

The genus *Acanthosoma* in Taiwan (Hemiptera: Heteroptera: Acanthosomatidae)

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Abstract. Species of the genus *Acanthosoma* Curtis, 1824 (Hemiptera: Heteroptera: Acanthosomatidae) occurring in Taiwan are reviewed. Twelve species are recognized, treated, and keyed. Four species (*A. atayal* sp. nov., *A. axicia* sp. nov., *A. fallax* sp. nov. and *A. pugnax* sp. nov.) and one subspecies (*A. haemorrhoidale formosanum* subsp. nov.) are described as new. Five species are recorded for the first time from Taiwan: *A. crassicaudum* Jakovlev, 1880; *A. expansum* Horváth, 1905; *A. forficula* Jakovlev, 1880; *A. laevicornis* Dallas, 1851; *A. sichuanense* (Liu, 1980). The records of *A. forfex* Dallas, 1851 and *A. rufescens* Dallas, 1851 from Taiwan by previous authors are considered as erroneous. Lectotypes are designated for *A. expansum* and *A. laevicornis*. The *Acanthosoma* fauna of Taiwan is highly endemic; the zoogeographical affinities of the species are briefly discussed

Key words. Hemiptera, Heteroptera, Acanthosomatidae, *Acanthosoma*, taxonomy, new species, Taiwan

Introduction

Acanthosomatidae (Hemiptera: Heteroptera: Pentatomoidea) comprises about 150 species in 8 genera in South, Southeast and East Asia. Although a number of taxonomic and nomenclatural problems have been resolved in recent papers by TSAI & RÉDEI (2015a,b) and TSAI et al. (2015), the knowledge on the fauna of this region is still far from satisfactory.

Acanthosoma Curtis, 1824 is a well-known and species-rich genus currently comprising of 23 described species (TSAI & RÉDEI 2015b). Most species of *Acanthosoma* are apparently arboreal, therefore rarely captured; the host plant associations of the majority of species are unknown. The identification of many species is rendered difficult by the significant

intraspecific variation of the humeral processes of the pronotum and the methoracic carina, and the frequent cases of marked sexual dimorphism.

The present study attempts to review the species of *Acanthosoma* occurring in Taiwan. Four species have been recorded from Taiwan by previous authors: *A. asahinai* Ishihara, 1943, *A. forfex* Dallas, 1851 (ISHIHARA 1943), *A. firmatum* (Walker, 1868) and *A. rufescens* Dallas, 1851 (TSAI & RÉDEI 2015b). The material examined by us revealed 12 species in total. The species are keyed, their distribution and bionomics are reviewed, four species are described as new, five species are recorded from Taiwan for the first time (one of them represented by a subspecies described here as new), and misidentifications of previous authors are corrected in the present paper.

Material and methods

External structures and genitalia were examined using stereoscopic microscopes (Olympus SZX12, Zeiss Discovery.V8). Drawings were made using a camera lucida. Measurements were taken using a micrometer eyepiece. Male genitalia were dissected after careful heating in hypertonic KOH solution. Digital photographs were taken with a Nikon D90 camera equipped with an AF-S Micro Nikkor 60mm f/2.8G ED lens, final images were stacked from different focal levels using the software Helicon Focus 6.2.0 (<http://www.heliconsoft.com>).

No attempt was made to compile complete bibliographies of all species treated in this paper; only selected references are listed. With the exception of the taxa described here as new, several additional specimens from localities outside Taiwan were also examined. Their label data are not provided in detail, but the localities and the depositories of specimens are listed under the distribution of the respective species. Specimens examined by us are marked by an exclamatory point ‘!’; doubtful literature records by a question mark ‘?’.

Abbreviations for depositories:

BMNH	Natural History Museum, London, United Kingdom;
ELKU	Entomological Laboratory, Kyushu University, Fukuoka, Japan.
HNHM	Hungarian Natural History Museum, Budapest, Hungary;
IZAS	Institute of Zoology, Chinese Academy of Sciences, Beijing, China;
NCHU	Department of Entomology, National Chung Hsing University, Taichung, Taiwan;
NHRS	Naturhistoriska Riksmuseet, Stockholm, Sweden;
NKUM	Institute of Entomology, Nankai University, Tianjin, China;
NMNS	National Museum of Nature and Science, Taichung, Taiwan;
NMPC	National Museum, Prague, Czech Republic;
NSMT	National Museum of Nature and Science, Tsukuba, Japan;
NTU	Department of Entomology, National Taiwan University, Taipei, Taiwan;
OMHJ	Otaru Museum, Otaru, Japan;
SEHU	Systematic Entomology, Faculty of Agriculture, Hokkaido University, Sapporo, Japan;
TARI	Taiwan Agricultural Research Institute, Taichung, Taiwan;
TFRI	Insect Collection of Taiwan Forestry Research Institute, Taipei, Taiwan;
TMNH	Tianjin Museum of Natural History, Tianjin, China;
USNM	United States National Museum of Natural History, Washington, D.C., USA;
ZJPC	Zdeněk Jindra's private collection, Prague, Czech Republic;
ZMAS	Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

Taxonomy

Genus *Acanthosoma* Curtis, 1824

Acanthosoma Curtis, 1824a: [legend to plate 20]. Type species by subsequent designation (CURTIS 1824b: [legend to plate 28]): *Cimex haemorrhoidalis* Linnaeus, 1758.

Anaxandra Stål, 1876: 110. Type species by subsequent designation (DISTANT 1902: 321): *Acanthosoma rufescens* Dallas, 1851. Synonymized by KUMAR (1974: 53), confirmed by TSAI & RÉDEI (2015b: 5).

Remark. A redefinition and a selected bibliography of the genus and redescrptions of selected species were provided by TSAI & RÉDEI (2015b).

Diagnosis and distribution. The genus contains 23 previously described species occurring in temperate, subtropical and tropical regions of Eurasia (TSAI & RÉDEI 2015b). By describing four new species in the present effort, this number is now increased to 27. Twelve species are known to occur in Taiwan.

Key to the species of *Acanthosoma* occurring in Taiwan

- 1 Humeri rounded, slightly surpassing costal margins of fore wing laterally. 2
- Humeri produced into distinct processes of various length (Figs 56–91). 3
- 2 Body large (17.5–19.5 mm). Posterolateral angle of pronotum provided with a small, triangular process directed posteriad and extending over base of corium. Black markings of connexival plates enclosing intersegmental sutures broad (as wide as or wider than tibia). Genital capsule of male large, robust, with short, broad, apically rounded lateral projections not surpassing apex of membrane, ventrally densely pilose, provided with 1+1 pigmented denticles subapically and 1+1 denticles proximally. Posterior margin of laterotergites VIII of female broadly rounded, ventrites VI and VII each with a pair of large Pendergrast's organs. *A. crassicaudum* Jakovlev, 1880
- Body of medium size (14.5–16.5 mm). Posterolateral angle of pronotum without small triangular process. Black markings of connexival plates enclosing intersegmental sutures narrow (narrower than tibia). Genital capsule of male provided with a pair of long, slender, posteriorly strongly diverging posterolateral projections, apical halves of projections surpass apex of membrane, ventral surface lacking pigmented denticles. Posterior margin of laterotergite VIII of female truncate, ventrites VI and VII each with a pair of small Pendergrast's organs. *A. forficula* Jakovlev, 1880
- 3 Posterolateral angles of pregenital abdominal ventrites not produced (Fig. 16). Posterolateral angle of pronotum horizontal, subtriangularly produced and broadly obtuse apically (population in Japan and the Asian mainland) or elevated, finger-shaped, with rounded apex (population in Taiwan), in both cases with black punctures nearly to their tip (Figs 86–91). Genital capsule of male without lateral projection, subquadrate in posterior view, ventral rim with 1+1 pigmented denticles laterally (Figs 16–19). Ventricle VII of female with 1+1 small, black, rounded spots laterad of median incision of posterior margin, Pendergrast's organs on ventrites VI and VII narrowly separated (Fig. 55). *A. expansum* Horváth, 1905

- Posterolateral angles of abdominal ventrites II–VI produced into small, sharp denticles (as in Figs 1, 6, 8, 15, 45–46, 48–55). 4
- 4 Connexivum uniformly pale. 5
- Connexival plates with conspicuous black markings anteriorly and posteriorly, enclosing intersegmental sutures. 10
- 5 Head unpunctured or at most with very few punctures which are pale, never contrasting black. 6
- Head with irregularly distributed black punctures on mandibular plates and between eyes. 7
- 6 Body very large (16.5–20.7 mm) (Figs 80–83, 92–93). Genital capsule of male with a pair of robust, apically rather acute posterolateral projections, with 2+2 denticles on dorsal rim due to extension of dorsal wall over ventral infolding, and 1+1 of protuberances on ventral rim laterally (Fig. 15). Paramere as in Figs 40–41. Posterior margin of laterotergites VIII of female truncate, reaching or slightly surpassing posterolateral angles of ventrite VII; Pendergrast's organs of ventrite VII larger (diameter more than 0.5 mm) (Fig. 54). *A. laevicornae* Dallas, 1851
- Body relatively small (13.8–16.5 mm) (Figs 84–85). Genital capsule of male with a pair of short posterolateral projections, dorsal rim broadly U-shaped, apex of paramere bifurcated. Posterior margin of laterotergites VIII of female broadly rounded, far surpassing posterolateral angles of ventrite VII, posterior margin of ventrite VII with a deep, U-shaped incision margined with black; Pendergrast's organ of ventrite VI small (diameter less than 0.5 mm). *A. sichuanense* (Liu, 1980)
- 7 Humeral process long, directed distinctly anterolaterad, apically sharp (Figs 60–63, 72–75). 8
- Humeral process short, directed laterad, apically sharp (Figs 68–71) or obtuse (Figs 56–59). 9
- 8 Humeral process bright red (Figs 60–63). Head punctured, interocular area with a pair of longitudinal rows of black punctures, maxillary plate without tubercle.
..... *A. haemorroidale formosanum* subsp. nov.
- Humeral process black or brownish (Figs 72–75). Head with very few and faint punctures, interocular area without longitudinal rows of black punctures, maxillary plate with a conspicuous, obtuse tubercle antieriad and mesad of antennal insertion.
..... *A. pugnax* sp. nov.
- 9 Maxillary plate without tubercle. Humeral process short and broad, subtriangular, apically obtuse, reddish brown to red with more or less distinct dark suffusion (Figs 56–59). Genital capsule of male with a pair of short and broad posterolateral projections, dorsal rim broadly U-shaped, greatly covered by membrane (Figs 1–3). Posterior margin of laterotergites VIII of female strongly protruding; Pendergrast's organ on ventrite VII of female small (Fig. 45). *A. atayal* sp. nov.
- Maxillary plate with a conspicuous, obtuse tubercle antieriad and mesad of antennal insertion. Humeral process spiniform, directed laterad, yellow to pale orange (Figs 68–71). Genital capsule with a pair of elongate, gracile, arched posterolateral projections far surpassing apex of membrane, dorsal rim narrowly U-shaped, concave at midline

- (Figs 8–9). Posterior margin of tergite VIII of female truncate, not surpassing posterolateral angles of abdominal segment VII; Pendergrast's organs of ventrites VI and VII of female elliptical, of equal size (Fig. 51). *A. fallax* sp. nov.
- 10 Head with irregularly distributed black punctures on mandibular plates and between eyes. Hind tibia of male dilated subbasally (Fig. 47). Genital capsule of male with a pair of long, subparallel posterolateral projections (Figs 6–7). Posterior margin of tergite VIII of female prominent, far surpassing posterolateral angles of segment VII (Fig. 48–49). *A. asahinai* Ishihara, 1943
- Head unpunctured or at most with very few punctures which are pale, never contrasting black. Hind tibia of male not dilated. 11
- 11 Humeral process relatively long, directed laterad (population in Taiwan) or more or less anterolaterad (population in Japan and the Asian mainland), frequently red. Male genital capsule with a robust, apically obtusely rounded posterolateral projections not surpassing apex of membrane, widely separated by a broad median incision, ventral rim broadly excavate, of rather rectangular outline, densely pilose, with a pair of small, pigmented denticles. Posterior margin of ventrite VII of female with a pentagonal median incision; Pendergrast's organs of ventrites VI and VII small (diameter less than 0.5 mm), rather broadly separated. *A. firmatum* (Walker, 1868)
- Humeral process short, invariably directed laterad, yellow to pale orange, never red (Figs 76–79). Male genital capsule with a pair of scissors-like posterolateral projections surpassing apex of membrane by their apical halves, dorsal rim nearly V-shaped, ventral surface densely covered by long setae (Figs 11–14). Posterior margin of ventrite VII of female with a shield-shaped median incision; Pendergrast's organs of ventrites VI and VII large (diameter more than 0.5 mm), narrowly separated (Fig. 52).
..... *A. axicia* sp. nov.

Acanthosoma atayal sp. nov.

(Figs 1–3, 20–21, 45, 56–59)

Type material. HOLOTYPE: ♂, TAIWAN: NANTOU Co.: Yuanfeng, Provincial Rd. No.14A 22.5K, 15.x.2010, ex *Photinia nitakayamensis* Hayata, leg. S.W. Hou; mounted on card, intact, deposited in NMNS (Figs 56–57). PARATYPES: TAIWAN: TAIPEI Co.: Wulai, 15.x.2008, leg. C.B. Sun (1 ♂ [dissected] NTU). TAICHUNG Co.: Anmasan, 18.vii.1983, leg. C.L. Chen (1 ♀ NCHU). NANTOU Co.: same as holotype (1 ♂ 1 ♀ NMNS); same as holotype, ex *Cyclobalanopsis stenophylloides* (Hayata) Kudo & Masamune ex Kudo (1 ♂ NCHU); Yuanfeng, Provincial Rd. No.14A, 24.5K, 1.x.2010, ex *Photinia nitakayamensis* Hayata, leg. S.W. Hou (1 ♂ 1 ♀ NCHU); Yuanfeng, Provincial Rd. No.14A, 24.5K, 1.x.2010, ex *Photinia nitakayamensis* Hayata, leg. S.W. Hou (1 ♂ 1 ♀ HNHM, 1 ♂ 1 ♀ NMPC, 1 ♂ TFRI); Ho Huan Shan, 26.vii.1990, sweeping, leg. W.C. Chuang, NMNS ENT 639-546 (1 ♀ NMNS); Sun Moon Lake, Yuchih env., Puli, 12–16.vi.1995, leg. J. Dalihod (1 ♂ ZJPC); Tseifeng, 1.viii.1985, leg. H. Takizawa (2 ♀♀ SEHU). CHIAYI Co.: Alishan, 20.vi.1982, leg. K. Nagami, NMNT-I-He 34905 (1 ♀ NSMT). HUALIEN Co.: Tayuling, 2560 m, 12–15.ix.1980, leg. K.S. Lin & C.W. Wang (1 ♂ TARI).

Diagnosis. The species can be recognized by its humeri being distinctly produced but relatively short and broad, apically obtuse, directed slightly posterolaterad, punctured, and tinged with reddish. The male (Figs 1–3) and female (Fig. 45) terminalia are diagnostic.

Description. Colour. Ground colour of dorsum green (turning to yellowish in dead specimens), suffused with reddish brown to various extent; pronotum broadly suffused with red on calli

and along its posterior margin, humeral processes reddish brown to red with more or less distinct dark suffusion; endocorium of fore wings usually with strong ferruginous suffusion; abdomen pale yellow, with distinct red suffusion on exposed parts of segments VII (♂, ♀), VIII (♀), and dorsal surface of genital capsule (♂); connexival plates and corresponding ventrites of abdominal segments II–VII without black markings.

Integument and vestiture. Body glabrous except of fine, scattered hairs on appendages and terminalia; mandibular plates with a few scattered black punctures, interocular area with a pair of irregular longitudinal rows of black punctures; pronotum, scutellum and sclerotized parts of fore wings with rather uniform black punctation except on calli, distal portions of humeral processes and costal margin of fore wing, punctation of exocorium and neighbouring part of endocorium not conspicuously different; ventral surface of body virtually unpunctured except of scattered punctures on ventral surface of humeral process and faint, superficial punctures along posterior margin of abdominal ventrite VIII and on ventral surface of genital capsule of male.

Structure. *Body* elongate oval with distinctly produced humeri, distance between tips of humeral processes about 1.2–1.25 (♂, ♀) times as long as greatest width of body posterior of humeri. *Head* 1.2–1.25 (♂, ♀) times as broad as its median length, about 1.55–1.6 times as broad as interocular distance, finely transversely rugose, anterior portion of clypeus depressed, with a broad median longitudinal groove. *Labium* slightly surpassing mid coxae. *Pronotum* with anterolateral margin weakly concave, continued in humeral processes without conspicuous break in its outline; humeri short and broad, subtriangular, directed subhorizontally, apically obtuse. *Thoracic pleuron and sternum.* Mesosternal carina distinctly surpassing base of head, highly elevated, rather broadly rounded anteriorly; metathoracic scent gland ostiole with a long, slightly arched peritreme.

Male and female terminalia. *Male.* Genital capsule (Figs 1–3) with a pair of short posterolateral projections each with a dense tuft of setae apically; dorsal rim broadly U-shaped; ventral rim with a tuft of setae medially, ventral infolding densely pilose. Paramere (Figs 20–21) L-shaped, apex finger-shaped. *Female* (Fig. 45). Posterior margin with a deep, shield-shaped median incision surrounding valvifers VIII; posterior margin of laterotergites VIII prominent, far surpassing posterolateral angle of abdominal segment VII. Pendergrast's organs on ventrites VI and VII broadly separated, those on ventrite VII much smaller than those on ventrite VI.

