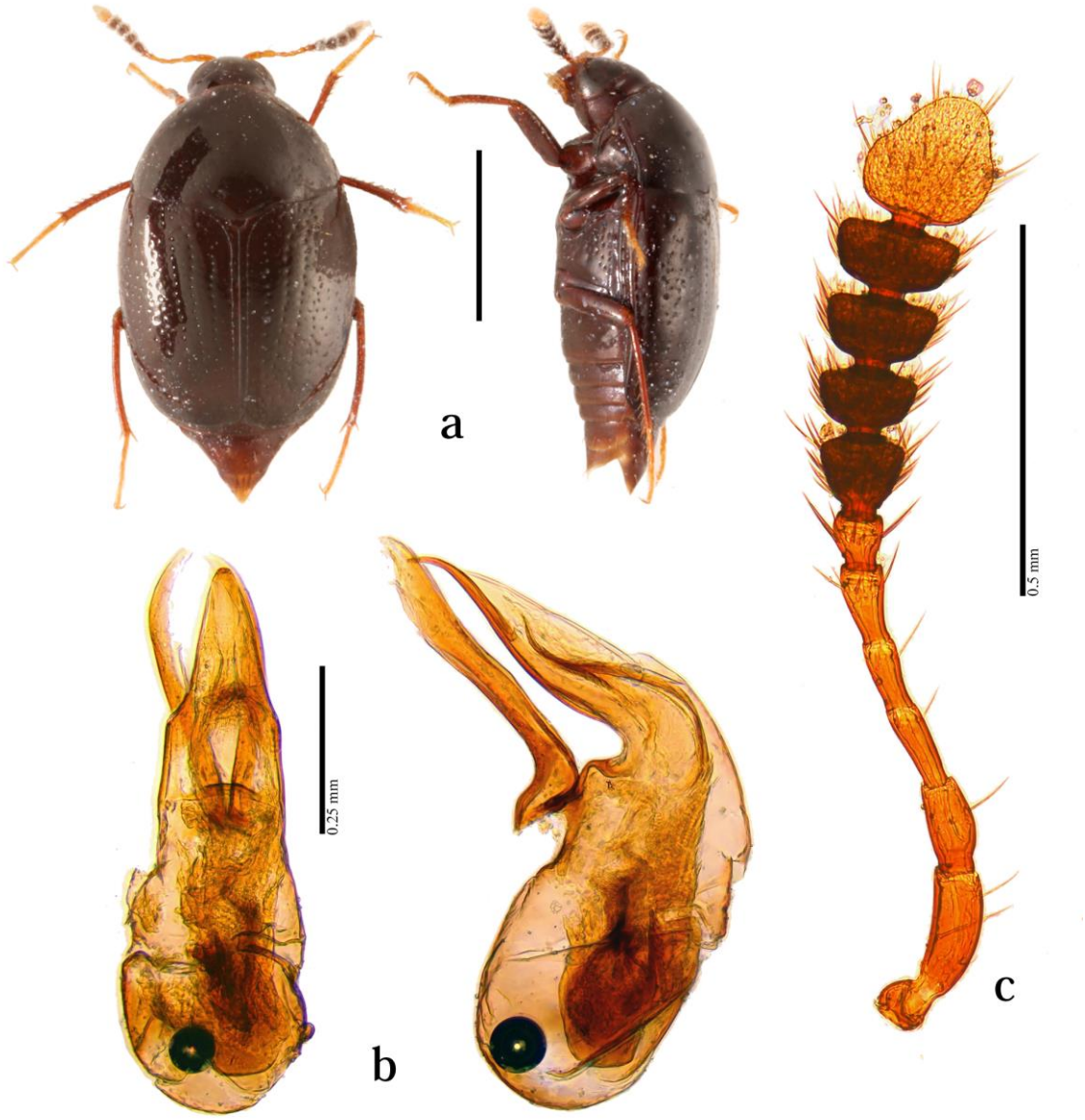

Fig. 4–11. *Cyparium* sp1. a, Habitus in dorsal and lateral views; b, male genitalia in dorsal and lateral views; c, antenna. Scale of habitus: 1.0 mm.

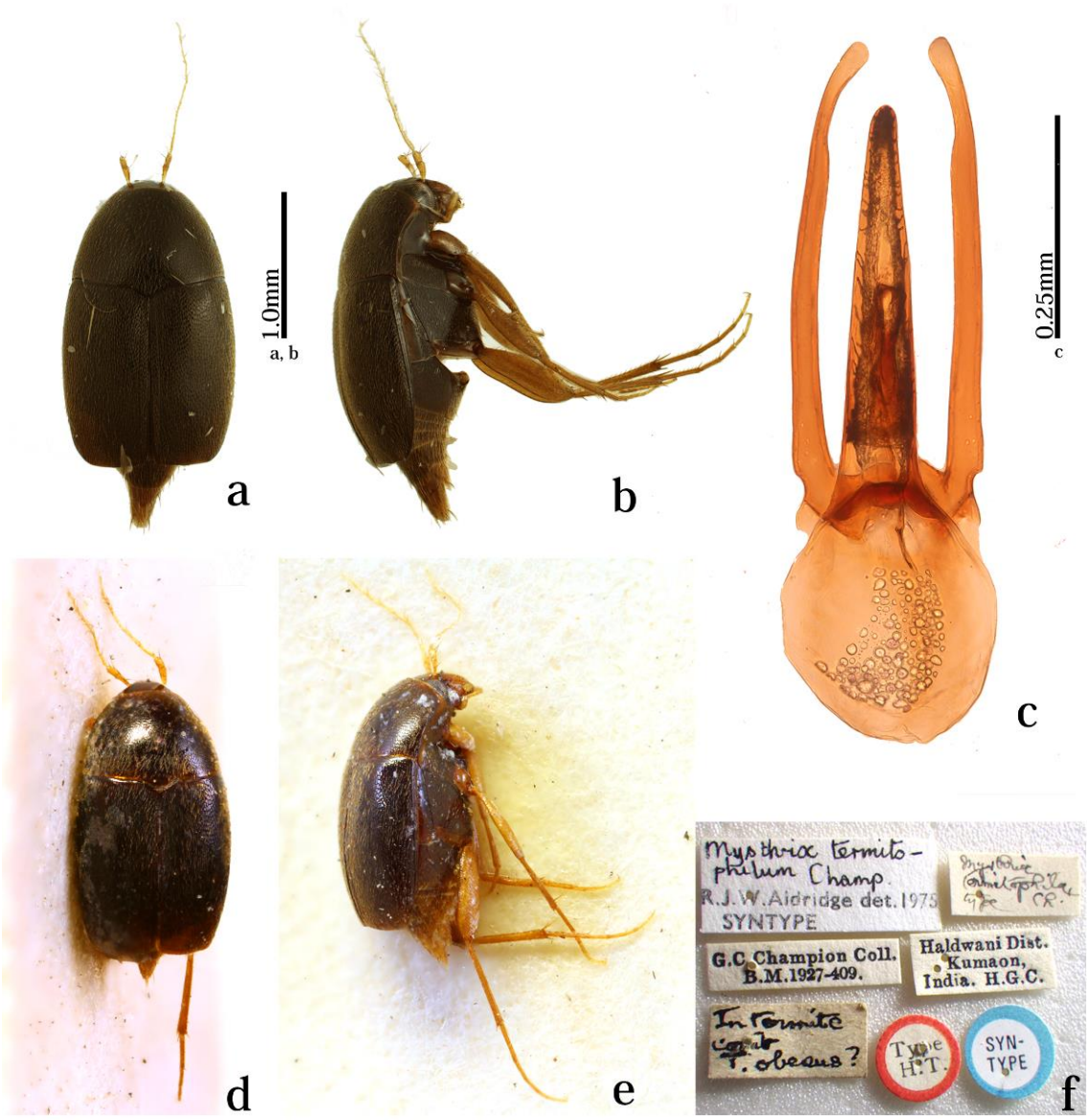

Fig. 4–12. *Vituratella termitophila* (Champion). a, c, d, Dorsal; b, e, lateral. a–c, Male from Sulawesi; c, male genitalia. d, e, Holotype (male, India); f, labels of the holotype.

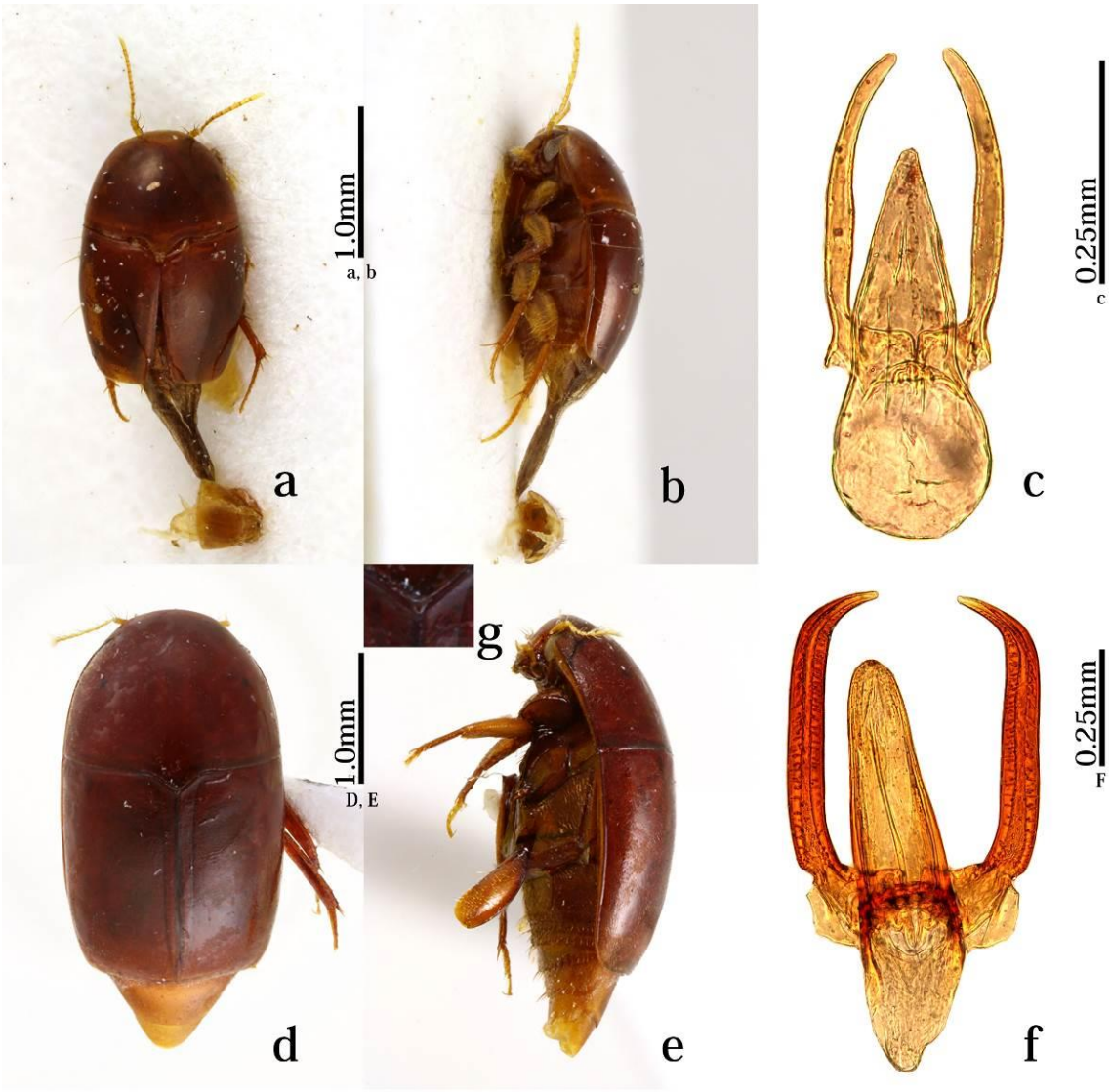

Fig. 4–13. a–c, *Termitoscaphium kistneri* Löbl; d–g, *Baeoceridium celebense* Löbl. a, c, d, f, g, Dorsal; b, e, lateral. a–g, Paratypes (males); c, f, male genitalia; g, scutellum.

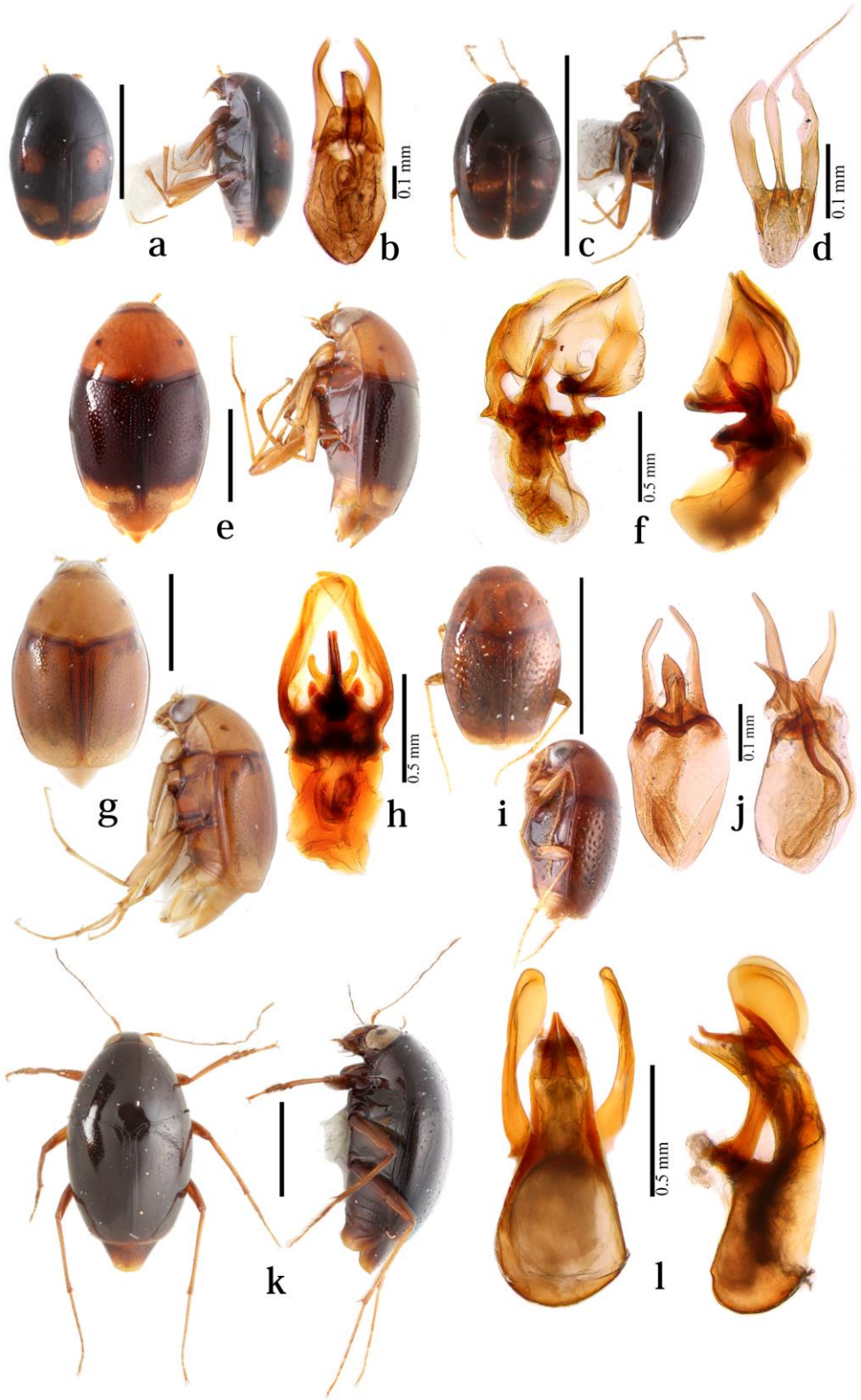

Fig. 4–14. Habitus and male genitalia of *Scaphisoma* spp. in dorsal and lateral views. a, c, e, g, i, k, Habitus; b, d, f, h, j, l, male genitalia. a, b, *S. bugi*; c, d, *S. sadang*; e, f, *S.* cf. *tricolor*; g, h, *S. palu*; i, j, *S. napu*; k, l, *S. latitarse*. Scales of habitus: 1.0 mm.

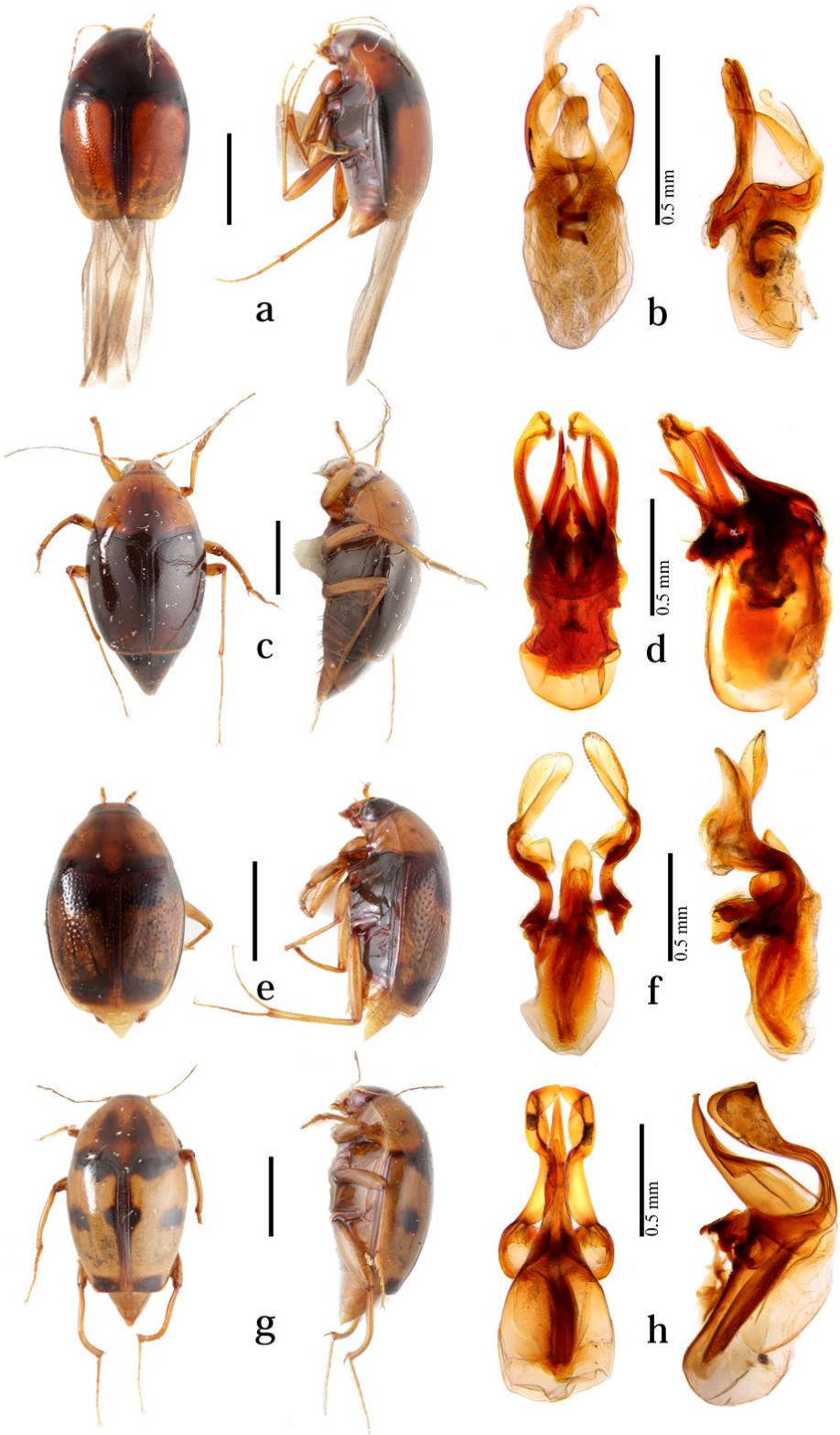

Fig. 4–15. Habitus and male genitalia of *Scaphisoma* spp. in dorsal and lateral views. a, c, e, g, Habitus; b, d, f, h, male genitalia. a, b, *S.* sp1; c, d, *S.* sp2; e, f, *S.* sp3; g, h, *S.* sp4. Scales of habitus: 1.0 mm.

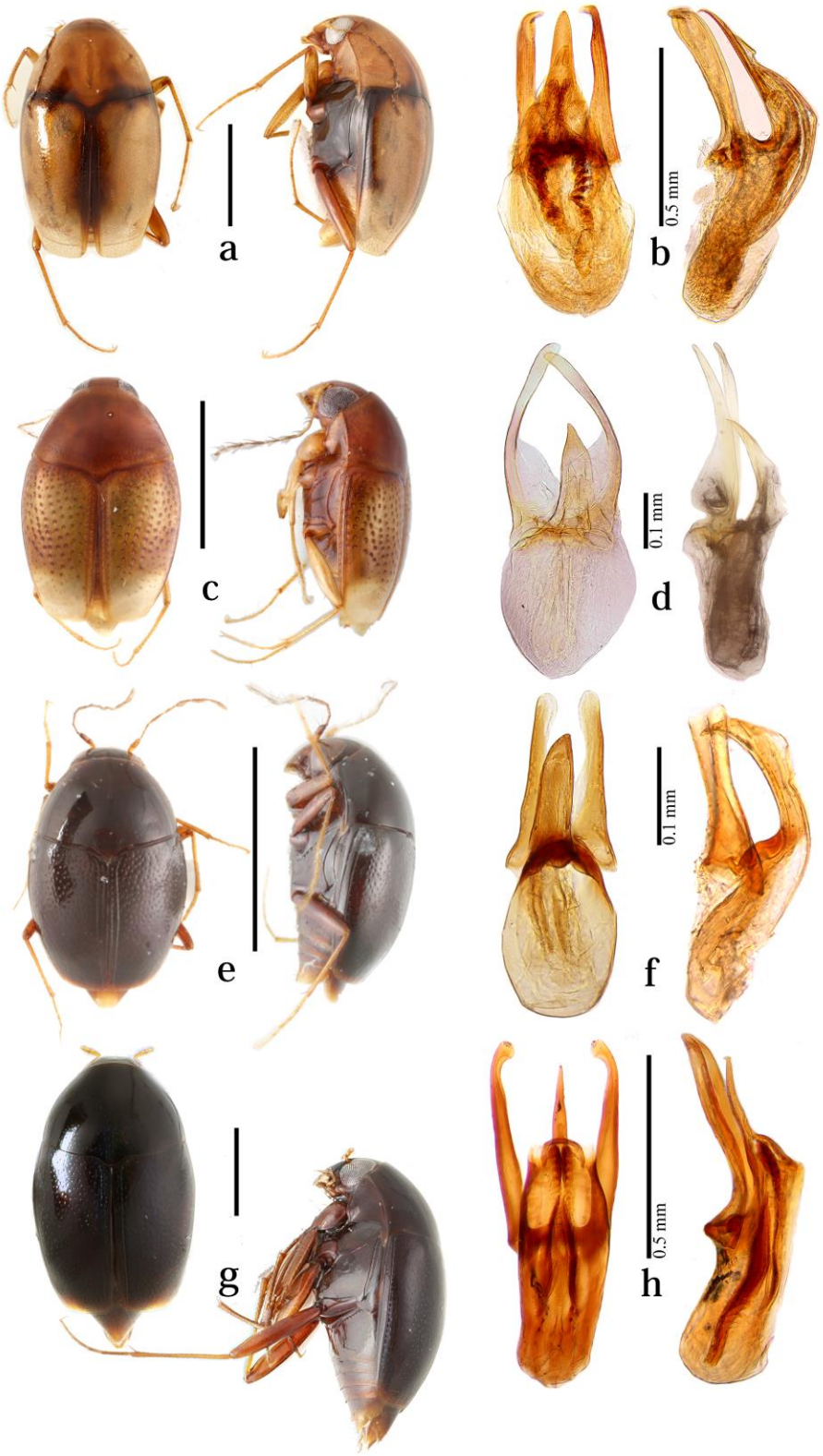

Fig. 4–16. Habitus and male genitalia of *Scaphisoma* spp. in dorsal and lateral views. a, c, e, g, Habitus; b, d, f, h, male genitalia. a, b, *S*. sp5; c, d, *S*. sp6; e, f, *S*. sp7; g, h, *S*. sp8. Scales of habitus: 1.0 mm.