Measurements (in mm). Body length from apex of head to apex of membrane 11.9–12.2 (♂) / 13.7–14.9 (♀); greatest width of body posterior of humeral processes 5.06–8.34; median length of head 1.75–1.95, width across eyes 2.15–2.40, interocular distance 1.35–1.55; length of antennal segments (I) 1.50–1.55 : (IIa) 1.65–1.80 : (IIb) 1.25–1.40 : (III) 1.85–2.00 : (IV) 1.80–1.85; median length of pronotum 2.00–2.75, greatest width (across tips of humeri) 6.41–8.49; median length of scutellum 3.45–4.45, width at base 2.85–3.70.

Etymology. The specific epithet is derived from the name of the Atayal people, one of Taiwan's indigenous tribes residing in the mountainous regions of northern and central Taiwan where the new species occurs; noun in apposition, ending not to be changed.

Bionomics. Several specimens were collected in multiple occasions from *Photinia niitakyamensis* Hayata (Rosaceae) during its fruiting period. The breeding season of the species is around October. A few specimens were found on *Cyclobalanopsis stenophylloides* Kudô & Masam. (Fagaceae).

Distribution. The species is endemic to Taiwan, apparently restricted to mountainous regions ranging from 1500 to 2500 m in altitude.

Remarks. This species belongs to the *Acanthosoma haemorrhoidale* species group hereby defined in the following way: posterolateral angles of genital capsule produced into a pair of short and broad projections but never into conspicuously elongate processes, of trapezoid shape in posterior view, ventral infolding perpendicular, facing posteriad in rest; paramere simple, rod-like, apex either rounded or hooked but never bifurcate. The group currently contains *A. haemorrhoidale* (Linnaeus, 1758), *A. emeiense* Liu, 1980, *A. spinicolle* Jakovlev, 1880, *A. nigrodorsum* Hsiao & Liu, 1977, *A. murreeanum* (Distant, 1900) and the newly described *A. atayal* sp. nov. The new species differs from all of the previously described members of the species group in its relatively smaller and more slender body, the shape of its humeral processes, and the reduced Pendergrast's organs on ventrite VII. It is particularly similar to *A. haemorrhoidale*; besides of the above characters, it differs from the latter species in the angularly broken apical portion of the paramere (Fig. 20) (strongly hooked in *A. haemorrhoidale*, cf. Figs 22–24) and the strongly convex posterior margin of laterotergites VIII of female (weakly convex in *A. haemorrhoidale*).

Acanthosoma haemorrhoidale formosanum subsp. nov.

(Figs 4, 22, 46, 60–63)

Type material. HOLOTYPE: ♂, TAIWAN: TAICHUNG Co.: Dasyueshan logging Rd. 37.5K, 5.vi.2011, leg. W.M. Hunting; deposited in NCHU (Figs 60–61). PARATYPE: TAIWAN: NANTOU Co.: Habonsan, 29.vii.1983, leg. K. Ra (1 ♀ SEHU > NMNS) (Figs 62–63).

Diagnosis. Differs from the nominotypical subspecies *A. haemorrhoidale haemorrhoidale* as well as from *A. h. angulatum* and *A. h. ouchii* in the greatly elongate, anterolaterally directed, and apically sharp humeral processes (Figs 60–63). The nominotypical species and *A. h. angulatum* have short, apically obtuse and recurved humeri. *Acanthosoma h. ouchii* has elongate and anterolaterally directed, but apically broadly rounded and obtuse humeral processes. Morphology of the exoskeleton and genitalia of both sexes (Figs 5, 22, 46) as in the other subspecies.

Etymology. The subspecific epithet *formosanum* of this endemic Taiwanese subspecies is derived from Formosa, the historic name of Taiwan (of Portuguese origin), to which the Latin adjectival suffix *-anus* (*-ana*, *-anum*) was added, therefore to be treated as a latinized adjective.

Distribution. The subspecies is restricted to Taiwan, thus representing the southernmost population of the species. The two specimens known so far were collected in mountainous regions of medium altitude (around 2000 m a.s.l.).

Remarks. The humeral process of the pronotum of *A. haemorrhoidale* shows strong intraspecific variability. The following subspecies are currently recognized:

Acanthosoma haemorrhoidale haemorrhoidale: Humeri weakly produced. Distribution: Europe!, the Caucasus (Azerbaijan, Armenia, Georgia), Iran (KERZHNER 1964, GÖLLNER-SCHIEDING 2006). According to KERZHNER (1964) it occurs sporadically in West and East Siberia, the Russian Far East, and Korea, but all records from the Asian parts of Russia were considered as pertaining to *A. h. angulatum* by VINOKUROV et al. (2010). Records from China are erroneous, probably most of them pertain to *A. emeiense* Liu, 1980 (TSAI & RÉDEI 2015b).

Acanthosoma haemorrhoidale angulatum **Jakovlev, 1880**: Humeri more strongly produced horizontally, apically slightly recurved, reddish to black. Distribution: East and West Siberia, Russian Far East (VINOKUROV et al. 2010), Japan!, northeastern China!, Korea (GÖLLNER-SCHIEDING 2006).

Acanthosoma haemorrhoidale ouchii **Ishihara, 1950**: Humeri produced into a pair of strongly elongate, anterolaterally directed process with apex broadly rounded, distal part of its anterior margin strongly recurved; humeral process bright red. Distribution: China: Zhejiang (Mt. Tianmu!), Sichuan (Mt. Emei!).

Acanthosoma haemorrhoidale formosanum **subsp. nov.**: Humeri produced into a pair of strongly elongate, anterolaterally directed, apically sharp, bright red processes. Distribution: Taiwan!

Acanthosoma haemorrhoidale is apparently rare in China, and its few available literature records are partially wrong (TSAI & RÉDEI 2015b). We only could examine a very small number of specimens and it is therefore difficult to decide whether the local forms can be recognized as subspecies, or rather a distinct clinal variation on a latitudinal gradient is present. The difference between the nominotypical subspecies and *A. h. angulatum* is rather small, it is not always easy to assign a given specimen to any of the two taxa. Both of these forms are distributed over a vast area, and their distribution areas are broadly contiguous. Specimens with long humeri, resembling *A. h. angulatum*, are present in the southern border of the area of *A. h. haemorrhoidale* (Crimea, Caucasus); the humeri also exhibit geographic variability within the range of *A. h. angulatum*, e.g. specimens from the Russian Far East have particularly long humeral processes (KERZHNER 1964). In contrast, *A. h. ouchii* is separated from the other two above mentioned subspecies by a striking morphological gap. This form is apparently restricted to southern China, and so far it is known only from two localities (Mt. Tianmu in Zhejiang and Mt. Emei in Sichuan) situated far from each other. The new Taiwanese subspecies *A. h. formosanum* is also distinct morphologically, and its area is separated from those of the populations on the Asian mainland by the Taiwan Strait.

As there are only minor differences in the genitalia of these local populations, we consider them conspecific. The status of the described taxa needs a careful study based on a material more extensive than the one currently accessible to us. Considering their morphological distinctness and geographic isolation it is unlikely that *A. h. ouchii* and *A. h. formosanum* are parts of a continuous morphocline, and therefore they convincingly merit subspecies rank.

Acanthosoma asahinai **Ishihara, 1943**

(Figs 6–7, 25–28, 47–49, 64–67)

Acanthosoma asahinai Ishihara, 1943: 495. Holotype: ♂, Formosa [= Taiwan], Taityū-syū [= Nantou County], Mareppa-Oiwake [= Renai, Tsuifeng]; ELKU!

Acanthosoma asahinai: HSIAO & LIU (1977: 175) (listed, distribution), HUA (2000: 166) (listed, distribution), GÖLLNER-SCHIEDING (2006: 166) (catalogue, distribution), ZHENG & LIN (2013: 92) (partim) (redescription, photo).

Type material examined. HOLOTYPE: ♂, '20 VIII 1936 \ MAREPPA \ ---OIWAKE' [pink, printed], 'S. Asahina \ <collected> [in Japanese script]' [handwritten], 'No. 464' [yellow, printed], 'HOLOTYPE \ Acanthosoma \ asahinai \ Ishihara' [orange, handwritten]; pinned, segments III–IV of left and IV of right antenna, right mid leg, tarsus of left hind leg lacking; deposited in ELKU.

Material examined. TAIWAN: YILAN Co.: Dong Ao Ling, 18.iii.2009, leg. S.W. Hou (1 ♂ NCHU); Yuanyang Lake 100, logging Rd. 16K, 29.iii.2010, leg. S.F. Huang & S.J. Huang (1 ♀ NCHU). TAICHUNG Co.: Anmashan,

13.xii.2002, leg. C.S. Lin, sweeping net, NMNS ENT 3973–942 (1 ♀ NMNS). NANTOU Co.: Tunyuan, 5.vi.2003, leg. J.F. Tsai (1 ♂ [dissected]), 1 ♂ 1 ♀ NCHU); Sungk[u]ang, 29.vii.1985, leg. T. Hattori, NSMT-I-He 34906 (1 ♀ NSMT); Huisun Forest Station Emergency rd. to Huisun Mon., 10.ix.2010, 24.0842°N 121.0272°E, pine forest, 1000 m acc. Ti-25a Colls, ex UV light sheet, leg. C. Skinner & W. Hunting (1 ♀ NCHU); Huisun Experimental Forest Station, 12.xi.2010, ex *Rhus javanica* L. var. *roxburghii* (DC.) Rehder & E.H. Wilson, leg. Z.Y. Wang (1 ♀ NCHU, 1 ♂ 1 ♀ NCHU > SEHU); Jenai, Chunyang, 31.v.1995, UV light, leg. M.L. Chan & C.S. Lin, 2005–141 (1 ♀ NMNS); Meifeng, 18.xii.2001–19.ii.2002, Malaise trap, leg. C.S. Lin & W.T. Yang, NMNS ENT 4467–2 (1 ♀ NMNS); Nanshanxi, 6.ix.1994 (1 ♂ OMHJ); Shizitou, 18.x.1994 (1 ♂ 1 ♀ OMHJ). MIAOLI Co.: Simaxian logging Rd., 8.ix.2010, leg. Y.C. Liao (1 ♂ NCHU); Nanzhuang, Luhui, 9.ix.2010, ex *Rhus javanica* L. var. *roxburghii* (DC.) Rehder & E.H. Wilson, leg. Y.C. Liao (1 ♂ HNHM). KAOHSIUNG Co.: Yushan Nat. Pk. 24–28.x.1990, 23.28°N 120.54°E 1800–1900m, leg. C.K. Starr & S.S. Lu, NMNS ENT 764–68 (1 ♂ NMNS). PINGTUNG Co.: Mt. Dahan, ex *Rhus javanica* L. var. *roxburghii* (DC.) Rehder & E.H. Wilson, leg. Y.X. Shieh (1 ♀ HNHM).

Diagnosis. This species is readily recognized based on the horizontally directed, acute humeral processes of both sexes, the conspicuous subbasal dilation of the hind tibia of the male, and the elongate, posteriorly directed projections of the male genital capsule. The detailed original description (ISHIHARA 1943) allows unambiguous recognition of the species; as an addition, the male (Figs 6–7, 25–28) and female (Figs 48–49) genitalia are described and figured in the present paper. The female of this species is similar in size, colour, and in the presence of sharp humeral processes to that of *A. fallax*, but the broadly rounded posterior margin of laterotergites VIII sharply differs from the condition found in the latter species.

Description of male and female terminalia. *Male.* Genital capsule (Figs 6–7) with a pair of elongate posterolateral projections directed posteriad, running subparallel, slightly curved mesad subapically, apically with a tuft of setae; dorsal rim with a deep, obtuse concavity at midline, provided with several fine setae; ventral infolding with a pair of fine setal tufts and a pair of heavily sclerotized and pigmented denticles laterad of paramere sockets. Paramere (Figs 25–28) T-shaped, dorsal arm with blunt apex, without distinct subapical denticle, ventral arm bird-head-shaped apically. *Female* (Figs 48–49). Posterior margin of ventrite VII with a deep, broadly U-shaped incision surrounding valvifers VIII; tergite VIII with dark markings proximally and distally as in Fig. 48; posterior margin of laterotergites VIII broadly rounded, far surpassing posterolateral angles of abdominal ventrite VII, mesal portion (surrounding postgenital segments) with dark marking; Pendergrast's organs of ventrites VI and VII sub-elliptical, of equal size.

Measurements (in mm). Body length to apex of membrane 14.3–15.9 (♂) / 15.9–17.2 (♀); to imaginary line connecting apices of projections of genital capsule 15.2–17.1 (♂)

Bionomics. Adults, larvae and eggs of this species are frequently observed on *Rhus javanica* L. var. *roxburghii* (DC.) Rehder & E.H. Wilson (Anacardiaceae) which is apparently its host plant. The breeding season is from September to October.

Distribution. The species is apparently endemic to Taiwan and it is relatively frequent in the *Machilus-Castanopsis* forest zone of the mountainous regions ranging between 500–1800 m in altitude.

Remarks. *Acanthosoma asahinai* was described based on a single male from 'Marepa-Oiwake' (now Renai, Tsuifeng) in Taiwan. The identity of the species was confirmed by reexamination of the holotype during the present study.

Except of ZHENG & LIN (2013) no subsequent authors provided original data on the species. The top left photo in p. 92 of ZHENG & LIN (2013) shows *A. asahinai* but the top right one is

A. fallax sp. nov.; their redescription of '*A. asahinai*' includes characters of both species. The male is redescribed and the female is described for the first time in this paper.

The new species belongs to the *Acanthosoma forfex* species group hereby defined in the following way: genital capsule with a pair of greatly elongate posterolateral projections; paramere T-shaped, with a long dorsal and a somewhat shorter ventral arm. The group comprises the following species: *A. asahinai*, *A. forcipatum* Reuter, 1881, *A. forfex* Dallas, 1851, *A. forficula* Jakovlev, 1880, *A. ishiharai* Yamamoto & Hayashi, 2011, *A. labiduroides* Jakovlev, 1880, the newly described *A. fallax* sp. nov., and perhaps *A. hamptoni* (Distant, 1900) (the latter one doubtfully associated). *Acanthosoma asahinai* is apparently sister to *A. labiduroides* based on the high similarity of the genital capsule and female terminalia. A study on the molecular phylogeny of the family also supports the sister relationship of the two species (TSAI et al., in preparation).

***Acanthosoma fallax* sp. nov.**

(Figs 8–9, 29–32, 50–51, 68–71)

Acanthosoma forfex (non Dallas, 1851): ISHIHARA (1943: 495). Misidentification (cf. TSAI & RÉDEI 2015b: 31).

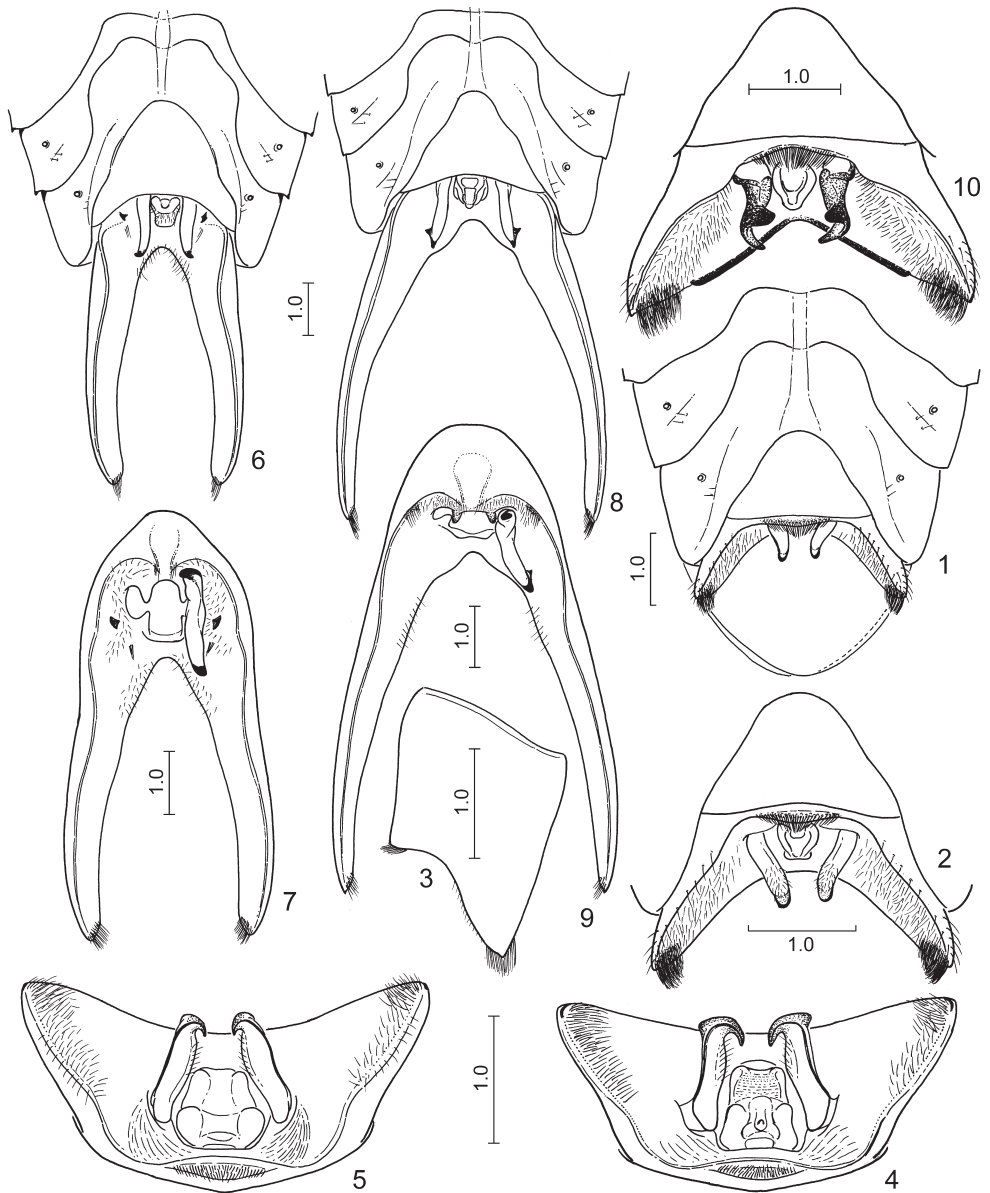
Acanthosoma asahinai (non Ishihara, 1943): ZHENG & LIN (2013: 92) (partim). Misidentification.

Type material. HOLOTYPE: ♂, TAIWAN: NANTOU Co.: Meifeng Farm, faculty dorm, 5.v.2014, at light, leg. J.F. Tsai; mounted on card, left antennal segments III–IV lacking; deposited at NMNS (Figs 68–69). PARATYPES: TAIWAN: CHIAYI Co.: Jhuchi, Fenchifu, 30–31.x.2003, sweeping, leg. C.S. Lin, NMNS ENT 4288–1069 (1 ♀ NMNS). HSINCHU Co.: Guanwu, 16.xi.2011, leg. Y.B. Fan (1 ♂ 1 ♀ TFR1). TAICHUNG Co.: Da Syue Shan Forstry Rd. 42k, 26.ix.2009, leg. Y.J. Liu (1 ♂ HNHM); Wuling Farm, Cika Cabin, 2.x.2010, leg. C.T. Tang (1 ♂ 1 ♀ NCHU); Anmashan, 6–9.vii.1979, leg. W.J. Wu (1 ♂ [dissected], NCHU). NANTOU Co.: Tsuifeng, 1.viii.1985, H. Takizawa leg. (1 ♂ SEHU); Yuanfeng, 13.iii–10.iv.2007, Malaise trap, leg. C.S. Lin & W.T. Yang (1 ♂ NMNS).

Diagnosis. Recognized by the following combination of characters: humeri relatively short, spiniform, directed laterad, apically sharp; hind tibia simple, not dilated (♂, ♀); genital capsule of male with a pair of very long, posteriorly directed, weakly diverging lateral projections slightly curved inward and gradually tapering distally, apically with a tuft of setae (Figs 8–9); minute denticles at posterolateral angles of ventrites III–VI black but otherwise lateral margin of pregenital abdomen without conspicuous black markings. The female of this species is similar in size, colour, and in the presence of sharp humeral processes to that of *A. asahinai*, but the broadly rounded posterior margin of laterotergites VIII (Figs 50–51) sharply differs from the condition found in the latter species (Figs 48–49).

Description. Colour. Dorsum rather uniformly bright green (becomes paler in dead specimens), venter pale yellow; humeral processes yellow to pale orange; abdominal ventrite VII laterally (♂, ♀), genital capsule (♂) / terminalia (♀) suffused with red; minute denticles at posterolateral angles of ventrites III–VI black but otherwise lateral margin of abdominal segments II–VII (♂) / II–VI (♀) pale yellow, posterior portion of connexival plates of segment VII and neighbouring proximal portion of tergite VIII (♀) with black markings (Fig. 50), mesal portions of laterotergites VIII with dark marking surrounding postgenital segments (Fig. 51); antenna as ground colour of body but apical 3/4 of segment IIb and whole of segments III–IV black in male; legs yellowish.

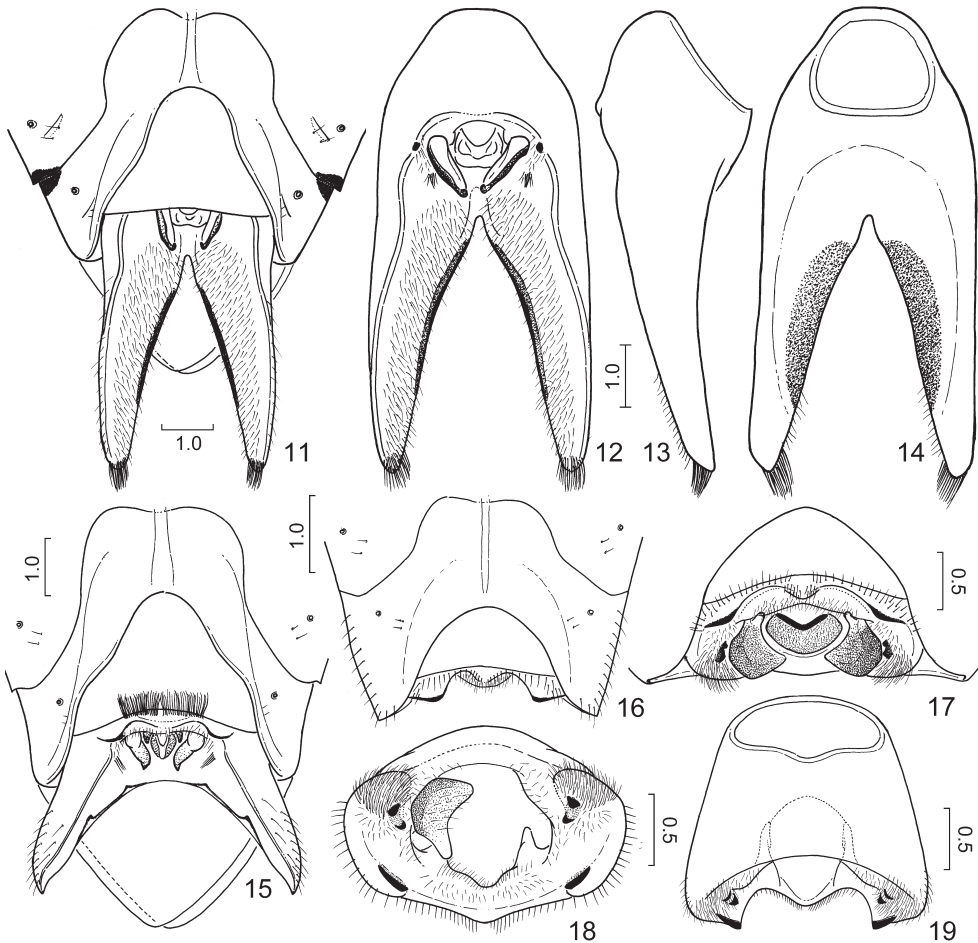
Integument and vestiture. Body glabrous except of fine, scattered hairs on appendages and terminalia; mandibular plates with a few scattered black punctures, interocular area with a pair of irregular longitudinal rows of black punctures; maxillary plate with an obtuse



Figs 1–10. *Acanthosoma* spp., males. 1 – *A. atayal* sp. nov., posterior part of abdomen, ventral view; 2 – same, genital capsule and exposed part of segment VIII, ventral view; 3 – same, genital capsule, lateral view; 4 – *A. haemorrhoidale formosanum* subsp. nov., holotype, genital capsule, posterior view; 5 – *A. haemorrhoidale haemorrhoidale* (Linnaeus, 1758) (Spain: Fuente Dé, HNHM), genital capsule, posterior view; 6 – *A. asahinai* Ishihara, 1943, posterior part of abdomen, ventral view; 7 – same, genital capsule, ventral view; 8 – *A. fallax* sp. nov., posterior part of abdomen, ventral view; 9 – same, genital capsule, ventral view; 10 – *A. pugnax* sp. nov., genital capsule and exposed part of segment VIII, ventral view. Scales in mm.

tubercle anterior and mesad of antennal insertion; pronotum, scutellum and sclerotized parts of fore wings with rather uniform black punctation except on calli, distal portions of humeral processes and costal margin of fore wing, punctation of exocorium and neighbouring part of endocorium not conspicuously different; ventral surface of body virtually unpunctured.

Structure. *Body* elongate oval with distinctly produced humeri, distance between tips of humeral processes about 1.3–1.35 (♂) / 1.4 (♀) times as long as greatest width of body posterior of humeri. *Head* 1.1–1.15 (♂) / 1.2–1.3 (♀) times as broad as its median length, 1.5–1.6



Figs 11–19. *Acanthosoma* spp., males. 11 – *A. axicia* sp. nov., posterior part of abdomen, ventral view; 12 – same, genital capsule, ventral view; 13 – same, lateral view; 14 – same, dorsal view; 15 – *A. laevicorne* Dallas, 1851, posterior part of abdomen, ventral view; 16 – *A. expansum* Horváth, 1905, posterior part of abdomen, ventral view; 17 – same, posteroventral view; 18 – same, genital capsule, posterior view; 19 – same, ventral view. Scales in mm.

(♂) / 1.5–1.55 (♀) times as broad as interocular distance, finely transversely rugose, anterior portion of clypeus with a broad median longitudinal groove. *Labium* projecting between or slightly surpassing mid coxae. *Pronotum* with anterolateral margin weakly concave, gradually transitioning into humeral process which is short, spiniform, directed subhorizontally, apically sharp. *Thoracic pleuron and sternum*. Mesosternal carina distinctly surpassing base of head, highly elevated, rather broadly rounded anteriorly; metathoracic scent gland ostiole with a long, slightly arched peritreme.

Male and female terminalia. *Male*. Genital capsule (Figs 8–9) with a pair of elongate and rather gracile, posteriorly directed, curved lateral projections tapering distally, apex of each projections with a tiny denticle and a tuft of hairs; dorsal rim with a small, obtuse concavity medially; ventral rim with a pair of setal tufts laterad of paramere sockets. Paramere (Figs 25–28) T-shaped, dorsal arm with a small subapical denticle directed backward, ventral arm beak-like apically. *Female* (Figs 50–51). Posterolateral angle of ventrite VII relatively strongly produced, curved, posterior margin with a deep, broadly U-shaped median incision surrounding valvifers VIII; posterior margin of laterotergites VIII truncate; Pendergrast's organs of ventrites VI and VII elliptical, subequal in size.

Measurements (in mm). Body length from apex of head to apex of membrane 13.7–15.3 (♂) / 16.1–16.7 (♀), from apex of head to line connecting apices of projections of genital capsule 17.2–17.8 (♂); greatest width of body posteriad of humeral processes 6.40–8.05; median length of head 2.09–2.23, width across eyes 2.40–2.68, interocular distance 1.55–1.80; length of antennal segments (I) 1.60–1.88 : (IIa) 1.90–2.00 : (IIb) 1.45–1.85 : (III) 2.15–2.30 : (IV) 1.90–2.00; median length of pronotum 2.68–3.28, greatest width (across tips of humeri) 8.70–11.02; median length of scutellum 4.02–5.36, width at base 3.58–4.77.

Etymology. The specific epithet is the Latin adjective *fallax* (m, f, n) ('deceptive, deceitful') referring to the fact that the species was misidentified by previous authors.

Bionomics. Unknown. It is sometimes attracted to light.

Distribution. The species is apparently endemic to Taiwan, distributed in the *Quercus* forest zone of mountains ranging from 1500 to 2500 m in altitude. Its distribution overlaps with that of *A. asahinai*, but the latter species frequently occurs at lower altitudes.

Remarks. The identity of *Acanthosoma forfex* Dallas, 1851 was elucidated by TSAI & RÉDEI (2015b). The record of *A. forfex* from Taiwan (ISHIHARA 1943) is based on misidentification and pertains to *A. fallax* sp. nov. The redescription of *A. asahinai* by ZHENG & LIN (2013) contains a combination of characters of both *A. asahinai* and *A. fallax* sp. nov.; the top left photo in their p. 92 shows *A. asahinai*, the top right one *A. fallax* sp. nov.

The elongate posterolateral projections of the genital capsule and the shape of the paramere indicate that the new species belongs to the *Acanthosoma forfex* species group as it was defined under *A. asahinai*. It is morphologically similar to *A. forfex*, but it can be distinguished by the apically sharp humeral process (obtuse in *A. forfex*), unicolorous abdominal connexiva and ventrites (with conspicuous black markings in *A. forfex*), and the long, gracile, curved lateral projections of the genital capsule (much shorter and less gracile in *A. forfex*). The character states of *A. forfex* were illustrated by TSAI & RÉDEI (2015b). The species can readily be distinguished from *A. asahinai* by the shape of genital capsule of the male, the truncate posterior margin of laterotergites VIII of female, and the simple hind tibiae of male (subbasally dilated

in *A. asahinai*). The processes of the male genital capsule of *A. fallax* sp. nov. are distinctly longer than those of all other known congeners.

Acanthosoma pugnax sp. nov.

(Figs 10, 33–36, 53, 72–75)

Type material. HOLOTYPE: ♂, TAIWAN: TAICHUNG Co.: Wuling Hostel, 15.iv.2013, MV lamp, leg. S. Wu; male genitalia dissected, preserved in glass vial with glycerol, pinned with the specimen; deposited in NMNS (Figs 72–73). PARATYPE: TAIWAN: TAICHUNG Co.: Anmashan, 2275 m, 6–9.vii.1979, leg. W.J. Wu (1 ♀ TARI) (Figs 74–75).

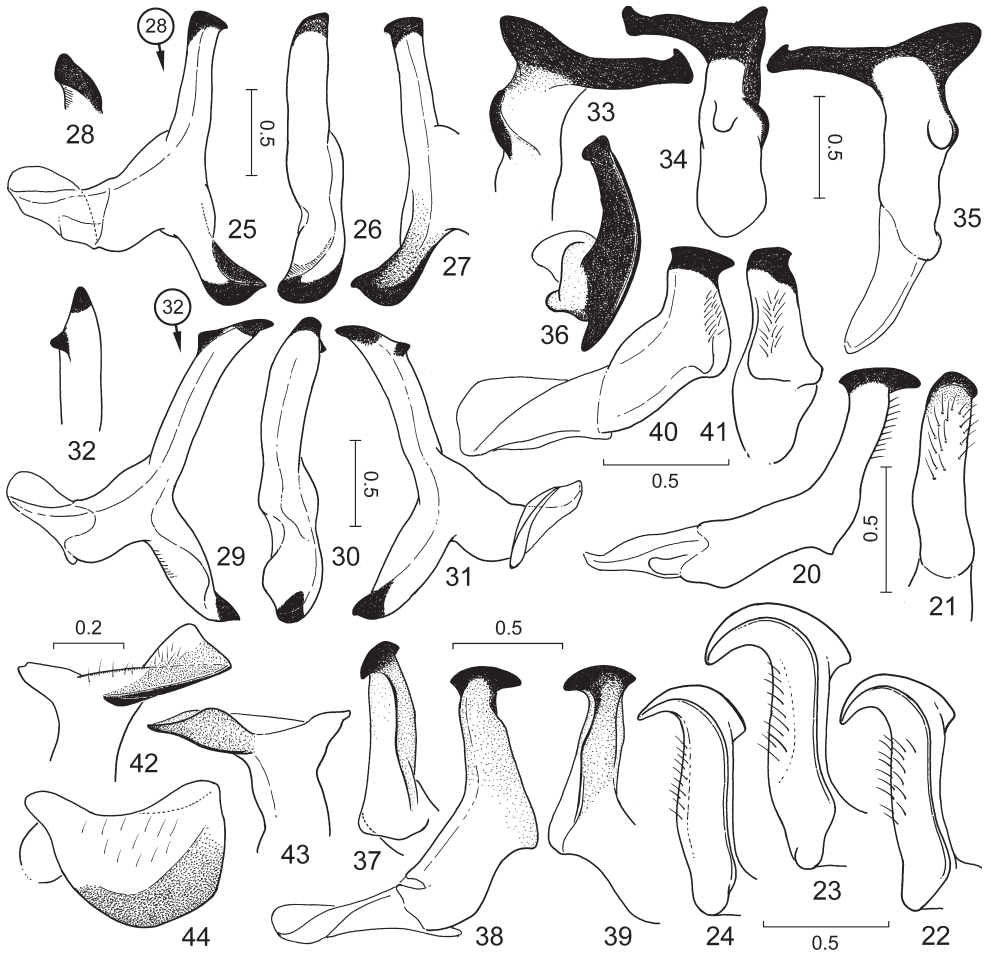
Diagnosis. Recognized by the following combination of characters: humeral process dark, greatly elongate, straight, apically sharp, directed anterolaterad; mesosternal carina short, slightly surpassing base of head; male genital capsule with a sclerotized ridge along margin of dorsal rim (Fig. 10). The paramere (Figs 33–36) and female terminalia (Fig. 53) are diagnostic.

Description. Colour. Ground colour of dorsum green suffused with ferruginous to various extent, occasionally completely reddish brown; humeral processes suffused with black except their anterior margin; endocorium of fore wings with strong ferruginous suffusion; abdomen pale yellow, with distinct red suffusion on exposed parts of segments VII (♂, ♀), VIII (♀), and dorsal surface of genital capsule (♂); minute denticles at posterolateral angles of ventrites III–VI black but otherwise lateral margin of pregenital abdomen without conspicuous black markings.

Integument and vestiture. Body glabrous except of fine, scattered hairs on appendages and terminalia; mandibular plates with a few scattered black punctures, interocular area with a pair of irregular longitudinal rows of black punctures; maxillary plate with an obtuse tubercle anteriad and mesad of antennal insertion; pronotum, scutellum and sclerotized parts of fore wings with rather uniform black punctation except on calli, distal portions of humeral processes and costal margin of fore wing, punctation of exocorium and neighbouring part of endocorium not conspicuously different; ventral surface of body virtually unpunctured except of scattered punctures on ventral surface of humeral process and faint, superficial punctures along posterior margin of abdominal ventrite VIII and on ventral surface of genital capsule of male.