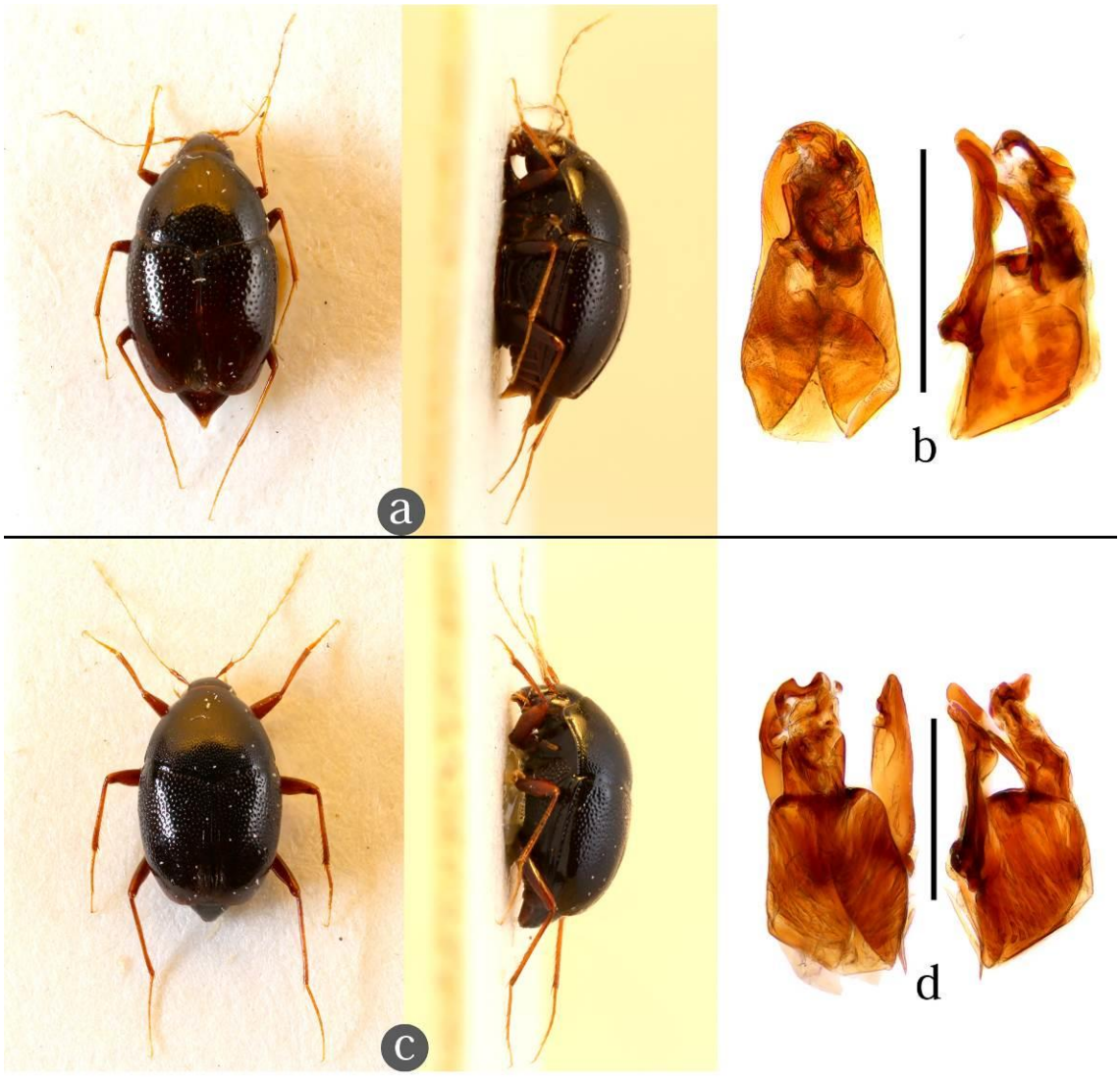

Fig. 4–17. Habitus and male genitalia of *Birocera* spp. in dorsal and lateral views. a, c, Habitus; b, d, male genitalia. a, b, *B. derougemonti*; c, d, *B. punctatissima*. Scales: 0.5 mm.

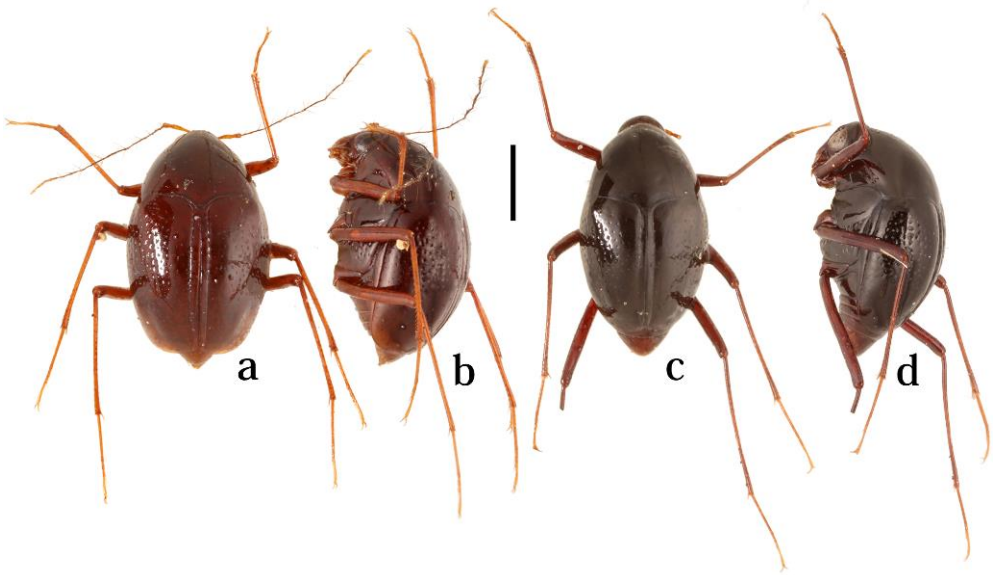

Fig. 4–18. Habitus of *Bironium* sp1 in dorsal and lateral views. a, b, Female; c, d, male. a, c, Dorsal; b, d, lateral. Scales: 1.0 mm.

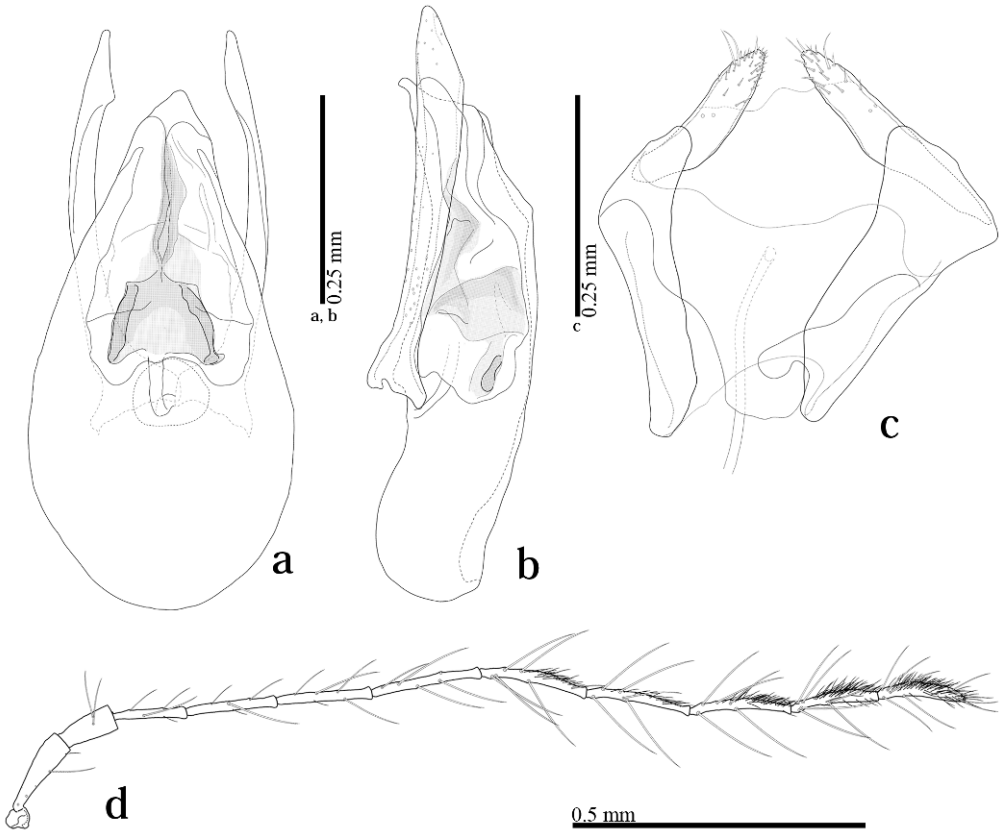

Fig. 4–19. Genitalia and antenna of *Bironium* sp1. a, b Male genitalia; c, female genitalia; e male antenna. a, Dorsal; b, lateral; c, ventral.

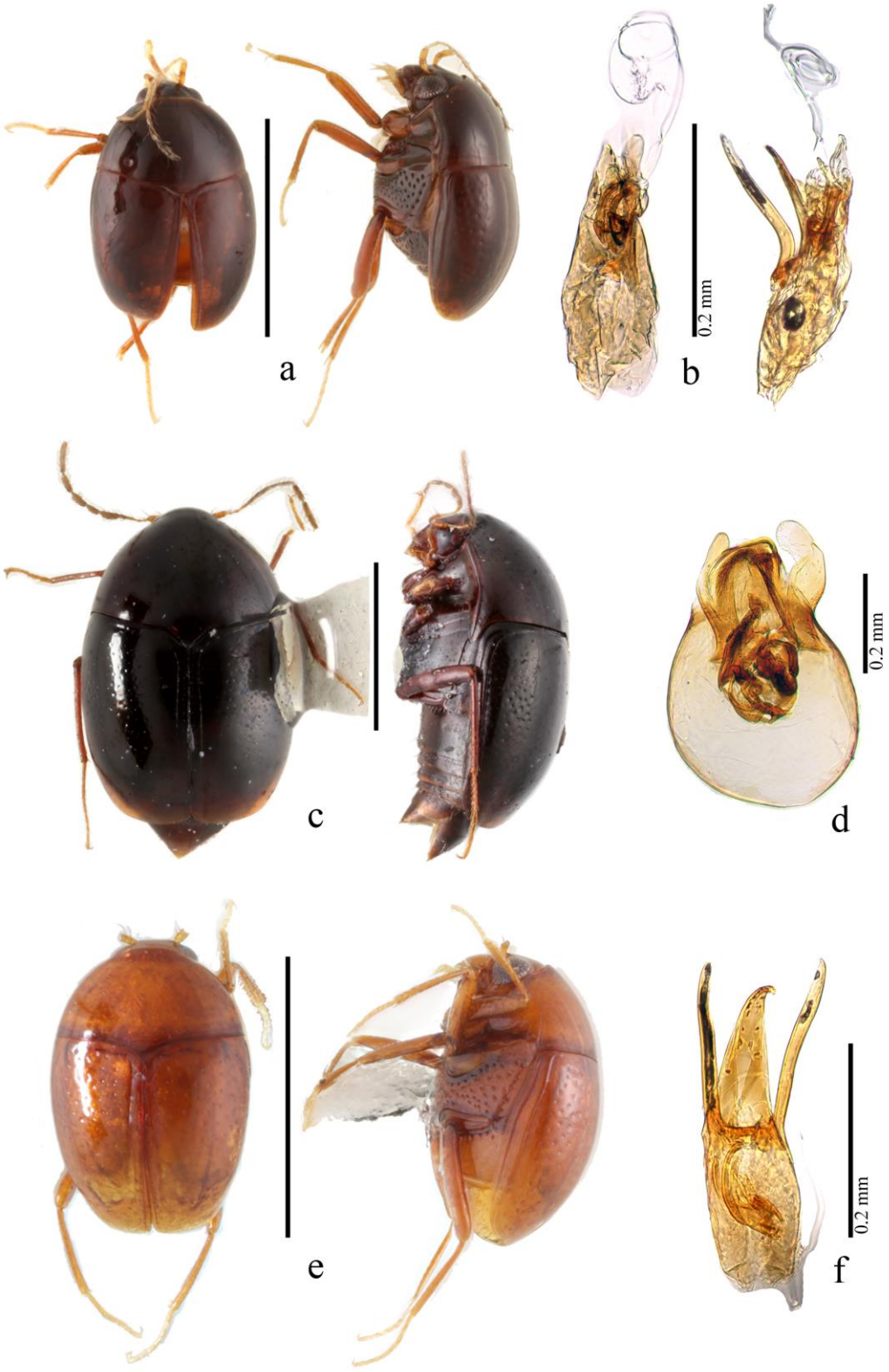

Fig. 4–20. Habitus and male genitalia of *Baeocera* spp. in dorsal and lateral views. a, c, e, Habitus; b, d, f, male genitalia. a, b, *B. derougemonti*; c, d, *B.* sp1; e, f, *B.* sp2. Scales of habitus: 1.0 mm.