Structure. Body elongate oval with distinctly produced humeri, distance between tips of humeral processes about 1.65 (♀) times as long as greatest width of body posteriad of humeri. Head 1.18 (♂) / 1.24 (♀) times as broad as its median length, about 1.58 (♂) / 1.53 (♀) times as broad as interocular distance, finely transversely rugose, anterior portion of clypeus with a broad median longitudinal groove. Labium projecting between or slightly surpassing mid coxae. Pronotum with anterolateral margin weakly concave, gradually transitioning into humeral process which is long, straight, spiniform, directed subhorizontally, apically sharp. Thoracic pleuron and sternum. Mesosternal carina distinctly surpassing base of head, highly elevated, rather broadly rounded anteriorly; metathoracic scent gland ostiole with a long, slightly arched peritreme.

Male and female terminalia. Male. Genital capsule (Fig. 10) with short, broad, widely diverging posterolateral projections, provided with a tuft of dense setae apically; dorsal rim broadly V-shaped, with a heavily sclerotized and pigmented ridge along its margin; ventral rim with a concave incision medially, provided with setal tufts, its infolding densely pilose.



Figs 20–44. *Acanthosoma* spp., right parameres in different views. 20–21 – *A. atayal* sp. nov.; 22 – *A. haemorrhoidale formosanum* subsp. nov., holotype; 23 – *A. haemorrhoidale ouchii* Ishihara, 1950 (China: Sichuan, Mt. Emei, USNM); 24 – *A. haemorrhoidale haemorrhoidale* (Linnaeus, 1758) (Spain: Fuente Dé, HNHM); 25–28 – *A. asahinai* Ishihara, 1943; 29–32 – *A. fallax* sp. nov.; 33–36 – *A. pugnax* sp. nov.; 37–39 – *A. axicia* sp. nov.; 40–41 – *A. laevicorne* Dallas, 1851; 42–44 – *A. expansum* Horváth, 1905. Scales in mm.

Paramere (Figs 33–36) bifurcated and heavily pigmented apically, internal surface concave, upper branch elongate with a digitiform process, lower branch short with a fin-shaped process, stem with a protrusion subapically. *Female* (Fig. 52). Posterior margin of ventrite VII with a deep, U-shaped median incision margined with black at bases of valvifers VIII; posterior margin of laterotergites VIII moderately rounded and prominent; Pendergrast's organs on ventrite VII much smaller than those on ventrite VI.

Measurements (holotype ♂ / paratype ♀) (in mm). Body length from apex of head to apex of membrane 13.3 / 13.8 (♀); greatest width of body posteriad of humeral processes – / 6.41; median length of head 1.95 / 1.85, width across eyes 2.30 / 2.30, interocular distance 1.45 / 1.50; length of antennal segments (I) 1.65 / 1.65 : (IIa) 1.65 / 1.60 : (IIb) 1.75 / 1.40 : (III) 1.35 / 1.85 : (IV) 2.15 / 1.55; median length of pronotum 2.30 / 2.65, greatest width (across tips of humeri) 10.6 / 10.6; median length of scutellum 3.70 / 3.95, width at base 3.35 / 3.45.

Etymology. The specific epithet is the Latin adjective *pugnax* (m, f, n) ‘combative, fond of fighting’, referring to the produced, sharp humeri of the species.

Bionomics. Unknown. The male holotype was collected at light.

Distribution. This species is apparently endemic to Taiwan. Specimens are rare in collections, so far only the holotype and one paratype are known, both collected in the central, mountainous region of the main island of Taiwan.

Remarks. Although the single male available is badly damaged (Figs 72–73), we judged that it, together with an obviously conspecific female, will make it possible to prepare a description which will allow unambiguous recognition of the species.

The new species is taxonomically closely related to *A. shensiense* Hsiao & Liu, 1977 and *A. montanum* (Liu, 1987) as indicated by the presence of a sclerotized and pigmented longitudinal ridge along the dorsal rim of the genital capsule of the male (a potential synapomorphy) and the similar shape of the paramere. Regarding *A. montanum*, the new species can be easily distinguished by the apically sharp humeri (apically obtuse, recurved in *A. montanum*), the different parameres, the more prominent posterior margin of laterotergites VIII of the female, and the reduced Pendergrast’s organs on ventrite VII.

Acanthosoma axicia sp. nov.

(Figs 11–14, 37–39, 52, 76–79)

Type material. HOLOTYPE: ♂, TAIWAN: NANTOU Co.: Lishan, 21.xi.2010, ex *Pittosporum illicoides* (Makino), leg. C.T. Tang & Y.C. Li; mounted on card, intact; deposited in NMNS (Figs 76–77). PARATYPES: TAIWAN: NANTOU Co.: same as holotype (1 ♀ NMNS, 1 ♂ [dissected] NCHU); Renai, Shihtyoutou [= Shizitou], 26.IV.1990, NSMT-I He 36136 (1 ♂ NSMT). TAICHUNG Co.: Dasyueshan logging Rd. 32K, 6.VII.2010, MV lamp, Y.C. Liao leg. (1 ♀ NCHU).

Diagnosis. Recognized by the following combination of characters: humeri spiniform, yellowish to pale orange, directed subhorizontally, slightly elevated, gradually narrowed, apically obtuse; hind tibia simple, not dilated (♂, ♀); pregenital abdomen with conspicuous black markings at intersegmental sutures dorsally and ventrally (Figs 11, 52); genital capsule of male with a pair of posteriorly directed, rather straight, apically obtuse lateral projections with inner margins rather straight and enclosing an angle of about 40°, ventral surface rather densely covered by long setae, provided with a distinct tuft of setae apically (Figs 11–14).

Description. Colour. Dorsum and venter rather uniformly stramineous, humeral processes somewhat paler (yellowish to pale orange); abdomen pale yellow, with distinct red suffusion on exposed parts of segments VII (♂, ♀), VIII (♀), and dorsal surface of basal portion of genital capsule (♂); intersegmental sutures between connexival plates of abdominal segments II–VII each enclosed by a black marking extending in whole width of connexivum, each continuous with a marginal marking on the respective ventrites, dorsal parts (mediotergite + connexival plates) of segment VII (♂, ♀) broadly margined with black posteriorly, lateral portions and

median, excised portion of ventrite VII of female broadly margined with black at both sides; tergite VIII of female with a large median, posteriorly narrowing triangular marking confluent with a pair of transverse lateral fasciae along basal margin of tergite VIII; lateral and mesal margins of valvifers VIII of female suffused with black (Fig. 52); posterolateral projections of genital capsule of male pale yellowish, inner margins broadly suffused with dark brown; antennal segment I and legs as general body colour, antennal segments II–IV blackish.

Integument and vestiture. Body glabrous except of fine, scattered hairs on appendages and terminalia; mandibular plates and interocular area virtually unpunctured; maxillary plate with an obtuse tubercle anterior and mesad of antennal insertion; pronotum, scutellum and sclerotized parts of fore wings with rather uniform black punctation except on calli, humeral processes and narrow costal margin of fore wing; punctation of exocorium and neighbouring part of endocorium not conspicuously different; ventral surface of body virtually unpunctured.

Structure. *Body* elongate oval with distinctly produced humeri, distance between tips of humeral processes about 1.5 times as long as greatest width of body posterior of humeri. *Head* 1.1–1.25 times as broad as its median length, about 1.5–1.6 times as broad as interocular distance, finely transversely rugose, anterior portion of clypeus depressed, with a broad median longitudinal groove. *Labium* projecting between or slightly surpassing mid coxae. *Pronotum* with anterolateral margin nearly straight anteriorly, then gradually continued in humeral process, therefore deeply emarginate; humeri spiniform, directed subhorizontally, apically rather obtuse. *Thoracic pleuron and sternum.* Mesosternal carina distinctly surpassing base of head, highly elevated, rather broadly rounded anteriorly; metathoracic scent gland ostiole with a long, slightly arched peritreme.

Male and female terminalia. *Male.* Genital capsule (Figs 11–14) with a pair of long, robust, scissors-like lateral projections directed posteriorly, surpassing apex of membrane by their apical halves, lateral margin nearly straight, apically rounded with a tuft of hairs, dorsal rim nearly V-shaped, ventral rim with a pair of rigid and pigmented denticles and a pair of setal tufts laterad of paramere sockets, ventral infolding densely pilose; dorsal wall of projection with pigmented thickening along basal half of dorsal rim; distal portion of lateral projection slightly curved dorsad in lateral view (Fig. 13). Body of paramere (Figs 33–36) L-shaped, apex transversely bifurcate, anchor-shaped. *Female* (Fig. 52). Posterior margin of ventrite VII with a deep, shield-shaped median incision margined with black, surrounding valvifers VIII; posterior margin of laterotergites VIII broadly arcuate, posteriorly far surpassing posterolateral angles of abdominal ventrite VII; Pendergrast's organs of ventrites VI and VII subelliptical, of equal size.

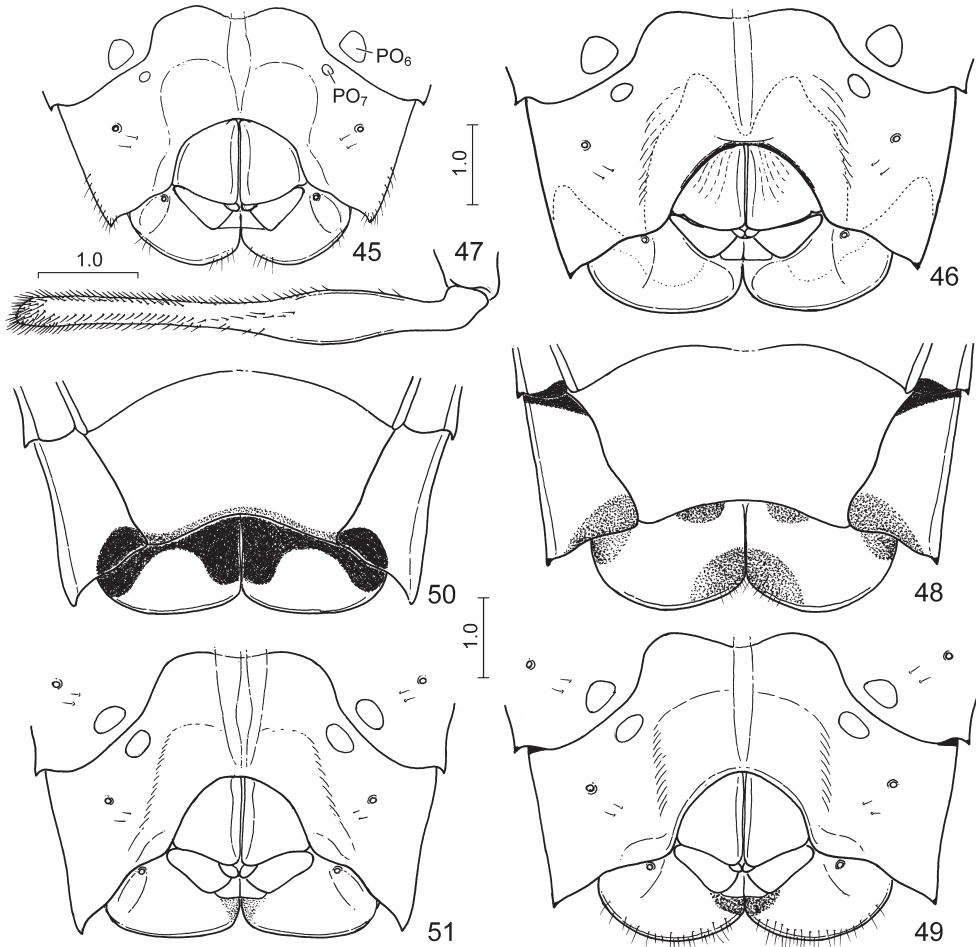
Measurements (3 ♂♂ 2 ♀♀) (in mm). Body length from apex of head to apex of membrane 13.7–14.2 (♂) / 15.3–15.6 (♀), from apex of head to line connecting apices of projections of genital capsule 15.7–17.1 (♂); greatest width of body posterior of humeral processes 6.70–7.60; median length of head 1.90–2.36, width across eyes 2.45–2.60, interocular distance 1.55–1.75; length of antennal segments (I) 1.50–1.70 : (IIa) 1.75–1.93 : (IIb) 1.55–1.70 : (III) 2.30–2.40 : (IV) 1.95–2.00; median length of pronotum 2.90–3.45, greatest width (across tips of humeri) 10.3–11.6; median length of scutellum 4.25–4.75, width at base 3.85–4.50.

Etymology. The specific epithet is the Latin noun *axicia* ('a pair of scissors') in apposition, referring to the shape of the genital capsule; ending not to be changed.

Bionomics. Some of the examined adults were collected from *Pittosporum illicioides* Makino (Pittosporaceae).

Distribution. The species is apparently endemic to Taiwan. The few specimens which we could access were collected in primary forests of high mountains at an altitude of about 1800–2500 m a.s.l.

Remarks. Although the relatively elongate posterolateral projections of the genital capsule superficially resemble the condition found in members of the *A. forfex* species group, the similarity is only apparent. The narrow, apically rather pointed, dorsally unpunctured head,



Figs 45–51. *Acanthosoma* spp. 45 – *A. atayal* sp. nov., female terminalia, posteroventral view; 46 – *A. haemorrhoidale formosanum* subsp. nov., paratype, female terminalia, posteroventral view; 47 – *A. asahinai* Ishihara, 1943, hind tibia of male; 48 – same, female terminalia, dorsal view; 49 – same, posteroventral view; 50 – *A. fallax* sp. nov., female terminalia, dorsal view; 51 – same, posteroventral view. PO₆, PO₇ = Pendergrast's organs of ventrites VI and VII, respectively. Scales in mm.

the shape and direction of the humeral process, and particularly the shape of the terminalia of both sexes (posterolateral projections of genital capsule of male robust, with flattened, densely pilose ventral infolding, body of paramere L-shaped, median excision of the posterior margin of ventrite VII of female broad) suggest that the new species is related to *Acanthosoma firmatum* (Walker, 1868).

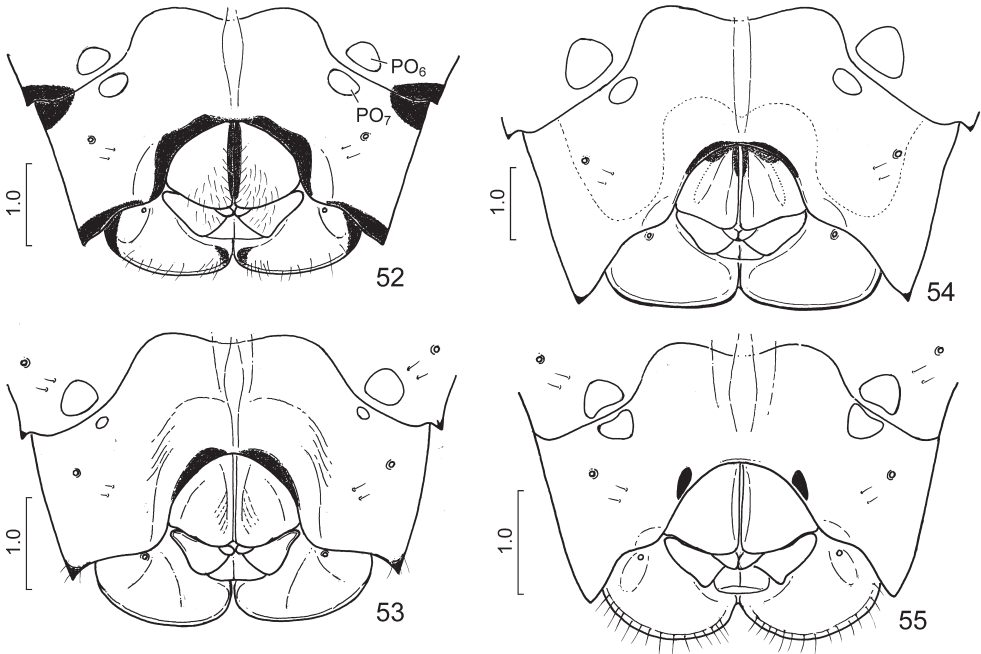
Acanthosoma firmatum (Walker, 1868)

Cuspicona firmata Walker, 1868: 569. Holotype: ♀, China; BMNH!

Acanthosoma giganteum Matsumura, 1913: 128. Holotype: ♀, Japan: Honshu, Kyoto; SEHU! Synonymized by TSAI & RÉDEI (2015b: 9).

Material examined. TAIWAN: NANTOU Co.: Meifeng, 15–16.ii.1990, leg. C.S. Lin, UV light trap, NMNS ENT 516-38 (1 ♀ NMNS), Meifeng, 30.viii.1992, leg. J.L. Sung (1 ♀ NTU), Howangshan, 10.ix.2000, leg. C.C. Lo, NMNS ENT 4463-258 (1 ♂ NMNS), same data, NMNS ENT 4463-182 (1 ♀ NMNS). TAICHUNG Co.: Guquan, 15.xi.1992, leg. R.C. Wang (1 ♀ NTU), unknown locality, 4.vi.2000, leg. Y.C. Huang (1 ♂ NCHU).

Bionomics. The species was recorded from the Japanese raisin tree, *Hovenia dulcis* Thunb. (Rhamnaceae) in Japan (YAMAMOTO et al. 2009). Its host plants in Korea, China and Taiwan are unknown.



Figs 52–55. *Acanthosoma* spp., female terminalia, posteroventral view. 52 – *A. axicia* sp. nov.; 53 – *A. pugnax* sp. nov.; 54 – *A. laevicorne* Dallas, 1851; 55 – *A. expansum* Horváth, 1905. PO₆, PO₇ = Pendergrast's organs of ventrites VI and VII, respectively. Scales in mm.

Distribution. The species occurs in Japan, Korea, China and Taiwan; the majority of the literature records from China are in need of confirmation because of previous confusion about the identity of this species in the Chinese literature (TSAI & RÉDEI 2015a).

Remarks. The identity of this species was clarified by TSAI & RÉDEI (2015b), who described genitalia, and provided several illustrations, records, and a selected bibliography.

Acanthosoma crassicaudum Jakovlev 1880

Acanthosoma crassicaudum Jakovlev, 1880: 386, 390. Lectotype (DERZHANSKY et al. 2002: 362): ♂, Russia: Vladivostok; ZMAS.

Acanthosoma glaucum Esaki, 1916: 125. Syntypes: ♂, ♀, Japan: Honshiu [= Honshu]: Mt. Minomo and Kyoto; ELKU. Synonymized by ESAKI (1926: 200).

Acanthosoma crassicaudum: KERZHNER (1964: 364) (records), KANYUKOVA (1988: 914) (in key, figure, distribution), KWON et al. (2001: 366) (catalogue, host plants, records, distribution), GÖLLNER-SCHIEDING (2006: 167) (catalogue, distribution), YAMAMOTO et al. (2009: 33) (host plant), YAMAMOTO & HAYASHI (2011: 150) (in key), YAMAMOTO & HAYASHI (2012: 503) (redescription, host plants, distribution).

Acanthosoma crassicauda: LETHIERRY & SEVERIN (1893: 252) (catalogue, distribution), KIRKALDY (1909: 171) (catalogue, distribution), ESAKI (1926: 200) (type material, diagnostic characters, records, distribution, synonymy), HOFFMANN (1935: 101, 184) (catalogue, distribution), ISHIHARA (1947: 69) (listed, figures), ESAKI (1950: 203) (redescription, habitus, distribution), MIYAMOTO (1962: 81) (redescription, host plant, phenology, distribution), LEE (1971: 214) (in key), 217 (redescription, photo, figure, records, distribution), 501 (catalogue, distribution), HIURA (1977: 106) (listed, figure, distribution), JOSIFOV & KERZHNER (1978: 165) (records), VINOKUROV et al. (2010: 225) (catalogue, distribution), ZHENG & LIN (2013: 99) (redescription, photo).

Material examined. TAIWAN: MIAOLI Co.: Mt. Xue, black forest [*Abies kawakamii* forest], ca. 3300 m, 12.xii.2010, leg. Y.C. Liao (1 ♀ NCHU). NANTOU Co.: Aowanda National Forest Recreational Area, near bird watching platform, 1265 m, 30.v.2011, UV light, leg. W.M. Hunting (2 ♀♀ NCHU).

Diagnosis. A large, robust species (body length 17.5–19.5 mm) readily recognizable based on the following combination of characters: humeri rounded, not produced; connexival plates with broad (as wide as or wider than tibia) black markings enclosing intersegmental sutures; posterolateral angle of pronotum with a small, triangular process directed posteriad and extending over base of corium; genital capsule of male large, robust, with short, broad, apically rounded lateral projections not surpassing apex of membrane, ventrally densely pilose, provided with 1+1 pigmented denticles subapically and 1+1 denticles proximally; posterior margin of laterotergites VIII of female broadly rounded. ESAKI (1926, 1950), ISHIHARA (1947), MIYAMOTO (1962), LEE (1971), HIURA (1977), KANYUKOVA (1988), YAMAMOTO & HAYASHI (2012) and ZHENG & LIN (2013) provided redescriptions and illustrations which are useful for recognizing this species.

Bionomics. The species feeds on *Prunus buergeriana* Miq. (Rosaceae) in Japan (YAMAMOTO et al. 2011). Several other *Prunus* species (*P. avium* (L.) L., *P. donarium* Siebold, *P. glandulosa* Thunb., *P. ishidoyana* Nakai, *P. nakaii* H.Lév., *P. leveilleana* Koehne, *P. mume* Siebold & Zucc., *P. padus* L., *P. salicina* Lindl., *P. sargentii* Rehder, *P. serrulata* Lindl., *P. yedoensis* Matsum.) were recorded as its host plants in Korea (KWON et al. 2001). The host plants in Taiwan are unknown.

Distribution. The species occurs in the Russian Far East, Korea and Japan. It was recorded from Taiwan by ZHENG & LIN (2013) without precise locality; we present the first exact record for the country. It is apparently rare all over its distribution area. It was recorded from

Fujian Province (Jiayang) of China by HSIAO & LIU (1977). The specimen photographed by the authors (HSIAO & LIU 1977, plate 29 fig. 409) (label data: Fujian, Jiayang, Huangkeng, 8.vi.1965, leg. S.L. Liu, preserved in NKUM) was examined in connection with the present study, and it is identified as a female of *A. denticaudum* Jakovlev, 1880. The subsequent records of *A. crassicaudum* from Fujian (CHAO 1982, LIN et al. 1999, HUA 2000) are apparently based on HSIAO & LIU (1977). Due to the confusion about the identity of this species in the Chinese literature we consider the record from Henan (ZHENG et al. 1999) as questionable. We could not see any specimens which could prove occurrence of the species in the country, therefore, although the species likely occurs in the northeastern part of China, it is deleted from the Chinese fauna until voucher specimens could be located.

Summary of known records: **RUSSIA: FAR EAST TERRITORY:** Primorsky Krai (KERZHNER 1964, VINOKUROV et al. 2010). — **JAPAN: HONSHU:** Ueda!, Nagano! (SEHU); **KYUSHU:** Mt. Hiko!, Fukuoka!, Kirishima! (SEHU); **SHIKOKU** (YAMAMOTO & HAYASHI 2012). — **KOREA: NORTH** (KWON et al. 2001); **SOUTH:** Kyongsangbuk Prov., near Kimchon, Chikchi-sa! (HNHM). — **CHINA?: HENAN?** (ZHENG et al. 1999). — **TAIWAN:** MIAOLI Co.!, NANTOU Co.!

Acanthosoma laevicornis Dallas, 1851

(Figs 15, 40–41, 54, 80–83, 92–93)

Acanthosoma laevicornis Dallas, 1851: 311. Syntypes: ♂, ♀, unknown locality; BMNH!

Anaxandra levicornis: HSIAO & LIU (1977: 171). Incorrect subsequent spelling.

Acanthosoma laevicornis: HERRICH-SCHÄFFER (1853: 4) (listed, distribution), DOHRN (1859: 18) (catalogue, distribution), STÅL (1876: 115) (as of unknown generic placement, listed).

Acanthosoma laevicornis: WALKER (1867: 399) (listed).

Anaxandra laevicornis: ATKINSON (1889: 23) (reproduction of original description), LETHIERRY & SEVERIN (1893: 254) (catalogue), DISTANT (1900: 229) (listed), DISTANT (1902: 323) (redescription, habitus, figures, distribution), KIRKALDY (1909: 174) (catalogue, distribution), KUMAR (1974: 54) (type material), LEI & ZHOU (1998: 42) (listed, distribution), LIN et al. (1999: 97) (redescription, habitus, distribution), HUA (2000: 166) (listed, distribution), GÖLLNER-SCHIEDING (2006: 169) (catalogue, distribution), LIU & JU (2006: 327) (listed), LI et al. (2008: 214) (listed), LIU & WANG (2009: 594) (listed), HAN & LIU (2010: 158) (records, distribution), AUKEMA et al. (2013: 430) (catalogue, distribution).

Anaxandra levicornis: HSIAO & LIU (1977: 171) (in key, redescription, photo, figure, distribution), CHAO (1982: 51) (listed, distribution), LIU (1987: 152) (in key, distribution), LI et al. (1989: 39) (listed), ZHANG (1994: 36) (distribution), HE et al. (2007: 109) (listed), DING & LIU (2009: 102) (listed, distribution).

Anaxandra [inadvertent error] *levicornis*: ZHANG et al. (1980: 32) (records, phenology).

Type material examined. LECTOTYPE (present designation): ♂, '144 [printed] .a [handwritten]', 'Hardwicke \ Bequest.' [printed, with black frame], 'Acanthosoma [printed] \ liturata [printed, crossed out by hand] \ laevicornis [handwritten] \ Walker's catal. [printed]'; pinned, both antennae, right fore and mid legs, tarsal segments II of left mid and hind legs lacking (BMNH) (Figs 92–94). PARALECTOTYPE: ♀, 'Type' [printed, with red margin] '14?' [printed, last character illegible because of damage by pin] .a [handwritten]', 'Hardwicke \ Bequest.' [printed, with black frame], '36. ACANTHOSOMA LAEVICORNIS,' [printed, cut from WALKER (1867: 399)]; pinned, segments II–IV of left, segments III–IV of right antenna, left fore and hind legs, tarsal segment II of right mid leg, tarsus of right hind leg lacking (BMNH). **Additional material examined.** **TAIWAN:** TAICHUNG Co.: Wushikeng, Exp. Station ESRI [= Endemic Species Research Institute], 24°16'25.6"N 120°56'54.0", ca. 1000 m, 30.viii.2014, leg. C.T. Tang, ex *Pyraecantha koidzumii* (Hayata) Rehder (7 ♂♂ 1 ♀ NCHU); Nantou Co., Sungk[u]ang, 29.vii.1985, leg. T. Hattori, NSMT-I-He 34912 (1 ♀ NSMT). **INDIA:** UTTARAKHAND: Kumaon, W. Almora, vi.1918, coll. H.G.C. Champion, B.M. 1927-409 (1 ♀ BMNH). **VIETNAM:** TONKIN, vi.1917, leg. R.V. de Salva (1 ♂ [dissected] BMNH).

Diagnosis. A large and robust species (body length: 16.5–20.7 mm) with greatly elongate, anterolaterally directed and apically usually recurved humeral processes (Figs 80–83). The diagnostic male terminalia (Fig. 15), paramere (Figs 40–41) and female terminalia (Fig. 54) are illustrated in the present paper.

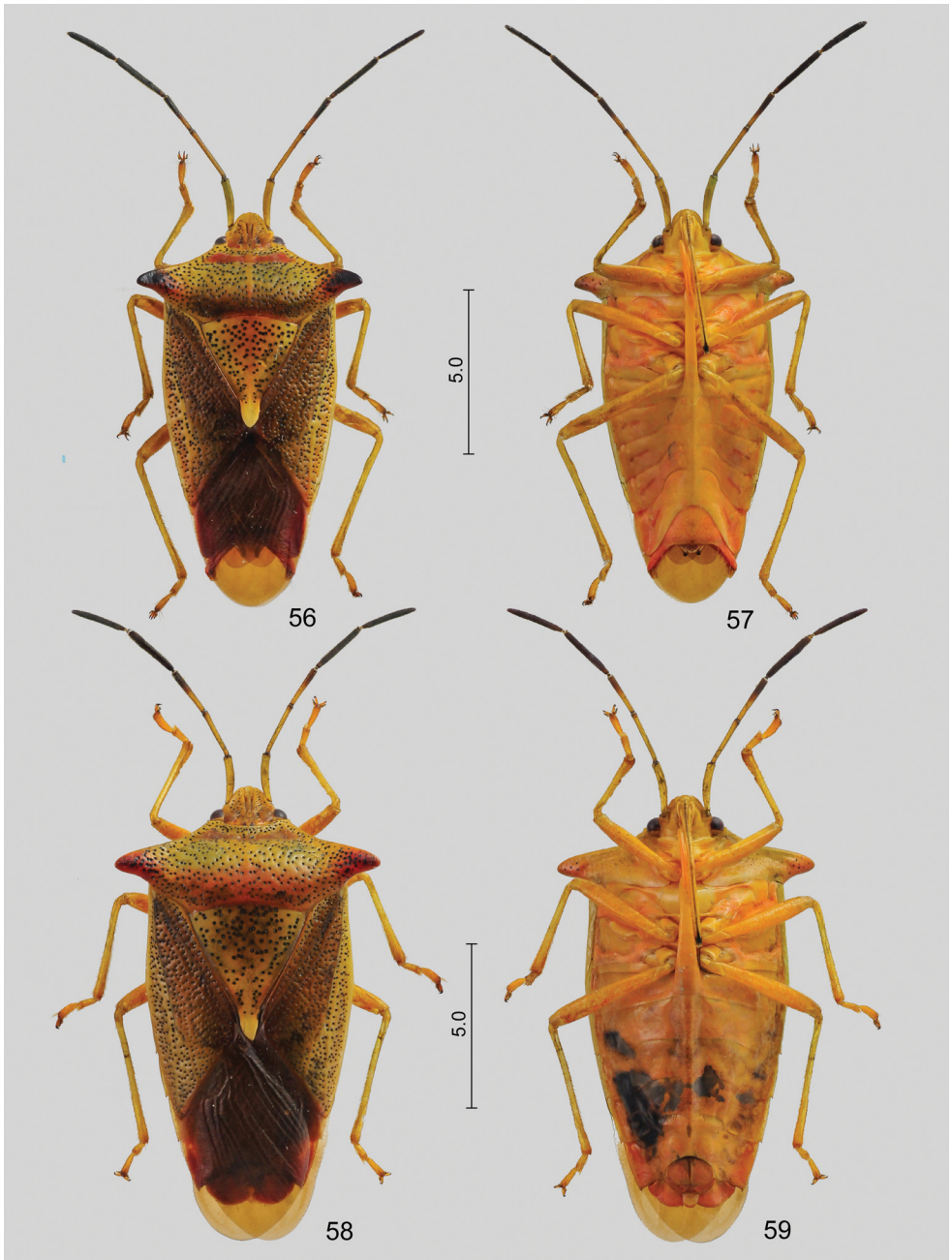
Bionomics. Eight adults and four larvae examined by us were collected from the endemic Formosa firethorn, *Pyracantha koidzumii* (Hayata) Rehder (Rosaceae) during a single collecting event; the collector informed us that he has observed them to feed on the fruits (C.T. TANG, pers. comm.). ZHANG et al. (1980) reported the species from the broad bean, *Vicia faba* L. (Fabaceae) from Zhejiang but this host plant record seems doubtful.

Distribution. *Acanthosoma laevicorne* has been recorded from a number of localities in southern China but it is apparently rare everywhere. It was listed from Shandong by HUA (2000) but this record was based on an unclear source and it seems questionable. DISTANT (1902) recorded it from ‘North-west Provinces’ of India; we present the first precise locality from the Indian Subcontinent. The species was listed from Japan by HSIAO & LIU (1977) and subsequent Chinese authors; as no Japanese authors have ever reported it from the country these records are considered as erroneous. A single old specimen from ‘Tonkin’ was examined by us and we consider this record as the first record for Vietnam. We present the first record from Taiwan.

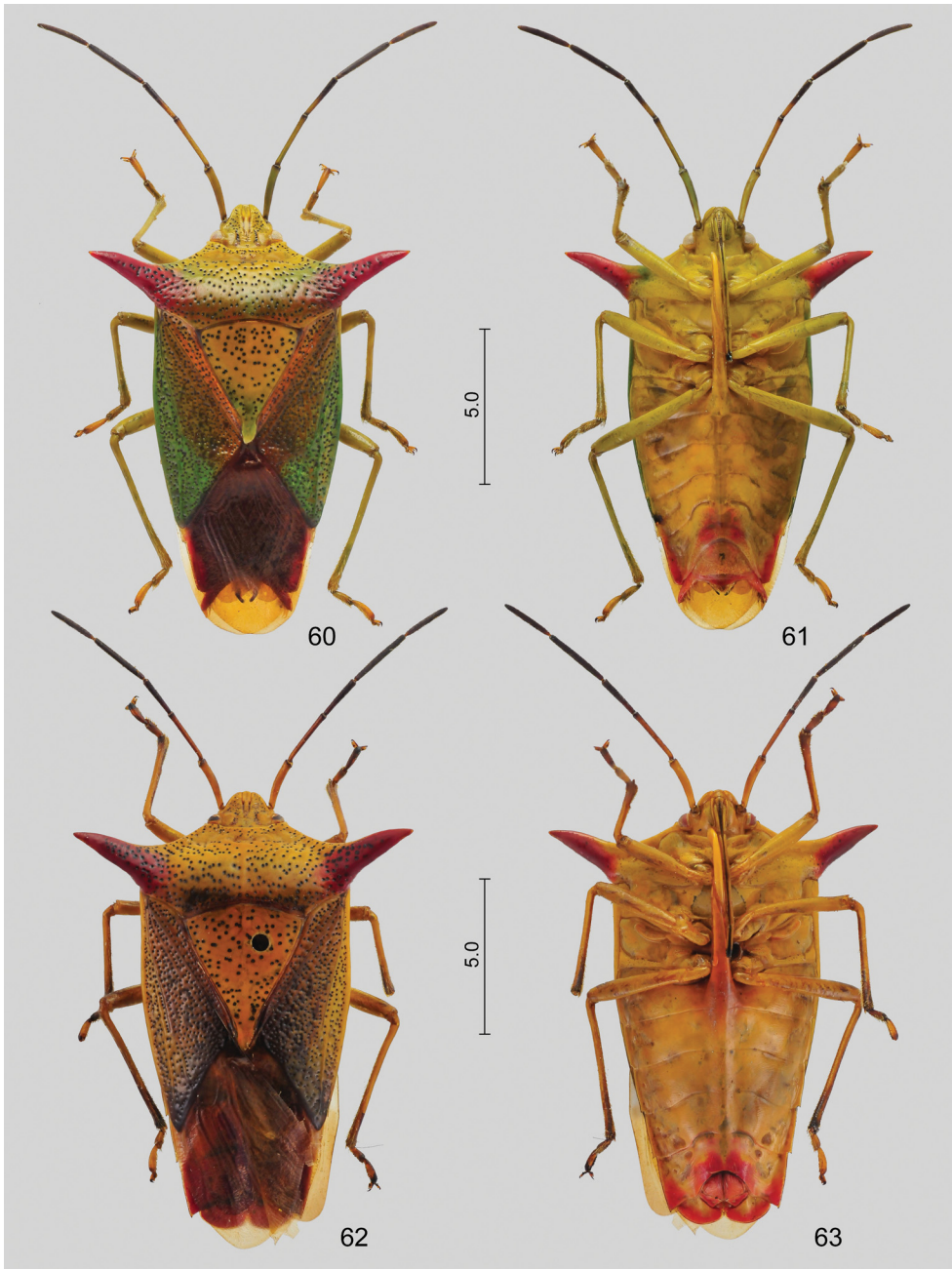
Summary of known records: **INDIA: UTTARAKHAND:** Kumaon, Almora! (BMNH). — **CHINA: HUBEI:** Wuchang!, Wufeng! (NKUM), Enshi (LEI & ZHOU 1998), Qizimeishan National Nature Reserve (LIU & JU 2006). **JIANGXI:** Guling! (IZAS), Lushan, Nanchang, Mt. Jinggang (ZHANG et al. 1980, ZHANG 1994), Jiulingshan National Nature Reserve (LI et al. 2008). **ZHEJIANG:** Wuyanling!, Qingyuan!, Mt. Fengyang! (NKUM). **SICHUAN** (HSIAO & LIU 1977, LIU 1987). **YUNNAN:** Luxi!, Nanjian: Mt. Fenhuang!, Xishuangbanna: Menglong! (NKUM), Kunming, Chenggong, Jinghong (HSIAO & LIU 1977, LIU 1987). **FUJIAN:** Amoy! [= Xiamen], Chong’an! (IZAS), Da’an (HSIAO & LIU 1977), Mt. Wuyi (LIN et al. 1999). **SHANDONG?** (HUA 2000). — **TAIWAN: TAICHUNG Co.!**; **NANTOU Co.!** — **VIETNAM: TONKIN!** (BMNH).