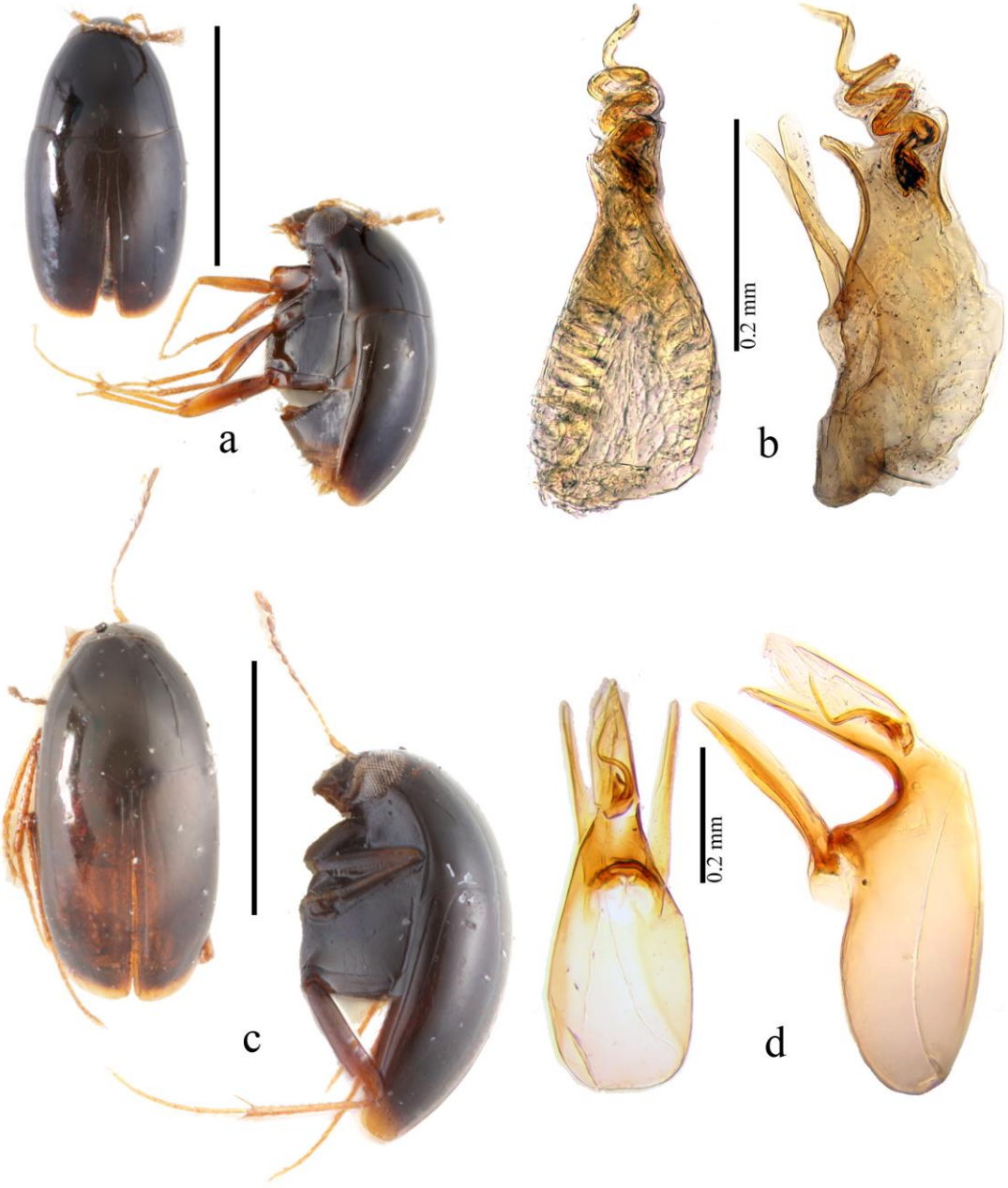

Fig. 4–21. Habitus and male genitalia of *Scaphobaeocera* spp. in dorsal and lateral views. a, c, Habitus; b, d, male genitalia. a, b, *S*. sp1; c, d, *S*. sp2. Scales of habitus: 1.0 mm.

Fig. 4–22. Habitus and male genitalia of *Xotidium* sp1 and *Scaphoxium* sp1, in dorsal and lateral views. a, c, Habitus; b, d, male genitalia. a, b, *Xotidium* sp1; c, d, *Scaphoxium* sp1. Scales of habitus: 1.0 mm.

Fig. 4–23. Habitus of *Scaphicoma* spp. in dorsal and lateral views. a, *S. subflava* sp. n.; b, *S. bidentia* sp. n.; c, *S. quadrifasciata* sp. n. Scale: 1.0mm.

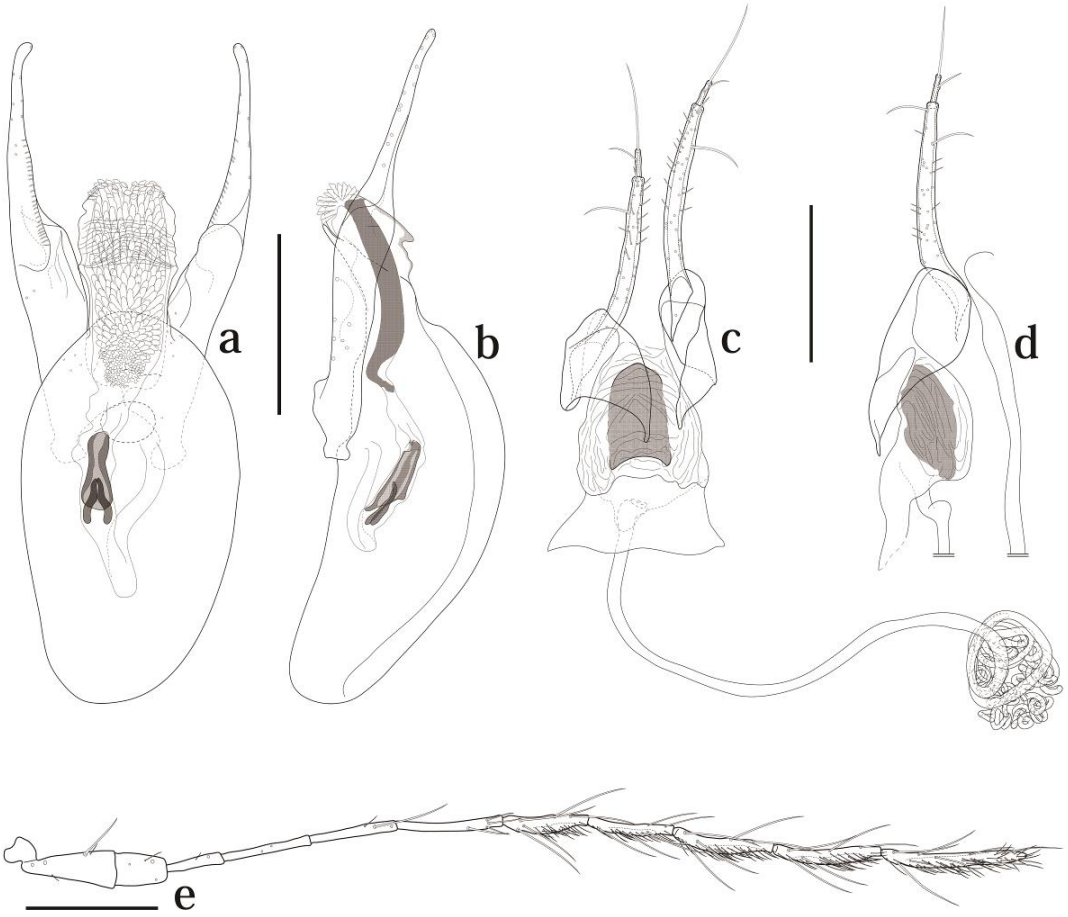

Fig. 4–24. Genitalia and antenna of *Scaphicoma subflava* sp. n. a, b, Male genitalia; c, d female genitalia; e, male antenna. a, c, Dorsal view; b, d, lateral view. Scales: 0.25 mm.

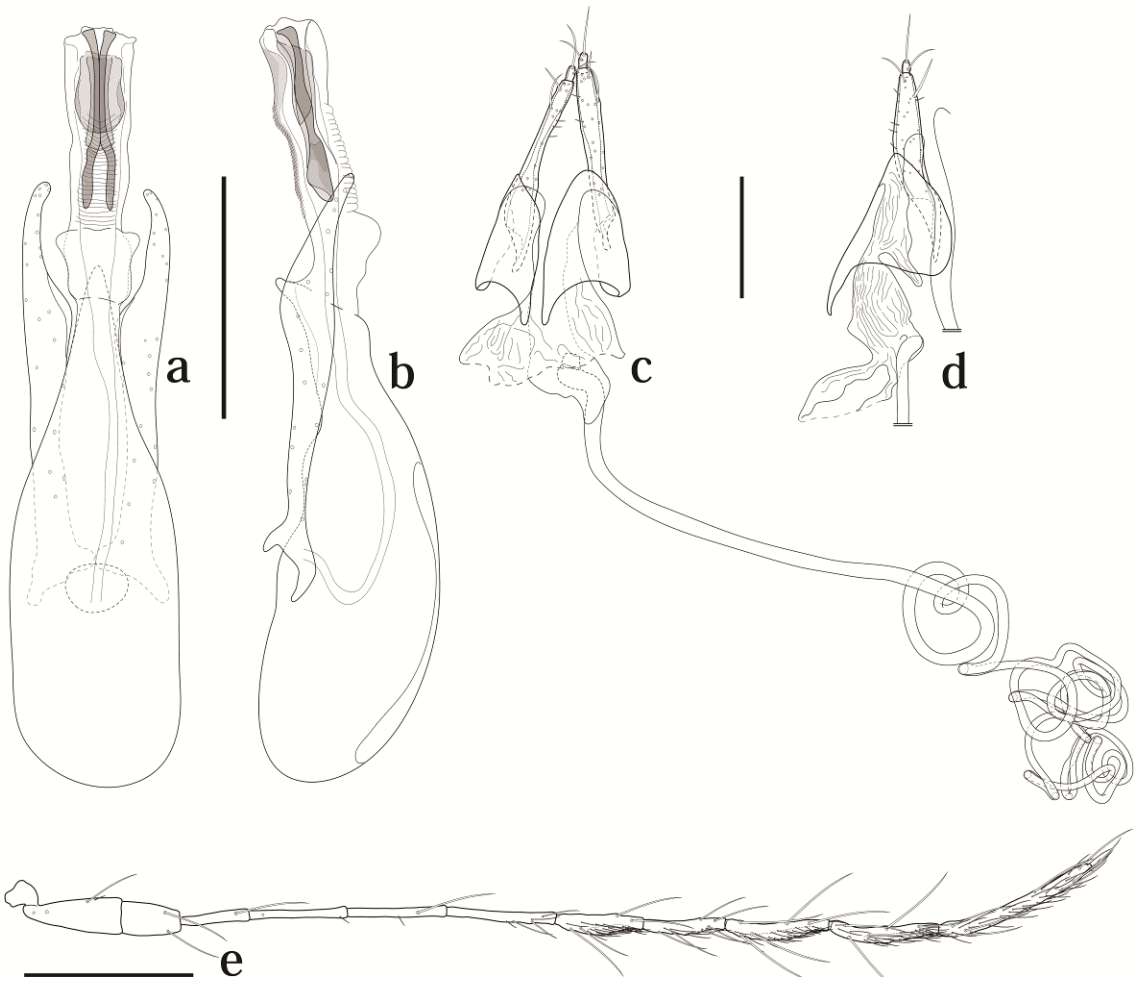

Fig. 4–25. Genitalia and antenna of *Scaphicoma bidentia* sp. n. a, b, Male genitalia; c, d, female genitalia; e, male antenna. a, c, Dorsal view; b, d, lateral view. Scales: 0.25 mm.

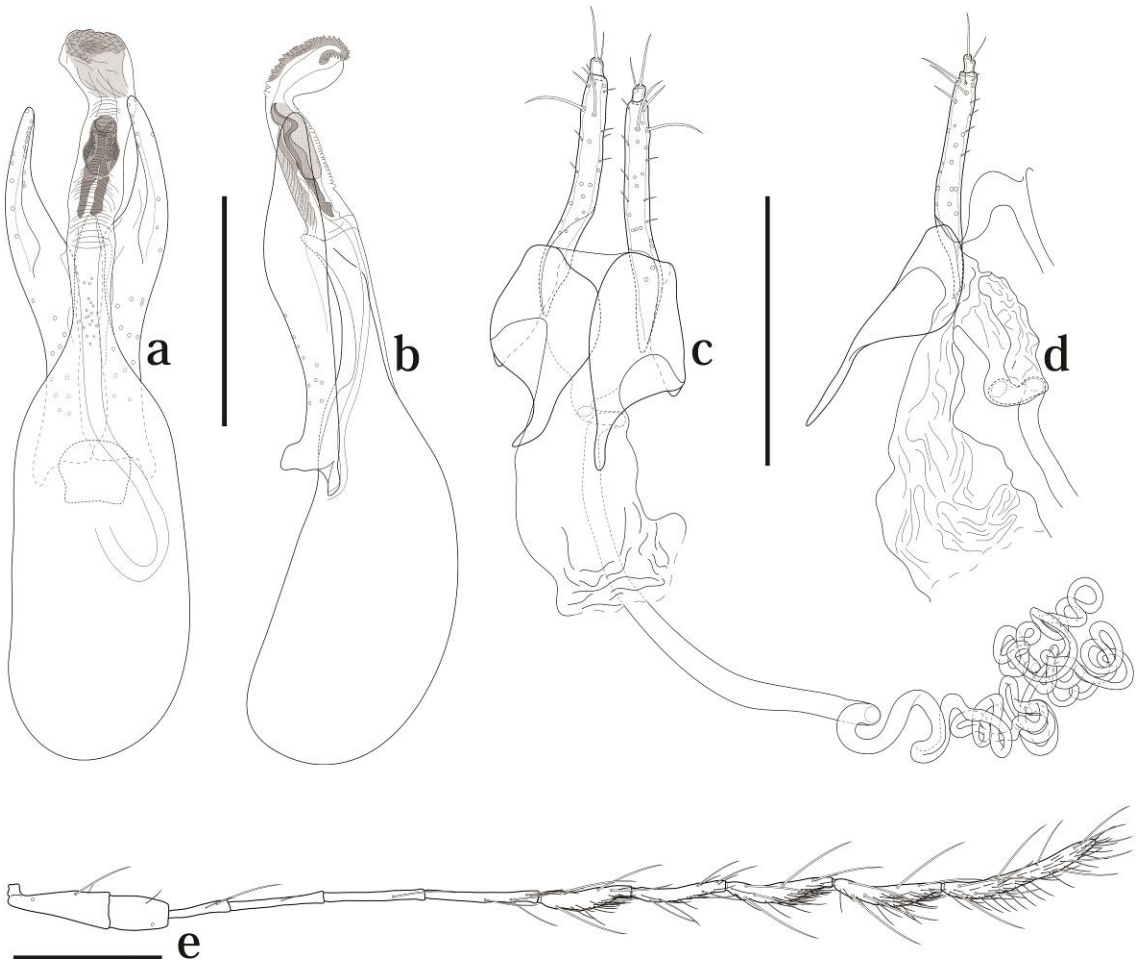

Fig. 4–26. Genitalia and antenna of *Scaphicoma quadrifasciata* sp. n. a, b, Male genitalia; c, d, female genitalia; e, female antenna. a, c, Dorsal view; b, d, lateral view. Scales: 0.25 mm.

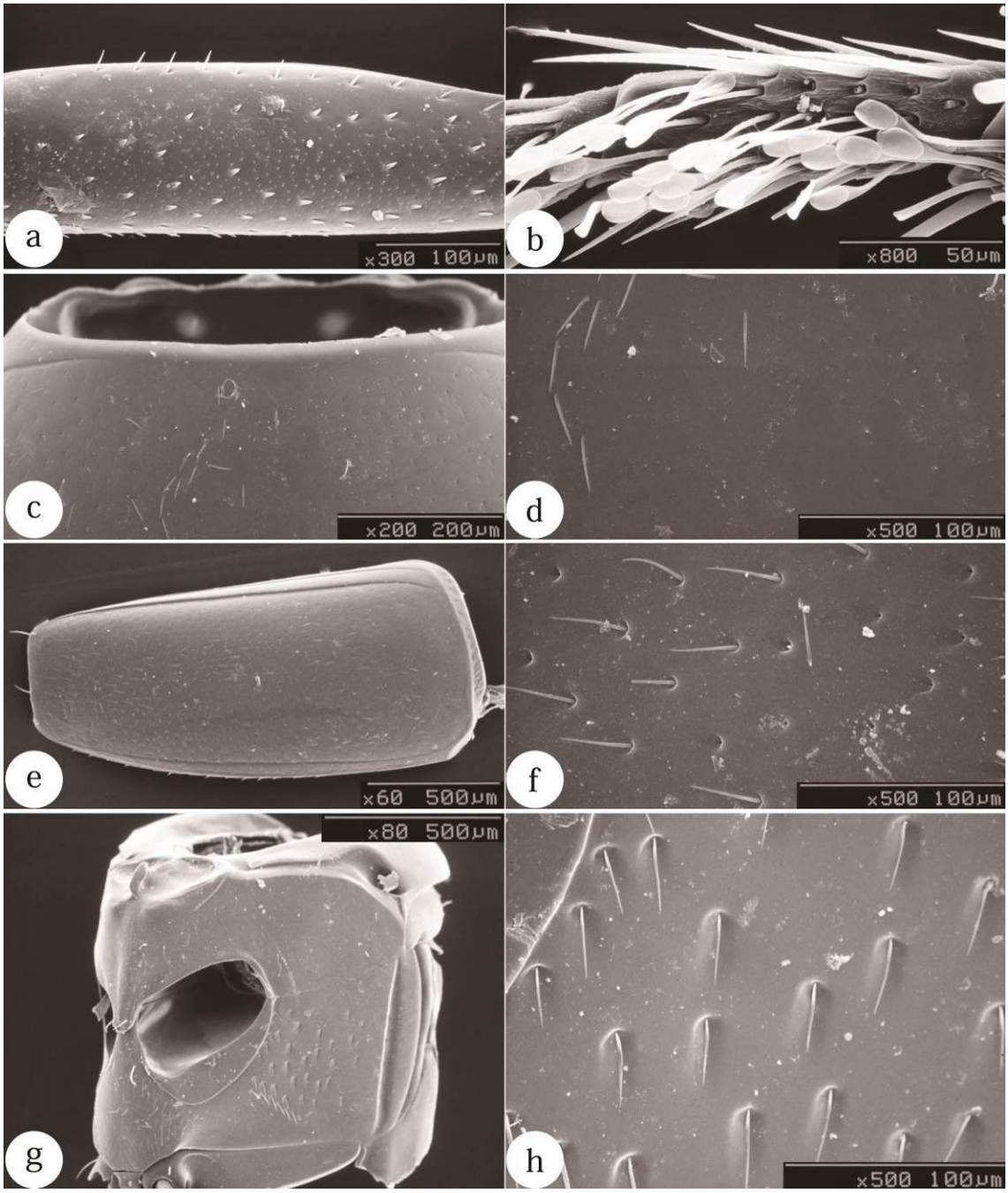

Fig. 4–27. SEM photographs of a male of *Scaphicoma subflava* sp. n. a, Profemur; b, tarsonomere III; c, anterior portion of pronotum; d, disc of pronotum; e, elytra; f, disc of elytra; g, meso- and metaventrite in oblique angle; h, lateral portion of metaventrite. a, c–f, Dorsal view; g, h, ventral view.

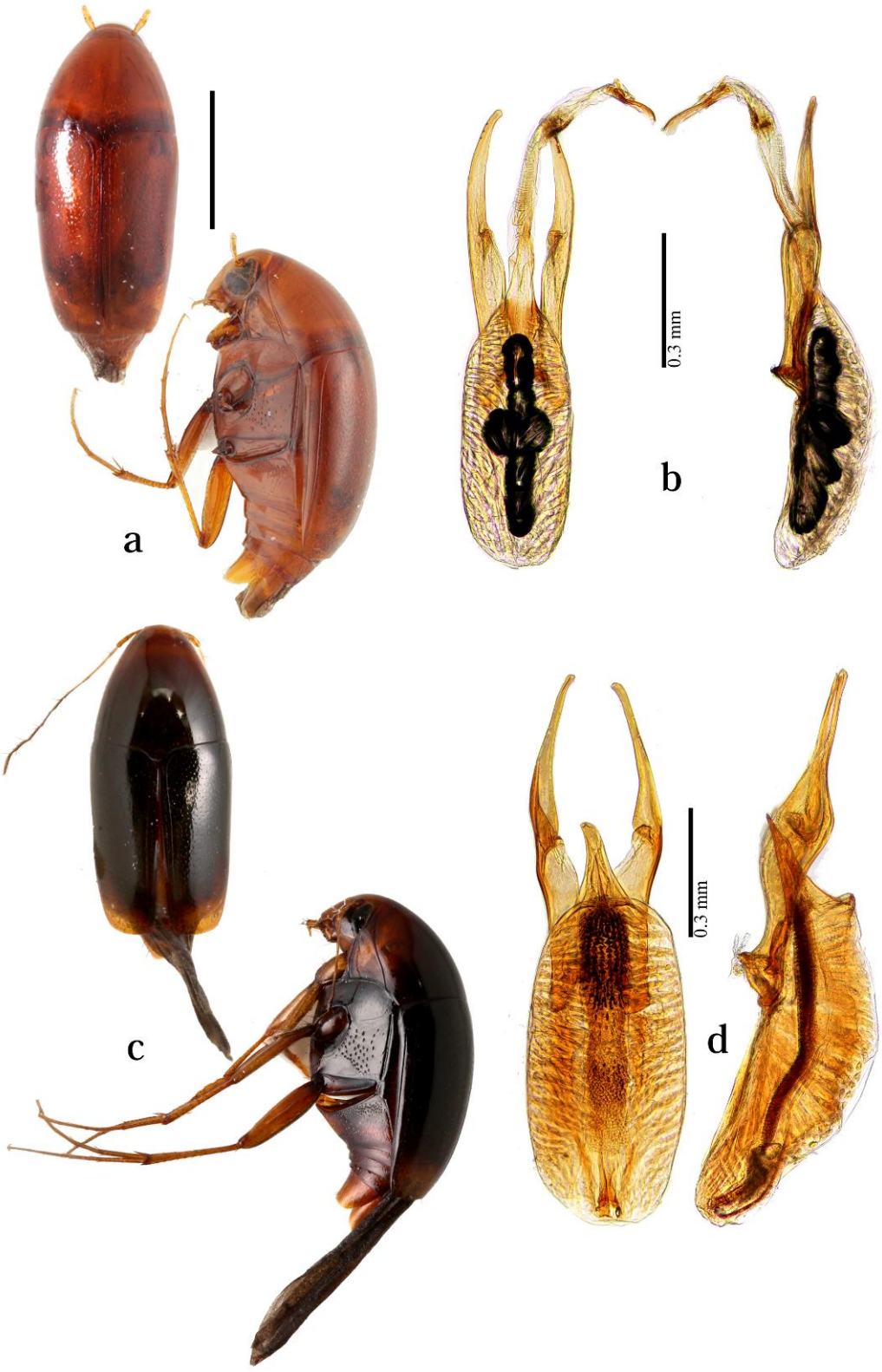

Fig. 4–28. Habitus and male genitalia of *Scaphicoma* spp. in dorsal and lateral views. a, c, Habitus; b, d, male genitalia. a, b, *S.* sp1; c, d, *S.* sp2. Scale of habitus: 1.0 mm.