Remarks. *Acanthosoma laevicorne* was described based on an unspecified number of males and females collected at an unknown locality by Th. Hardwicke (DALLAS 1851). A male and a female syntype were located in the BMNH, and the male (Figs 92–93) is hereby designated as lectotype.

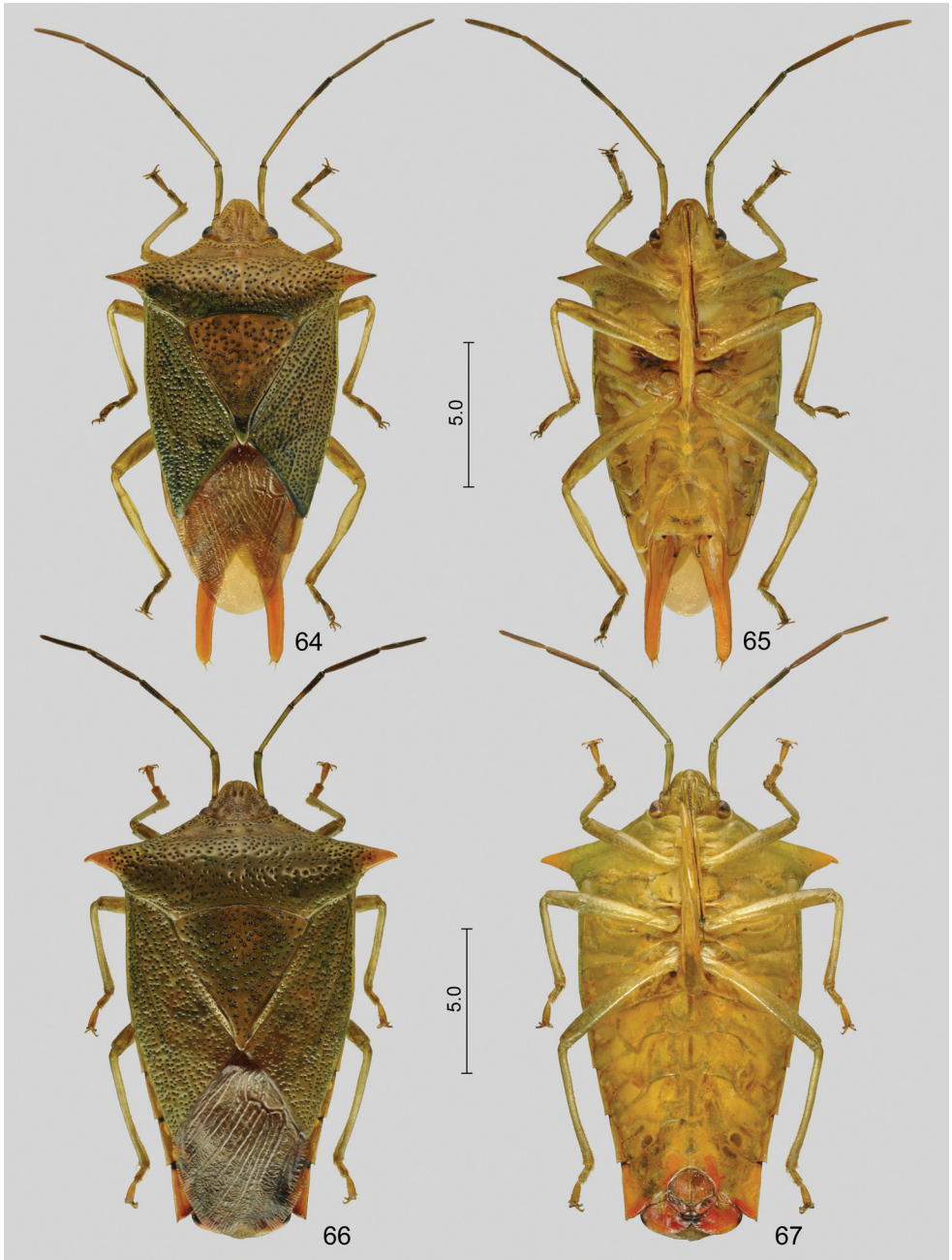
The species is related to *A. rufispinum* (Distant, 1887) and *A. tauriforme* (Distant, 1887); the three species apparently form a monophyletic group (called here as the *A. laevicorne* group) based on the following combination of characters: head triangular, pointed (mandibular plates narrow, clypeus surpassing them apically); strongly prolonged, sword-shaped, apically recurved humeral process; similar shape of genital capsule (with an extension of the dorsal wall over the ventral infolding and a pair of protuberances on the ventral rim laterally); similar shape of paramere. *Acanthosoma laevicorne* differs from the other three species by the presence of a distinct tubercle on the maxillary plate anteriorly and mesad of antennal insertion, the greatly produced mesosternal carina far surpassing middle of head, and its male and female terminalia. The other two species were illustrated by TSAI & RÉDEI (2015b).



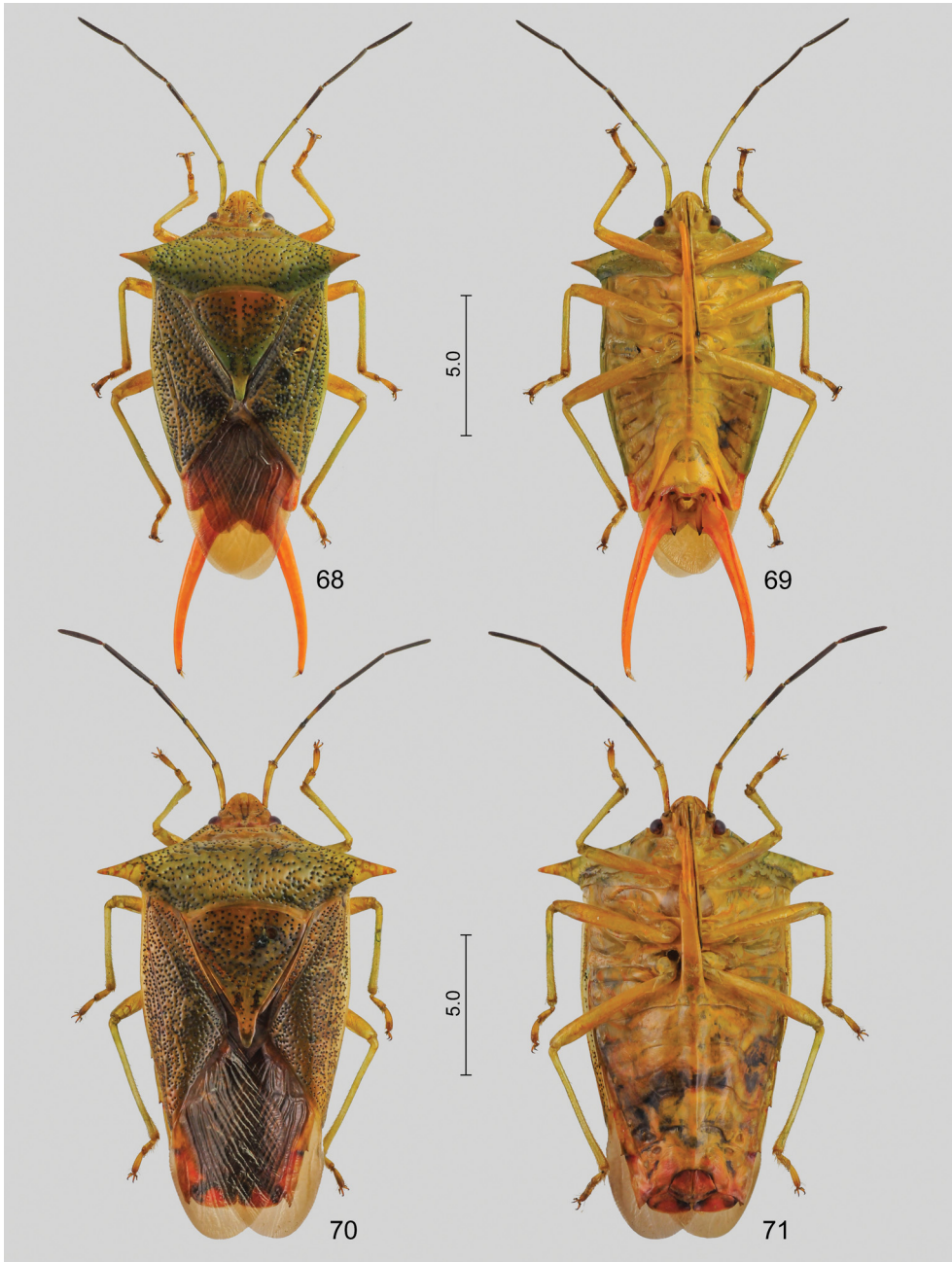
Figs 56–59. *Acanthosoma atayal* sp. nov. 56–57 – male; 58–59 – female. Scales in mm.



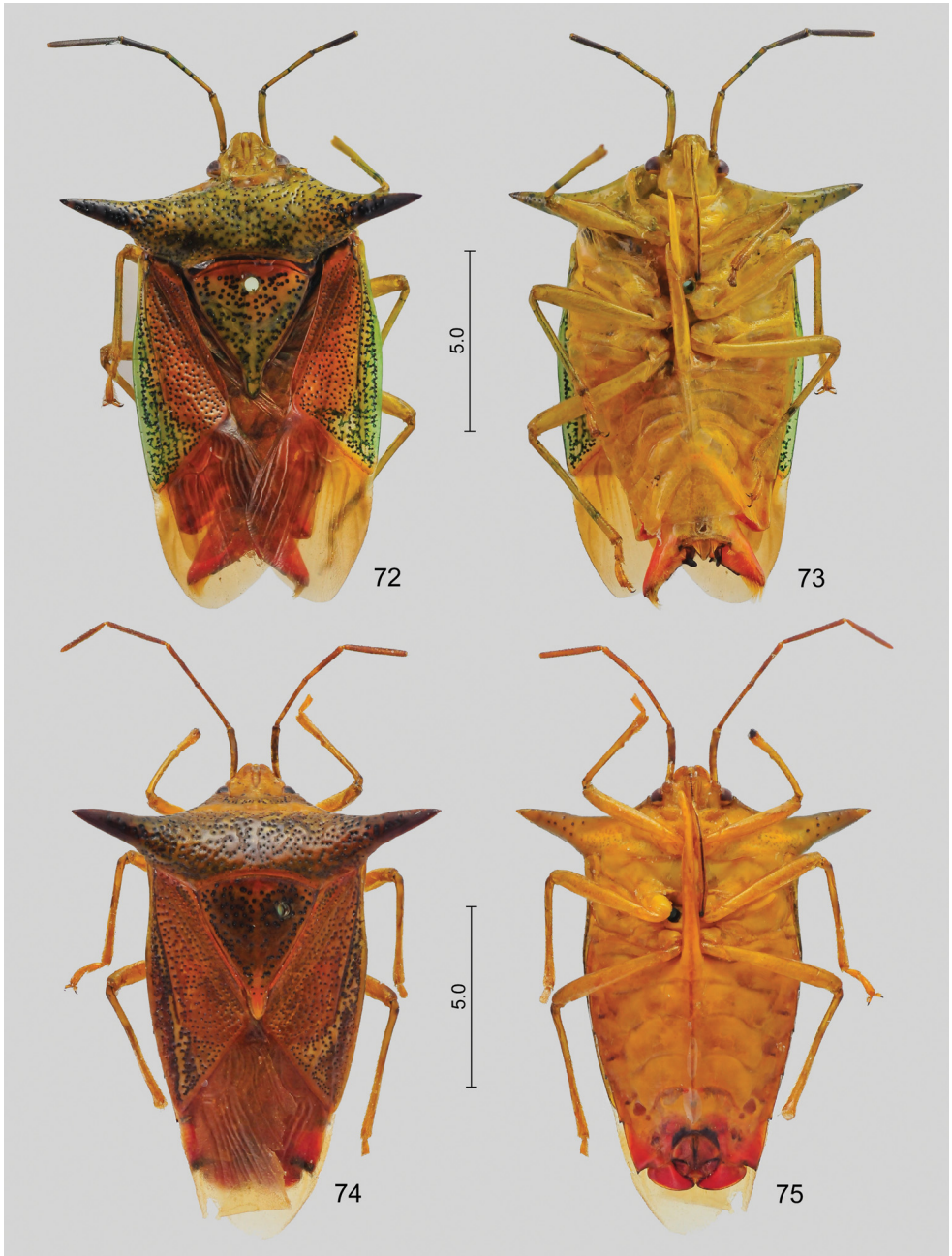
Figs 60–63. *Acanthosoma haemorrhoidale formosanum* subsp. nov. 60–61 – male (holotype); 62–63 – female (paratype, right antennal segment IV reconstructed digitally). Scales in mm.



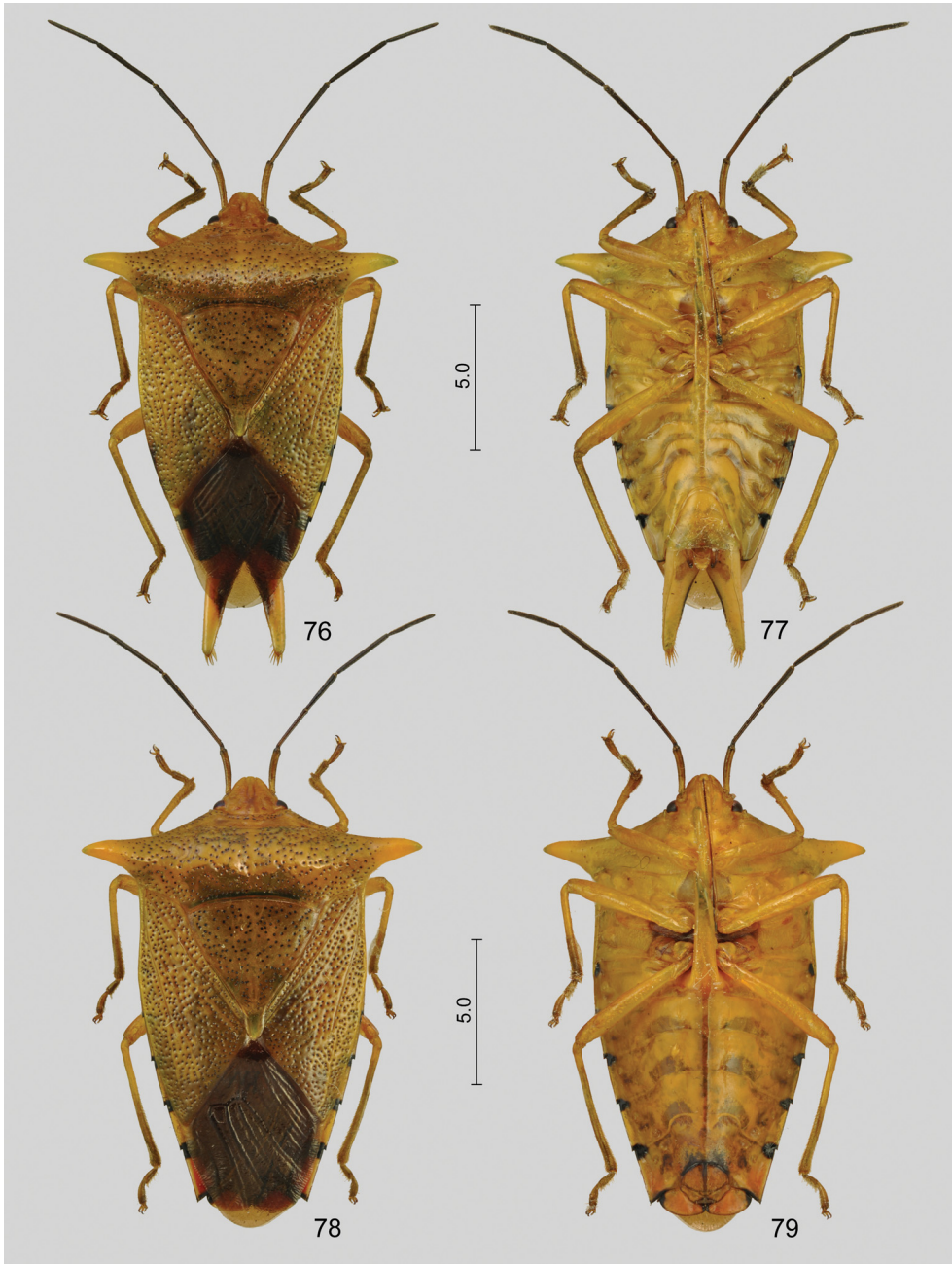
Figs 64–67. *Acanthosoma asahinai* Ishihara, 1943. 64–65 – male; 66–67 – female. Scales in mm.