Chapter 5 — Phylogeography of the Subfamily Scaphidiinae from Sulawesi

5. 1 Phylogenetic relationships of Sulawesian species

Interspecific relationships within each four monophyletic groups (*Scaphidium*, the termitophilous scaphidiines, *Scaphisoma*, and *Scaphicoma*), all supported by the phylogenetic analysis based on nuclear 28S gene (Chapter 3), were analysed based on mtCOI sequences. The results of analyses are summarised as below, including some morphological considerations.

5. 2 Genus *Scaphidium*

As shown in Fig. 5–1, the monophyly of clade I consisted of *Scaphidium celebense* + sp4 + *picconi* was strongly supported with 100% of MLB. As well, the clade I was also supported by morphological characters (they are very similar in the shape of sclerite on innter sac of male genitalia, and in the body color pattern; see 4. 1). Phylogenetic relationships of other species were ambiguous (MLB < 50%), except for the Taiwanese and Malaysian species of the *Scaphidium grande*-complex (Tang & Li 2010).

In the clade I, *S. picconi* from east Malaysia was found to be the sister-groups of *S. celebense* and *S.* sp4, which are distributed throughout Sulawesi. It seems quite probable that they were derived from the common ancestors in Sundaland and later dispersed (rafted) into Sulawesi. Also because they all are distributed throughout Sulawesi, it is unlikely that they have dispersed only on the Sunda plate.

Considering morphological characters, most other Sulawesian species of *Scaphidium* also have related species in East Asia (see 4. 1). However, two species of the Sulawesian species, *Scaphidium* sp8 and sp9, have related species in New Guinea with unique characters of metalic luster on body (see 4. 1). Although molecular evidence is not yet provided for the species-group, it is most likely that they have dispersed riding on the Australian plate because they were collected only in the regions of the plate (see 4. 1).

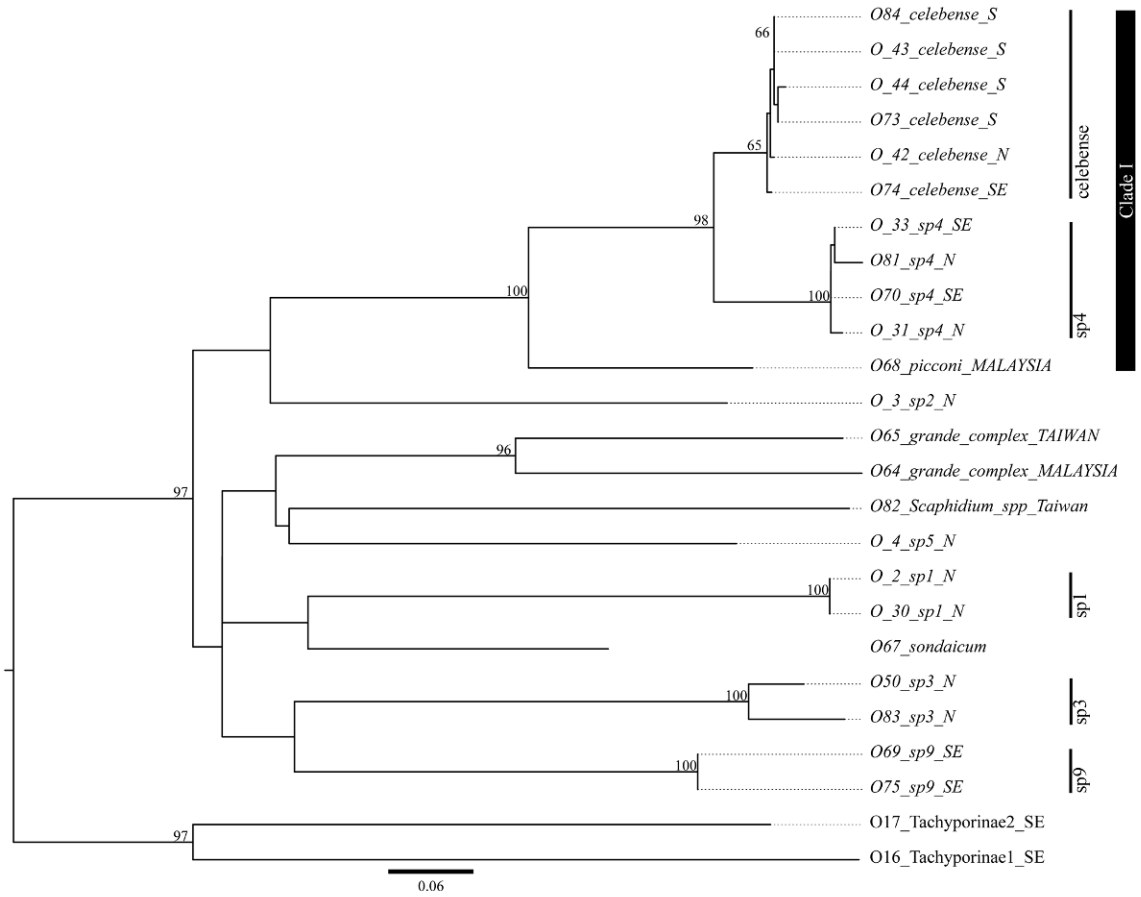

Fig. 5–1. Phylogenetic relationships of the genus *Scaphidium* based on mtCOI sequences with MLE. MLB more than 50% are shown above branches.

5. 3 Termitophilous scaphidiines

As shown in Fig. 4–30, phylogenetic relationships among species were ambiguous because of less than 50% MLB. *Vituratella termitophila*, obtained from southeastern and northern Sulawesi, is known to be widely distributed from north India to Indonesia (see 4. 1).

The distribution of fungus-growing termites is limited from Africa to Asia, not in New Guinea and Australia, and is the same to the termitophilous scaphidiines (Emerson & Schmidt 1955; Aanen *et al* 2002, Aanen & Eggleton 2005). Thus, I suppose with fair certainty that the termitophilous scaphidiines of Sulawesi have dispersed from the Oriental region.

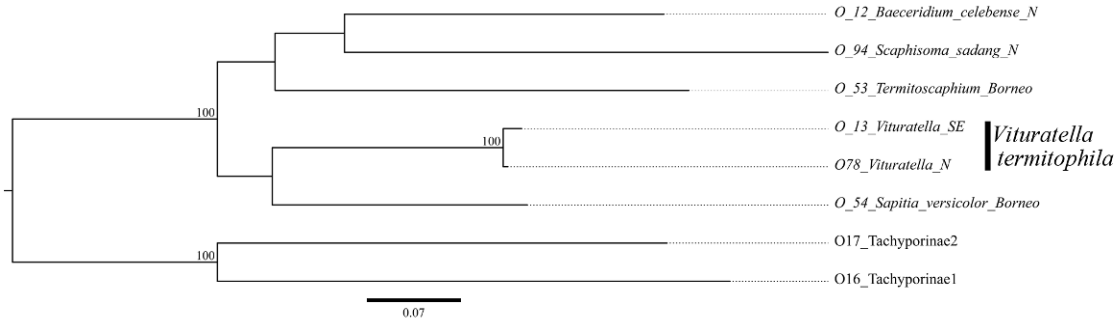

Fig. 5–2. Phylogenetic relationships of the termitophilous scaphidiines based on mtCOI sequences with MLE. MLB more than 50% are shown above branches.

5. 4 Genus *Scaphisoma*

As shown in Fig. 5–3, the monophyly of the *tricolor* group *sensu stricto* was supported by 64% of MLB under MLE. My phylogenetic tree suggested four groups within the *tricolor* group *s.str*. Each groups were also supported by morphological characters, e.g., the tip of apical process on the median lobe, the sclerotized portion and the shape of apical margin of elytra (see 4. 3. 2). Phylogenetic relationships of other species were ambiguous by less than 50% MLB.

Löbl (2012) has proposed the *tricolor* group *sensu lato* by only the structure of male genitalia (see 4. 3. 2), but here I proposed the *tricolor* group *sensu stricto* that is supported by morphological and molecular data.

In the *tricolor* group *s. str.*, the population of Sulawesi was found to be the sister-group of the population of Ogasawara. It seems quite probable that they were derived from the common ancestors around the Philippines Sea and later dispersed (rafted) into Sulawesi by ocean current because the most species of *tricolor* group *s.l.* have been reported from the islands of Philippines and Micronesia (Löbl 1970, 1981).

Considering morphological characters, most other Sulawesian species of *Scaphisoma* have related species in East Asia (see 4. 3. 2). Therefore, it is likely that they were also derived from the common ancestor in Sundaland.

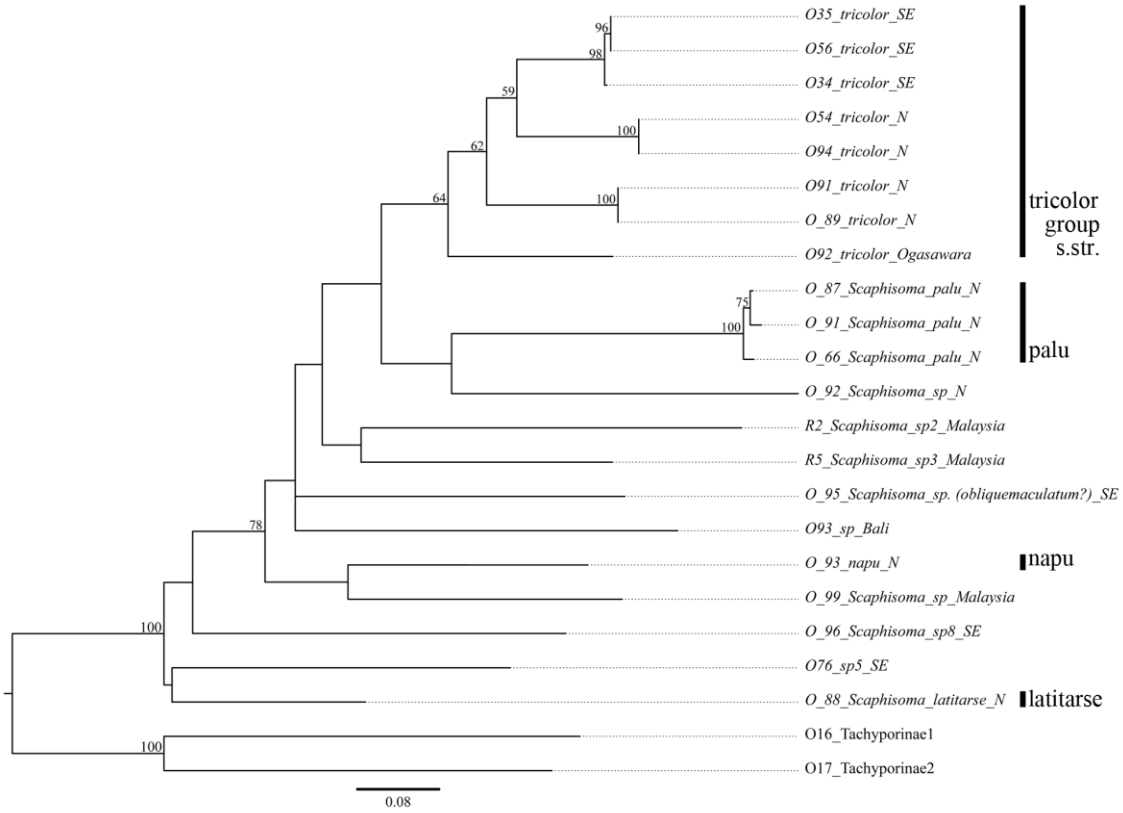

Fig. 5–3. Phylogenetic relationships of the genus *Scaphisoma* based on mtCOI sequences with MLE. MLB more than 50% are shown above branches.

5. 5 Genus *Scaphicoma*

As shown in Fig. 5–4, the Sulawesian species of *Scaphicoma* were related to those in the Oriental region (*S. pallens* from Malaysia, *S. hiranoi* from Ryukyu, and *S.* sp. from Taiwan). The monophyly of the clade of the Sulawesian species, including *S. pallens* from Malaysia, was supported by 58% of MLB and they were divided into two clades.

Clade I was characterized by the asymmetrical parameres and Clade II was characterized by the symmetrical parameres (see 4. 6).

The Sulawesian species of *Scaphicoma* were supported to be related to some species of the Oriental region by morphological and molecular data, although they were distributed throughout Sulawesi. Therefore, it is most likely that they are derived from the common ancestors in Sundaland.

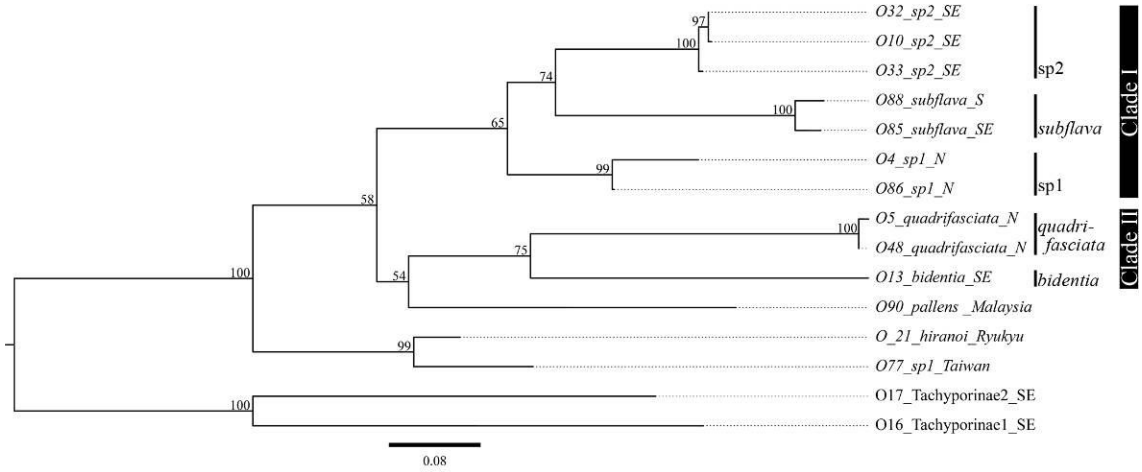

Fig. 5–4. Phylogenetic relationships of the genus *Scaphicoma* based on mtCOI sequences with MLE. MLB more than 50% are shown above branches.

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Chapter 6 — General Discussion

6. 1 Fauna of Sulawesian scaphidiines

The fauna of Sulawesi has been known to be distinctive from all other Indonesian faunas, i.e., 62% of mammals and 76% of amphibians are endemic to Sulawesi (Whitten *et al*. 1987). Total percentage of endemic invertebrates is not calculated in details, but many of them are certainly endemic, e.g., the species level endemism of butterflies in Sulawesi exceeds 40% (Vane-Wright & de Jong 2003).

The Sulawesian scaphidiines are up to 45 species of 13 genera by my taxonomic study. Except for five species of them, *Scaphidium sondaicum*, *Vituratella termitophila*, *Scaphisoma obliquemaculatum*, *Scaphisoma tricolor*, and *Birocera punctatissima* (see Chapter 4), all are endemic to Sulawesi. Thus the species level endemism of Sulawesian scaphidiines reaches 89%, although I have not yet examined the specimens from the surrounding islands of Sulawesi.

6. 2 "Vicariance" versus "dispersal"

The formation of Sulawesi dates from approximately 85 Ma through the extention, subduction, and uplift of the continental plates (Hall 2012). The West Sulawesi was separated from a part of the Asian margin (Sunda) in the Eocene of Cenozoic (ca. 45 Ma) by rifting that led to the formation of the Makassar Straits. Subsequently, the eastern part of Sulawesi was separated from the northern part of the Australian continental margin (Sahul) as the Sula spur in the Early Miocene (ca. 23–20 Ma) by the subduction that led to the extension of the Sula spur at the Java Trench (Hall 2009; Stelbrink *et al*. 2012). These splitting events on the geological history of Sulawesi have caused the separation of Sulawesi's fauna from the Asian and Australian origins.

Vicariance is expeted when the time of splitting event on the geological history is consistent with the divergence time from the most recent common ancestor (MRCA), and the mismatch between the splitting event and the MRCA highly indicates dispersal. Thus, "vicariance" versus "dispersal" can be judged from the estimation of divergence time for MRCA and the time of splitting event. Although estimating divergence time is still controversial, MCMCTREE developed by Yang & Rannala (2006) provides an excellent method for estimating approximate divergence times and formulating preliminary biogeographic hypotheses (Maekawa *et al*. 2001).

If the MRCA for a Sulawesi taxon predates or coincides with a vicariant event such

as the formation of the Makassar Strait or the separation of the Sula spur from New Guinea, its fauna may have been formed through "vicariance" (Stelbrink *et al*. 2012).

My MCMCTREE analysis shows that most genera of Scaphidiinae began to radiate in the Paleogene era of Cenozoic (ca. 25 Ma, see Chapter 3 and Fig. 3–3), and this postdated the time of vicariant event between Asian and Sulawesi such the formation of Makassar Straits (ca. 45 Ma), therefore most scaphidiines of the Asian origin could not be derived by the vicariance. On the other hand, the diversification of the termitophilous scaphidiines were dated from the Late-Cretaceous or the Paleogene era of Cenozoic (78 Ma of mean divergence time, see Chapter 3), and thus it is likely that they could be derived from the vicariance. However, Brandl *et al*. (2007) showed that the genus *Macrotermes* of the fungus-growing termites associated with the termitophilous scaphidiines began to radiate in approximately 40 Ma. Then, also the termitophilous scaphidiines could not be derived from the vicariance because they highly depend on the termites.

The separation of the Sula spur from New Guinea occurred in the Early Miocene (ca. 23–20 Ma) and the divergence of the genus *Scaphidium* (ca. 20 Ma, see Fig. 3–3) likely corresponds to this vicariant event. Although DNA samples of *Scaphidium* species from New Guinea were not obtained, I suggest that some Sulawesian species of *Scaphidium* related to New Guinean species have diverged from the MRCA on the Australian plate. Furthermore, the distribution of such Sulawesian species is limited to southeastern Sulawesi, which would be derived from the Australian plate. Therefore, they could be originated from the vicariance.

The present study first indicates that most Sulawesian scaphidiines are derived from "dispersal" while some from "vicariance".

6. 3 Biogeographical origins of Sulawesian scaphidiines

The current species distributed in Sulawesi must have a highly complex geological history. Stelbrink *et al*. (2012) have shown that the Sulawesi's fauna is predominantly the Asian origin. The Asian origin of Sulawesi's fauna is well supported by molecular phylogenetics as well as morphological analyses, indicating that most have dispersed after the formation of the Makassar Strait between Sulawesi and Asian. However, according to Stelbrink *et al*. (2012), the part of Sulawesi's fauna is obviously derived

from the Australian origin including New Guinea, e.g., mite harvestmen, freshwater snails, phalangerids, and sailfin silversides.

My molecular analyses and morphological observation suggest that most Sulawesian scaphidiines are originated from the Asian region while some are from the Australian region. For example, *Scaphidium celebense* and *S.* sp4 widely distributed in Sulawesi are closely related to *S. picconi* from Sumatra according to the morphological and molecular evidence (see 4. 1), thus they shuld be strongly supposed to have diverged from the MCRA in Asian. On the other hand, some Sulawesian species of *Scaphidium* having the unique morphological feature of metallic luster such as *Scaphidium* sp8 and sp9 are apparently related to the New Guinean species (see 4. 1 and 5. 2), thus obviously indicating that they are derived from the Australian origin.

The termitophilous scaphidiines are widely distributed from Africa to Southeast Asia but not known from the Australian region, corresponding to the distribution of their associated fungus-growing termites. It is suggested that the symbiosis between the termites and their associated fungi originated in the African rain forests and they have repeatedly dispersed into Southeast Asia (Aanen & Eggleton 2005). If the termitophilous scaphidiines followed the dispersal way of the termites, they likely have originated from Africa and later arrived at Southeast Asia. Thus, it is quite likely that the termitophilous scaphidiines have dispersed into Sulawesi via Southeast Asia together with the fungus-growing termites (see 5. 3).

The same Asian origin may also apply to the Sulawesian species of the genus *Scaphicoma*, being supported by my phylogenetic analysis and morphological observation (see 5. 5).

6. 4 Conclusion

My study makes it clear that the endemism of the Sulawesian scaphidiines is very high and the fauna of the Sulawesian's scaphidiines has been predominantly derived from "dispersal" of the Asian origin and partly from "vicariance" of the Australian origin.

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Appendix

The data of examined specimen for DNA extraction.

No.	Species Name	Localities	GPS Data	Collecting Dates	Collectors
O4	*Scaphicoma* sp1	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800m	0°34'28.52"N, 123°11'30.61"E	8. VI. 2012	R. Ogawa leg.
O5	*Scaphicoma quadrifasciata*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800-1300m	0°34'28.52"N, 123°11'30.61"E - 0°35'18.14"N, 123°13'22.71"E	9. VI. 2012	R. Ogawa leg.
O8	*Scaphisoma tricolor*	[OG12] Sekimon, Hahajima, Ogasawara IsIs., Japan	N26 41.018, E142 09.631	30. IX. 2012	H. Yoshitomi leg.
O10	*Scaphicoma* sp4	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	16. XII. 2013	R. Ogawa leg.
O11	*Scaphicoma* sp4	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	16. XII. 2013	R. Ogawa leg.
O13	*Scaphicoma* sp2	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 1500–400 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	18. XII. 2013	R. Ogawa leg.
O14	*Scaphicoma* sp2	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 1500–400 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	18. XII. 2013	R. Ogawa leg.
O16	Tachyporinae sp	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 1500–400 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	18. XII. 2013	R. Ogawa leg.
O17	Tachyporinae sp	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 1500–400 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	18. XII. 2013	R. Ogawa leg.
O21	*Bironium amicale*	Cameron highland, Malaysia, Path10		1. III. 2012	R. Ogawa leg.

O22	*Bironium amicale*	Cameron highland, Malaysia, Path10		1. III. 2012	R. Ogawa leg.
O30	*Scaphobaeocera* sp	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	16. XII. 2013	R. Ogawa leg.
O32	*Scaphicoma* sp4	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	16. XII. 2013	R. Ogawa leg.
O33	*Scaphicoma* sp4	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	16. XII. 2013	R. Ogawa leg.
O34	*Scaphisoma tricolor*	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	16. XII. 2013	R. Ogawa leg.
O35	*Scaphisoma tricolor*	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–1500 m	3°38’31”S, 121°05’42”E–3°38’17”S, 121°11’34”E	16. XII. 2013	R. Ogawa leg.
O41	*Scaphicoma quadrifasciata*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m	0°35'18.14N, 123°13'22.71E	10. VI. 2012	R. Ogawa leg.
O48	*Scaphicoma* sp3	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800–1300 m	0°35'18.14N, 123°13'22.71E	9. VI. 2012	R. Ogawa leg.
O54	*Scaphisoma tricolor*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800-1300m	0°34'28.52"N, 123°11'30.61"E - 0°35'18.14"N, 123°13'22.71"E	9. VI. 2012	R. Ogawa leg.
O63	*Scaphidium reitteri*	Kochi, Aki-Gun, Umaji-Mura		22. VII. 2012	R. Ogawa leg.
O64	*Scaphidium grande*-complex (*longicole*?)	[MALAYSIA] Univ. Malaya Field Studies Centre Ulu Gombak, Daerah Gombak, Selangor State, alt. 250m		8. III. 2009	Y. Senda leg.