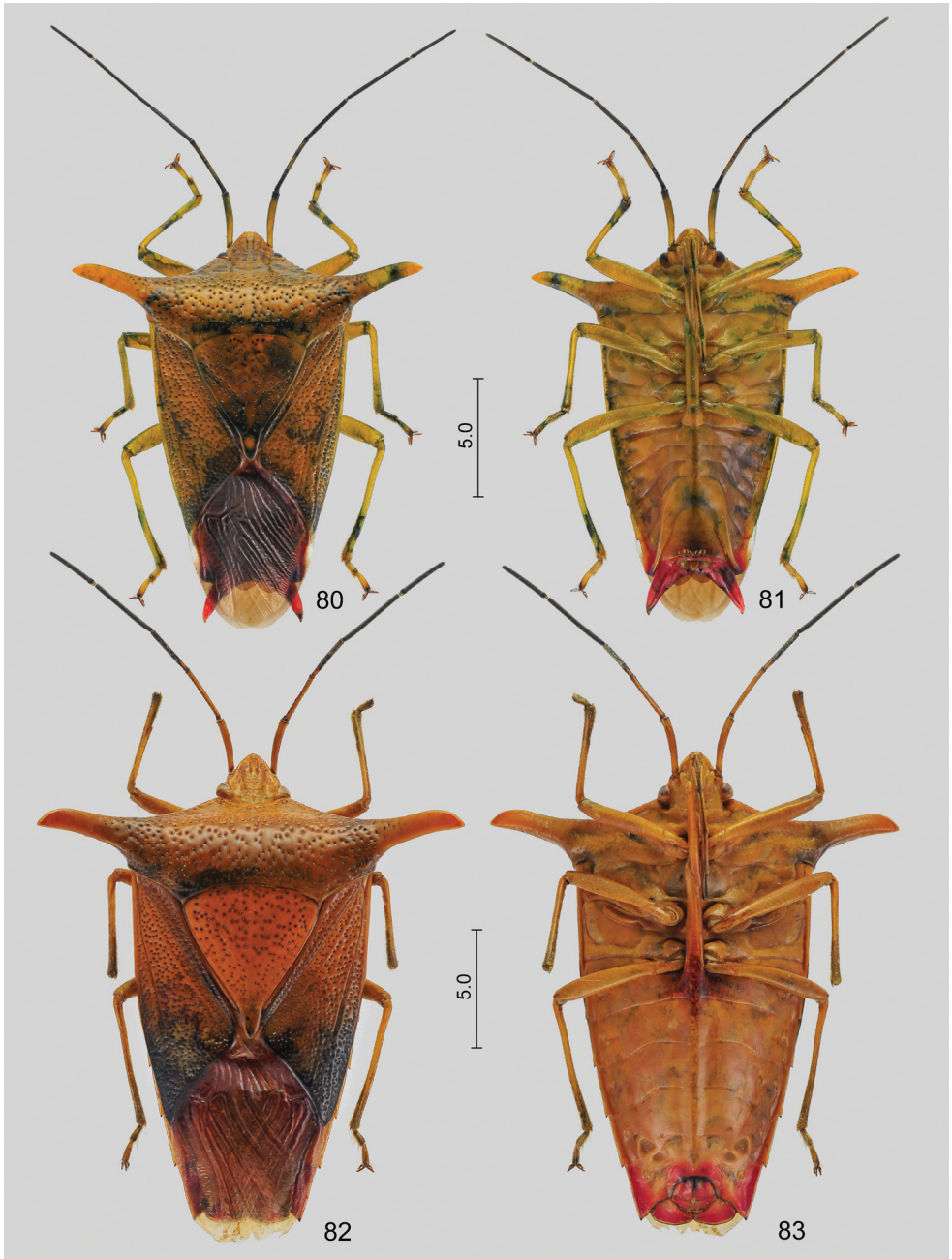
Figs 68–71. *Acanthosoma fallax* sp. nov. 68–69 – male (holotype, right antennal segments III–IV reconstructed digitally); 70–71 – female. Scales in mm.



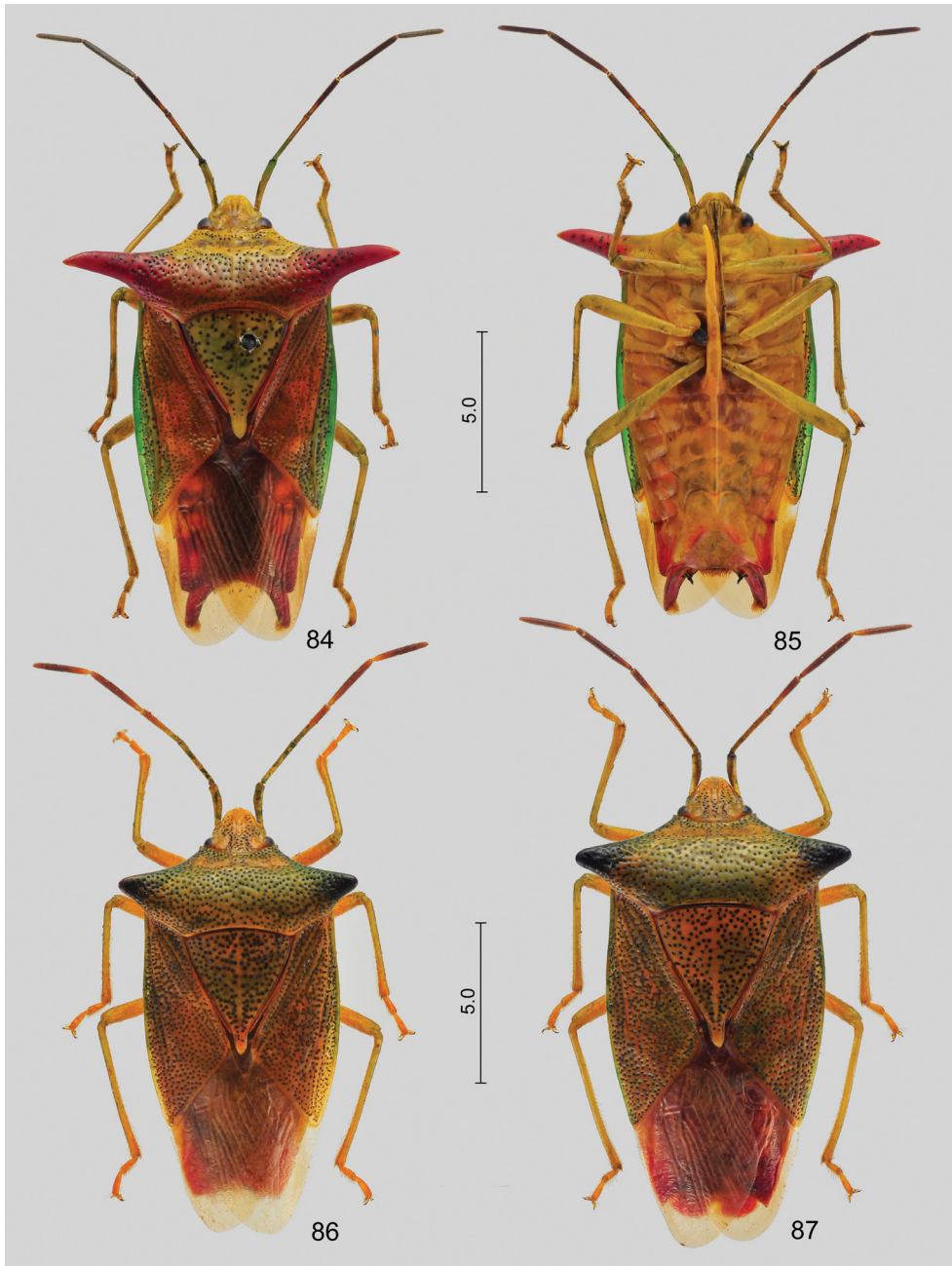
Figs 72–75. *Acanthosoma pugnax* sp. nov. 72–73 – male (holotype); 74–75 – female (paratype). Scales in mm.



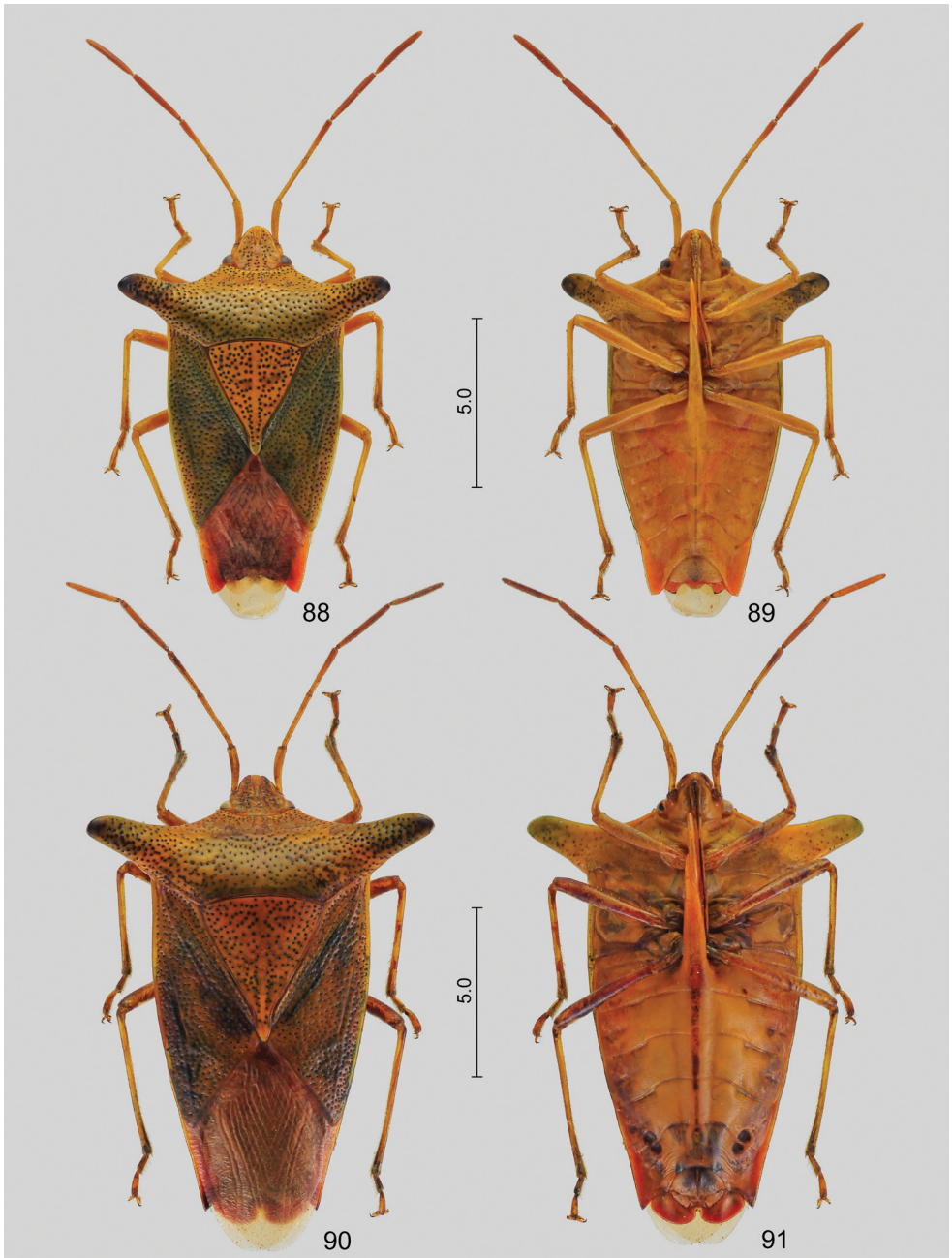
Figs 76–79. *Acanthosoma axicia* sp. nov. 76–77 – male; 78–79 – female. Scales in mm.



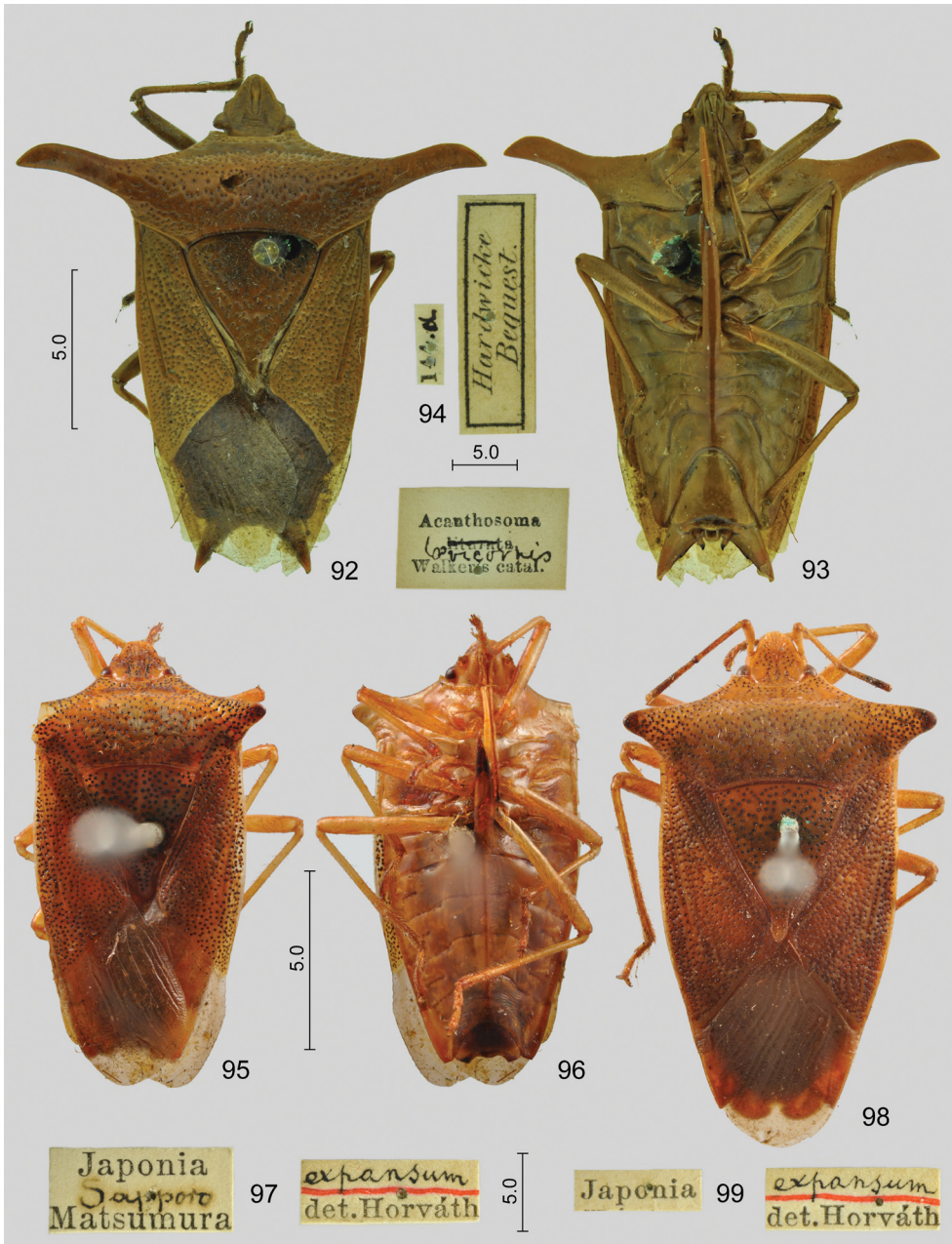
Figs 80–83. *Acanthosoma laevicorne* Dallas, 1851. 80–81 – male; 82–83 – female. Scales in mm.



Figs 84–87. *Acanthosoma* spp. 84–85 – *A. sichuanense* (Liu, 1980); 86 – *A. expansum* Horváth, 1905, male (Japan: Sapporo); 87 – same, female (Japan: Sapporo). Scales in mm.



Figs 88–91. *Acanthosoma expansum* Horváth, 1905. 88–89 – male (Taiwan: Nantou Co., Sunkang); 90–91 – female (Taiwan: Nantou Co., Tsuifeng–Sungkang). Scales in mm.



Figs 92–99. Type specimens of *Acanthosoma* spp. and their labels. 92–93 – *A. laevicorne* Dallas, 1851, lectotype; 94 – same, labels; 95–96 – *A. expansum* Horváth, 1905, lectotype; 97 – same, labels; 98 – *A. expansum*, paralectotype; 99 – same, labels. Scales in mm. © BMNH (92–94), HNHM (95–99).