O65	*Scaphidium grande*-complex (*longicole*?)	[TAIWAN] Dahanshan (Mt.), Alt. ca. 1500m, Chunri Township Pingtug County		11-12.IV.2012	J. Yamasako leg.
O66	*Scaphidium* spp.	19mile near Cameron Highland	4°22'N, 101°20'E	1. III. 2012	Susumu Matsuo leg.
O67	*Scaphidium sondicum* (*medionigrum sensu* Pic)	[MALAYSIA] Batu 19 nr. Cameron Highland, Daerah Batang Padang, Perak State, alt. 600m (dead tree)		2. III. 2009	Y. Senda leg.
O68	*Scaphidium picconi*	[MALAYSIA] Batu 19 nr. Cameron Highland, Daerah Batang Padang, Perak State, alt. 600m (dead tree)		2. III. 2009	Y. Senda leg.
O69	*Scaphidium* sp9	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–400 m	3°38’40”S, 121°07’32”E–3°38’31”S, 121°05’42”E	18. III. 2014	S. Fujie leg.
O70	*Scaphidium* sp4	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–400 m	3°38’40”S, 121°07’32”E–3°38’31”S, 121°05’42”E	18. III. 2014	S. Fujie leg.
O72	*Scaphisoma tricolor*	[OG12] Sekimon, Hahajima, Ogasawara IsIs., Japan	N26 41.018, E142 09.631	30. IX. 2012	H. Yoshitomi leg.
O73	*Scaphidium celebense*	Puncak Palopo, Sulawesi Selatan, Alt. ca. 800m	S 02°57’, E 120°05’	30. I–4. II. 2013	J. Yamasako leg.
O74	*Scaphidium celebense*	Mt. (Gunung) Mekongga, Wawo, Indonesia, alt. ca. 400m	3°38’31S, 121°05.42E	25. IV. 2014	R. Ogawa leg.
O75	*Scaphidium* sp9	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–400 m	3°38’40”S, 121°07’32”E–3°38’31”S, 121°05’42”E	18. III. 2014	S. Fujie leg.
O76	*Scaphisoma* sp5	Mt. Mekongga, Pos6 (2000m)		20-21. IV. 2014	Fajardin leg.
O77	*Scaphicoma* sp	[Taiwan] Xinanshan, Taoyuan Township, Kaohsiung County, alt. ca. 1600m		22-30. III. 2012	J. Yamasako leg.

O78	*Vituratella termitophila*	Mt. Tilongkabila, N. Sulawesi, Indonesia, alt. ca. 800m (FIT)	0°34'28.52N, 123°11'30.61E	set up in 25. I. 2013, collected in 27. I. 2013	R. Ogawa leg.
O81	*Scaphidium* sp4				
O83	*Scaphidium* sp3	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 800 m	0°34’28.52N, 123°11’30.61E	8. VI. 2012	R. Ogawa leg
O84	*Scaphidium celebense*				
O85	*Scaphicoma subflava*	Mt. Mekongga, Pos2~Pos3		23. IV. 2014	R. Ogawa leg.
O86	*Scaphicoma* sp1	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800m	0°34'28.52"N, 123°11'30.61"E	8. VI. 2012	R. Ogawa leg.
O88	*Scaphicoma subflava*	Bantimurung, S. Sulawesi		2. III. 2013	R. Ogawa leg.
O90	*Scaphicoma* spp	[Malaysia] Hulu Gomback, Gomback, Selangor State, alt. 250-350m	3°19'N, 101°45'E	18. XII. 2010	Susumu Matsuo leg.
O91	*Scaphisoma tricolor*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800m	0°34'28.52"N, 123°11'30.61"E	8. VI. 2012	R. Ogawa leg.
O92	*Scaphisoma tricolor*	[OG7] Chibusayama, Hahajima, Ogasawara IsIs., Japan	N26 39.581, E142 09.684	27. IX. 2012	H. Yoshitomi leg.
O93	*Scaphisoma* sp	nr. Lake Tamblingan, Munduk, Bali		4. II. 2011	R. Ogawa leg.
O94	*Scaphisoma tricolor*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800-1300m	0°34'28.52"N, 123°11'30.61"E - 0°35'18.14"N, 123°13'22.71"E	9. VI. 2012	R. Ogawa leg.
O96	*Xotidium* sp	[Taiwan] Wulu, Haiduan Township, Taitung County, alt. ca. 700m		17-18. VI. 2011	J. Yamasako leg.
O97	*Xotidium* sp	Mt. Pontolo, N. Sulawesi, alt. ca. 1400–1800m	0°54’59.77”N, 122°04’13.10E - 0°54’25.07”N, 122°04’20.71”E	25. VII. 2012	R. Ogawa leg.

O98	*Scaphobaeocera* sp1	Mt. Pontolo, N. Sulawesi, alt. ca. 1400–1800m	0°54’59.77”N, 122°04’13.10E - 0°54’25.07”N, 122°04’20.72”E	25. VII. 2012	R. Ogawa leg.
O99	*Scaphobaeocera* sp2	Mt. Pontolo, N. Sulawesi, alt. ca. 1400–1800m	0°54’59.77”N, 122°04’13.10E - 0°54’25.07”N, 122°04’20.73”E	25. VII. 2012	R. Ogawa leg.
O'1	*Bironium* spp	KL. MALAYSIA, Ulu Gombak, FRC of Univ. Malaya		19-22. IV. 2011	K. Takasuka leg.
O'2	*Scaphidium* sp1	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 1300–1500 m	0°35’18.14”N, 123°13’22.71”E–0°35’18.37”N, 123°13’22.61”E	28. I. 2011	R. Ogawa leg.
O'3	*Scaphidium* sp2	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300 m	0°35’18.14N, 123°13’22.71E	10. VI. 2012	R. Ogawa leg.
O'4	*Scaphidium* sp5	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 1300 m (FIT)	0°35’18.14N, 123°13’22.71E	set up on 9. IV. 2012, collected in 11. IV. 2012	R. Ogawa leg.
O'5	*Scaphidium quadrimaculatum*	Deutchland			K. Ando leg.
O'6	*Cyparium* spp (*siamense*?)	[VN27] Babe, Bac Kan Prov., Vietnam (FIT), ca 310m	22°24'42.44"N, 105°37'42.55"E	2-5. VII. 2014	H. Yoshitomi leg.
O'7	*Cyparium* spp (*siamense*?)	[VN27] Babe, Bac Kan Prov., Vietnam (FIT), ca 310m	22°24'42.44"N, 105°37'42.55"E	2-5. VII. 2014	H. Yoshitomi leg.
O'8	*Scaphidium* sp9	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 700–400 m	3°38’40”S, 121°07’32”E–3°38’31”S, 121°05’42”E	18. III. 2014	S. Fujie leg.
O'12	*Baeoceridium celebense*	Mt. Tilongkabila,, N. Sulawesi, Indonesia, alt. ca. 800m (FIT)	0°34'28.52N, 123°11'30.61E	set up in 25. I. 2013, collected in 27. I. 2013	R. Ogawa leg.
O'13	*Vituratella termitophila*	Mt. (Gunung) Mekongga, Wawo, Indonesia, alt. ca. 400m (FIT)	3°38’31S, 121°05.42E	set up on 23. IV. 2014, collected in 25. IV. 2014	R. Ogawa leg.

O'21	*Scaphicoma hiranoi*	Uehara, Taketomi-Cho, Yaeyama-Gun, Iriomote, Okinawa (Malaise Trap)		set up on 12. V. 2014 collected in 20. V. 2014	M. Ito leg.
O'30	*Scaphidium* sp1	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 1300–1500 m	0°35’18.14”N, 123°13’22.71”E–0°35’18.37”N, 123°13’22.61”E	28. I. 2011	R. Ogawa leg.
O'31	*Scaphidium* sp4	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. ca. 800 m	0°34’28.52N, 123°11’30.61E	29. I. 2011	R. Ogawa leg.
O'33	*Scaphidium* sp4	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 400–700 m (Danau)	3°38’31”S, 121°05’42”E–3°38’40”S, 121°07’32”E	21. IX. 2013	R. Ogawa leg.
O'40	*Baeocera* nr. *derougemonti*	Mt. Pontolo (Gunung Pontolo), N. Sulawesi, alt. ca. 1800–2000 m	0°54’25.07”N, 122°04’20.71”E–0°54’13.72”N, 122°04’38.30”E	20. I. 2011	R. Ogawa leg.
O'42	*Scaphidium celebense*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, alt. 100–500 m	0°33’10.96”N, 123°10’34.40”E–0°34’04.03”N, 123°11’15.42”E	20. II. 2013	R. Ogawa leg.
O'43	*Scaphidium celebense*	Tompo Bulu, Balocci, Pangkep (S. Sulawesi)		13-14. II. 2013	J. Yamasako leg.
O'44	*Scaphidium celebense*	Tompo Bulu, Balocci, Pangkep (S. Sulawesi)		13-14. II. 2013	J. Yamasako leg.
O'53	*Termitoscaphium* sp1.	MALASIA: Sarawak, Lambir Hills National Park, wterfall trail Host. (KT373), Odontotermes grandiceps det. 2012 T. Kanao leg.		11. X. 2012	KANAO Taisuke leg.
O'54	*Sapitia versicolor*	MALASIA: Borneo, Lambir Hills National Park, near Sungai Liku, (KT388) Host termite Macrotermes malaccensis det. 2012 T. Kanao leg.		23. X. 2012	T. Kanao leg.

O'87	*Scaphisoma palu*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, ca. 800–1500 m	0°34’28.52”N, 123°11’30.61”E–0°35’18”N, 123°13’22”E	22. II. 2013	R. Ogawa leg.
O'88	*Scaphisoma latitarse*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, ca. 800–1500 m	0°34’28.52”N, 123°11’30.61”E–0°35’18”N, 123°13’22”E	22. II. 2013	R. Ogawa leg.
O'91	*Scaphisoma palu*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, ca. 800–1500 m	0°34’28.52”N, 123°11’30.61”E–0°35’18”N, 123°13’22”E	22. II. 2013	R. Ogawa leg.
O'92	*Scaphisoma* sp	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, ca. 800–1500 m	0°34’28.52”N, 123°11’30.61”E–0°35’18”N, 123°13’22”E	22. II. 2013	R. Ogawa leg.
O'93	*Scaphisoma napu*	Mt. Tilongkabila (Gunung Tilongkabila), N. Sulawesi, ca. 800–1500 m	0°34’28.52”N, 123°11’30.61”E–0°35’18”N, 123°13’22”E	22. II. 2013	R. Ogawa leg.
O'94	*Scaphisoma sadang*	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 30–400 m	3°39’10”S, 121°03’00”E–3°38’31”S, 121°05’42”E	19. IX. 2013	R. Ogawa leg.
O'95	*Scaphisoma* sp. (*obliquemaculatum*?)	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 30–400 m	3°39’10”S, 121°03’00”E–3°38’31”S, 121°05’42”E	19. IX. 2013	R. Ogawa leg.
O'96	*Scaphisoma* sp8.	Mt. (Gunung) Mekongga, North Kolaka, Sulawesi Tenggara, ca. 30–400 m	3°39’10”S, 121°03’00”E–3°38’31”S, 121°05’42”E	19. IX. 2013	R. Ogawa leg.
O'98	*Pseudbironium* sp	Cameron highland, Malaysia, Path10		1. III. 2012	R. Ogawa leg.
O'99	*Scaphisoma* sp	Cameron highland, Malaysia, Path10		1. III. 2012	R. Ogawa leg.
R1	*Scaphobaeocera* sp	Cameron highland, Malaysia, Path10		1. III. 2012	R. Ogawa leg.
R2	*Scaphisoma* sp	Cameron highland, Malaysia, Path4		29. II. 2012	R. Ogawa leg.
R3	*Scaphisoma* sp	Cameron highland, Malaysia, Path4		29. II. 2012	R. Ogawa leg.

R4	*Scaphoxium* sp	Cameron highland, Malaysia, Path4	28. II. 2012	R. Ogawa leg.
R5	*Scaphisoma* sp	Cameron highland, Malaysia, Path4	28. II. 2012	R. Ogawa leg.