Acanthosoma forficula Jakovlev, 1880

- Acanthosoma forficula* Jakovlev, 1880: 387, 392. Holotype: ♂, [Russia:] Wladivostok [= Vladivostok]; ZMAS.
- Acanthosoma virens* Reuter, 1881: 74. Lectotype (JOSIFOV & KERZHNER 1978: 164): ♀, Amuria [= Russia: Amur region]; NHRS. Synonymized by JOSIFOV & KERZHNER (1978: 164).
- Acanthosoma kyotoanum* Esaki, 1916: 126. Syntypes: ♂, ♀, Japan: Honshiu [= Honshu]: Kyoto, Mt. Minamo, Shinano; ELKU. Synonymized by ESAKI (1926: 200).
- Acanthosoma forficula*: LETHIERRY & SEVERIN (1893: 253) (catalogue, distribution), KIRKALDY (1909: 171) (catalogue, distribution), ESAKI (1926: 200) (type material, records, distribution synonymy, comparison with *forcipatum*), ESAKI (1932: 1588) (redescription, habitus, figure, distribution, host plants), ISHIHARA (1947: 69) (listed, figures), ESAKI (1950: 202) (redescription, habitus, distribution), MIYAMOTO (1962: 80) (redescription, host plants, habitat, distribution), KERZHNER (1964: 364) (records), LEE (1971: 214) (in key, redescription, photo, figure, records, distribution), 500 (catalogue, distribution), HIURA (1977: 106) (diagnosis, photo, record, distribution, bionomics), JOSIFOV & KERZHNER (1978: 164) (synonymy, records), KANYUKOVA (1988: 913) (in key, figures, distribution), KWON et al. (2001: 369) (catalogue, host plants, distribution), DERZHANSKY et al. (2002: 362) (type material), GÖLLNER-SCHIEDING (2006: 167) (catalogue, distribution), YAMAMOTO et al. (2009: 33) (host plants), VINOKUROV et al. (2010: 225) (catalogue, distribution), YAMAMOTO & HAYASHI (2011: 145, 150) (in key, records, diagnostic characters, figures), YAMAMOTO & HAYASHI (2012: 504) (redescription, photos of adults and larvae, host plants, distribution), TSAI & RÉDEI (2015b: 30) (figures).
- Acanthosoma virens*: LETHIERRY & SEVERIN (1893: 253) (catalogue, distribution), KIRKALDY (1909: 172) (catalogue, distribution).

Material examined. TAIWAN: TAICHUNG Co.: Wuling Farm, 15.iv.2013, leg. S. Wu (1 ♀ NCHU). NANTOU Co.: Kahoerhsan, 7.v.1992, sweeping net, leg. W.T. Yang, 1447–728 (1 ♂ NMNS).

Diagnosis. The species can be readily recognized by the combination of the following characters: humeri rounded, not produced; connexival plates with narrow (not wider than tibia) black markings enclosing intersegmental sutures; genital capsule of male with a pair of long, slender, posteriorly strongly diverging posterolateral projections; posterior margin of laterotergite VIII of female truncate. ESAKI (1932, 1950), ISHIHARA (1947), MIYAMOTO (1962), LEE (1971), HIURA (1977), KANYUKOVA (1988), and YAMAMOTO & HAYASHI (2012) provided redescriptions and illustrations which are useful for recognizing this species.

Etymology. The species epithet is the Latin noun *forficula* (feminine diminutive form of *forfex*) ‘a pair of small scissors’ in apposition; ending not to be changed.

Bionomics. The following plant species were recorded as host plants of *A. forficula* in Korea: *Acanthopanax chiisanensis* Nakai and other unspecified *Acanthopanax* spp. (Araliaceae), *Cornus controversa* Hemsl., *C. kousa* Bürger ex Hance, *C. macrophylla* Wall., *C. walteri* Wangerin (Cornaceae) (KWON et al. 2001). *Cornus controversa* and the following additional species were reported from Japan: *Carpinus cordata* Blume and *C. japonica* Blume (Betulaceae), *Berchemia racemosa* Siebold & Zucc. (Rhamnaceae) (YAMAMOTO et al. 2009). The host plants in Taiwan are unknown.

Distribution. The species has been recorded from the Russian Far East, Japan, and Korea. There is only a single old record from the Khabarovsk Krai (‘Amuria’) (REUTER 1881), VINOKUROV et al. (2010) regarded it as questionable. The records from China (HSIAO & LIU 1977 and subsequent authors) are based on misidentification, most of them apparently pertain to *A. forfex* Dallas, 1851 (TSAI & RÉDEI 2015b); the occurrence in the country is in need of confirmation, as we could not see any voucher specimens. We present the first record from Taiwan. The available Taiwanese specimens do not differ from specimens from Japan and the Russian Far East.

Summary of known records: **RUSSIA: FAR EAST TERRITORY:** Khabarovsk Krai: Amuria? [= Amur Region] (REUTER 1881, as *A. virens*); Primorsky Krai (KERZHNER 1964, KANYUKOVA 1988, VINOKUROV et al. 2010). — **JAPAN: HONSHU:** Izu! (HNHM), Kanagawa! (SEHU). **SHIKOKU** (YAMAMOTO & HAYASHI 2012). **KYUSHU:** Kirishima!, Kyoto! (SEHU). **HOKKAIDO:** Shikotsuko!, Nopporo!, Sapporo!, Katsurasawa!, Yuni! (SEHU). **OKI ISLANDS:** Dogo (HAYASHI et al. 2006). — **KOREA: NORTH; SOUTH** (KWON et al. 2001). — **TAIWAN: TAICHUNG Co.!**; **NANTOU Co.!**

Acanthosoma sichuanense (Liu, 1980)

(Figs 84–85)

Anaxandra sichuanensis Liu, 1980: 234. Holotype: ♂, China: Sichuan, Emeishan [= Mt. Emei]; TMNH? (not found; TSAI & RÉDEI 2015b). Selected as correct original spelling by TSAI & RÉDEI (2015b: 36).

Anaxandra sichanensis: LIU (1980: 236). Incorrect original spelling.

Acanthosoma sichuanense: TSAI & RÉDEI (2015b: 36) (redescription, photos, figures, distribution).

Material examined. TAIWAN: TAITUNG Co.: Haituan, Provincial Rd. No. 20 (157.5 km), 19.vi.2005, light trap, leg. J.H. Chen, NMNS ENT 5019-145 (1 ♂ NMNS).

Bionomics. Unknown.

Distribution. The species is widely distributed all over the Oriental parts of China (TSAI & RÉDEI 2015b). We present the first record for Taiwan; the previous record of *A. rufescens* from the country (TSAI & RÉDEI 2015b) pertains to this species.

Remarks. The identity of this species was clarified, description of the genitalia, several illustrations, records, and a bibliography were provided by TSAI & RÉDEI (2015b). In the same paper we recorded *A. rufescens* Dallas, 1951 from Taiwan based on a single male. The specimen (Figs 84–85) was not before us during preparation of that manuscript and its subsequent reexamination after the paper has been published revealed that it represents *A. sichuanense*. Therefore the record of *A. rufescens* from Taiwan (TSAI & RÉDEI 2015b) is based on misidentification and pertains to *A. sichuanense*.

Acanthosoma expansum Horváth, 1905

(Figs 16–19, 42–44, 55, 86–91, 95–98)

Acanthosoma distincta (non Dallas, 1851): SCOTT (1874: 290). Misidentification (ESAKI 1926: 199).

Acanthosoma expansum Horváth, 1905: 413. Syntypes: ♂, ♀, Japan: Sapporo; HNHM!

Acanthosoma expansum: ESAKI (1926: 199) (type material, figures, distribution), ESAKI (1932: 1590) (redescription, habitus, distribution, host plants), ISHIHARA (1947: 69) (diagnosis, figures, host plant, distribution), ESAKI (1950: 204) (redescription, habitus, distribution), MIYAMOTO (1962: 81) (redescription, host plant, habitat, distribution), KERZHNER (1964: 364) (records, distribution), HIURA (1977: 106) (listed, figure, distribution), HSIAO & LIU (1977: 179) (in key, redescription, photo, figures, distribution), LIU (1979: 56) (listed), ZHANG & SIE (1987: 70) (listed, distribution), KANYUKOVA (1988: 912) (in key, figure, distribution), LIU (1988: 122) (record, distribution), LIU (1992: 132) (records, distribution), BU & ZHENG (1997: 207) (redescription, figure, record, distribution), LEI & ZHOU (1998: 42) (listed, distribution), HUA (2000: 166) (listed, distribution), KOBAYASHI & TACHIKAWA (2004: 286) (description of figures of preimaginal stages, host plants, bionomics, phenology, distribution), GÖLLNER-SCHIEDING (2006: 167) (catalogue, distribution), KANYUKOVA & MARUSIK (2006: 173) (listed, distribution), XUE & BU (2006: 225) (redescription, distribution), YAMAMOTO et al. (2009: 33) (host plants), HAN & LIU (2010: 158) (records, distribution), YAMAMOTO & HAYASHI (2011: 150) (in key), YAMAMOTO & HAYASHI (2012: 504) (redescription, distribution).

Acanthosoma expansa: KIRKALDY (1909: 171) (catalogue, distribution).

Acanthosoma expansum: VINOKUROV et al. (2010: 225) (catalogue, distribution).

Type material examined. LECTOTYPE (present designation): ♂, 'Japonia [printed] \ Sapporo [handwritten] \ Matsumura [printed]', 'expansum [handwritten red underline] \ det.Horváth [printed]'; pinned, both antennae lacking, left humeral process broken; deposited in HNHM (Figs 95–97). PARALECTOTYPE: ♀, 'Japonia' [printed], with type label as in lectotype; pinned, segments III–IV of both antennae, tarsus of left middle leg, tarsal segment II of right middle leg lacking; deposited in HNHM (Figs 98–99).

Additional material examined. TAIWAN: TAICHUNG Co.: Lishan, 10.v.1964, leg. C.T. Yang (1 ♀ NCHU); Dasyeshan logging Rd. 32.5 k, 9.v.2011, at light, leg. W.M. Hunting (1 ♀ NCHU). NANTOU Co.: Meifeng 2150 m, v.1984, Malaise trap, leg. K.S. Lin & K.C. Chou (1 ♂ [dissected] TARI); Tsuifeng–Sung kang, 23.iii.1977, leg. Y. Notsu, NSMT-I-He 34908 (1 ♀ NSMT); Sung kang, 7.vii.1995 (1 ♂ OMHJ); Tsuifeng, 14.iii.1979, leg. A. Shinohara, NSMT-I-He 34907 (1 ♀ NSMT); Jenai Chiepei, 7.v.1992, sweeping net, leg. W.T. Yang, NMNS ENT 1447–1604 (1 ♀ NMNS). CHIAYI Co.: Arisan, 18–30.ix.1949, Coll. T. Maa (1 ex. [abdomen missing] TARI).

Preimaginal stages. Eggs and all larval instars were described and illustrated by KOBAYASHI & TACHIKAWA (2004).

Bionomics. The following species were recorded as host plants of *A. expansum* in Japan: Rosaceae: *Rubus phoenicolasius* Maxim., *R. amabilis* Focke var. *aculeatissimus* T.T. Yu & L.T. Lu, *R. crataegifolius* Bunge; Caprifoliaceae: *Sambucus racemosa* L. var. *kamtschatica* E.L. Wolf (YAMAMOTO et al. 2009). Newly hatched larvae collected in Sapporo were successfully reared to adults on fresh fruits of *Sambucus* sp. by the first author under laboratory conditions. Its host plants in China and Taiwan are unknown.

The species is univoltine in Japan. Copulation occurs in May and June, adults of the new generation appear from August. It overwinters in adult stage (KOBAYASHI & TACHIKAWA 2004).

Distribution. Summary of known records: **RUSSIA: FAR EAST TERRITORY:** Kuril Islands (KERZHNER 1964, KANYUKOVA & MARUSIK 2006, VINOKUROV et al. 2010, MIYAMOTO & HAYASHI 2012). — **JAPAN: HONSHU:** Tokyo!, Kanagawa!, Nara!, Ibaraki! (SEHU), Mt. Mitsutoge! (HNHM). **SHIKOKU:** Mt. Tsurugi! (HNHM). **KYUSHU** (MIYAMOTO & HAYASHI 2012). **HOKKAIDO:** Kitami!, Jozankei!, Sapporo!, Yubari!, Hidaka!, Nukabira! (SEHU). — **CHINA: SHAANXI:** Zhouzhi!, Foping: Liangfengya! (NKUM). **HUBEI:** Shennongjia!, Changyang! (NKUM). **ZHEJIANG:** Mt. Fengyang!, Wuyanling! (NKUM). **SICHUAN:** Wolong!, Mt. Emei!, Guan County (HSIAO & LIU 1977), Mt. Wu (BU & ZHENG 1997). **GUIZHOU:** Mt. Fanjing! (NKUM). **YUNNAN:** Lushui, Yunlong: Mt. Zhiben, Weixi: Pantiang (LIU 1992). **GUANGXI:** Mt. Mao'er! (NKUM). **TIBET:** Zayü!, Bomê!, Yi'ong! (NKUM), Nyalam (ZHANG & SIE 1987). — **TAIWAN: TAICHUNG Co.!**; **NANTOU Co.!**; **CHIAYI Co.!**

Remarks. The species was described based on an unspecified number of males and females collected in Sapporo, Japan (HORVÁTH 1905). A male from Sapporo and a female from 'Japonia' [= Japan], both bearing G. Horváth's handwritten type labels, were located in the HNHM (Figs 95–99). Apparently both specimens are syntypes, and the male (Figs 95–96) is hereby designated as lectotype.

Specimens from Taiwan (Figs 88–91) conspicuously differ from specimens from Japan (Figs 86–87) and China in their long and elevated humeral processes (greatest width of pronotum across tips of humeral processes: Taiwan: ♂ 7.98–8.28 mm, ♀ 9.80–10.30 mm, Japan: ♂ 6.87–7.87 mm, ♀ 8.08–9.19 mm). Members of the population in Taiwan are also somewhat smaller than those from Japan (Taiwan: ♂ 11.9–12.2 mm, ♀ 13.7–14.2 mm, Japan: ♂ 12.2–13.1 mm, ♀ 14.4–15.2 mm), and their body appear slightly more narrow (greatest width of body measured posteriad of humeri: Taiwan: ♂ 5.35–5.45 mm, ♀ 6.06–6.56 mm,

Japan: ♂ 5.85–6.26 mm, ♀ 6.46–7.17 mm). As no difference could be found in the male and female genitalia of the two phenotypes, they are considered conspecific.

This species should be removed from *Acanthosoma* (TSAI & RÉDEI 2015b), but for the present it is tentatively cited in the original combination.

Discussion

Twelve species of *Acanthosoma* are recorded from Taiwan in the present paper. Five of them (42 %) (*A. asahinai*, *A. atayal* sp. nov., *A. axicia* sp. nov., *A. fallax* sp. nov., *A. pugnax* sp. nov.) are endemic to Taiwan; *A. haemorrhoidale* is represented by an endemic subspecies (*A. h. formosanum* subsp. nov.). All new species and subspecies inhabit the mountainous regions of Central Taiwan, at 1500–2500 m in altitude. It is remarkable that each endemic Taiwanese species of *Acanthosoma* is probably closely related to a species of the Asian mainland: *A. asahinai* is apparently a sister species of *A. labiduroides*; *A. pugnax* sp. nov. of *A. montanum*; *A. axicia* sp. nov., *A. fallax* sp. nov. and *A. atayal* sp. nov. of a yet undescribed species in China to be described in another publication. This suggests that the high endemism of *Acanthosoma* in Taiwan is probably a result of colonization from the Asian mainland through land bridges during glacial periods and subsequent vicariant isolation and divergence events during interglacial periods of the Pleistocene.

Species of *Acanthosoma* that occur in but not endemic to Taiwan include six species. These are results of speciation events in the Asian mainland and subsequent colonization of Taiwan during the Pleistocene. These can be grouped as follows:

East Asian (Manchurian-Japanese) elements: distributed in Japan and the neighbouring parts of the Korean Peninsula and Manchuria. Species included: *A. crassicaudum*, *A. forficula*. These species are connected to the zone of temperate deciduous forests; they do not enter the zone of subtropical semievergreen and deciduous forests in the Asian mainland, neither even the transitional region of humid warm-temperate deciduous woodlands between the two zones. Their occurrence in Taiwan is clearly extrazonal; during the Pleistocene glacial periods they probably occupied lower elevations, and retreated to higher altitudes following the area contractions of temperate forests.

Eastern Himalayan-Japanese elements: distributed in a corridor-shaped area extending from the Southeastern margin of the Tibetan Plateau (Hengduan Mountains) towards the northeast through the Yunnan-Guizhou Plateau, and colonizing mountainous regions of the four main islands of Japan. Species included: *A. expansum*, and tentatively *A. firmatum*. This distribution type is mainly influenced by the high altitude (and apparently the montane vegetation), thus it is extrazonal. *Acanthosoma expansum* is apparently a result of speciation and subsequent expansion from refugia in the East Himalayas. The distribution of *A. firmatum* is unsatisfyingly known partly because of its rarity, partly because of the long confusion about the identity of this species in the literature (TSAI & RÉDEI 2015b).

Southern Chinese elements: distributed in southern China. Species included: *A. sichuanense*. This species is restricted to zone of humid warm-temperate deciduous woodlands. Its occurrence in Taiwan is zonal.

Sub-Himalayan elements: distributed along the southern ranges of the Himalayas, extending into subtropical parts of Central and South China along the Yunnan-Guizhou Plateau. Species included: *A. laevicornis*. This species is connected to the subtropical semievergreen and deciduous forests of the Sub-Himalayan belt and South China. Its occurrence in Taiwan is zonal.

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