A THESIS

FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Systematic review of subfamily Phylinae (Hemiptera: Miridae) in Korean Peninsula with molecular phylogeny of Miridae

By

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Department of Agricultural Biotechnology

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SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL OF

SEOUL NATIONAL UNIVERSIITY

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FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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ABSTRACT

Systematic review of subfamily Phylinae (Hemiptera: Miridae) in Korean Peninsula with molecular phylogeny of Miridae

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The study conducted two themes: (1) The systematic review of subfamily Phylinae (Heteroptera: Miridae) in Korean Peninsula, with brief zoogeographic discussion in East Asia, and (2) Molecular phylogeny of Miridae: (i) Higher group relationships within family Miridae, and (ii) Phylogeny of subfamily Phylinae.

In systematic review a total of eighty four species in twenty eight genera of Phylines are recognized from the Korean Peninsula. During this study, twenty new reports including six new species were investigated; and purposed a synonym and revised recombination. Keys to genera and species, diagnosis, descriptions including male and female genitalia, illustrations and short biological notes are provided for each of the species.

Molecular based higher group relationships, and detail phylogenetic relationships of subfamily Phylinae were conducted. The higher group relationships were analyzed using 159 taxa, including seven subfamilies and six outgroups. The results of analysis indicated that subfamilies Cylapinae, Deraeocorinae, Isometopinae, Mirinae and Phylinae are monophyly, whereas Bryocorinae and Orthotylinae are paraphyletic. Dicyphini (of Bryocorinae) occurs as a sister group to all remaining mirid taxa.

Further, the phylogenetic analyses of subfamily Phylinae based on 68 taxa including 57 ingroup and 11 outgroup taxa (which include taxa of other subfamilies in Miridae except Psallopinae) were conducted. The results of analyses assure that, tribes Auricillocorini and Hallodapini are monophyletic, tribe Phylini is non-monophyletic but its member do not fall into other tribes, *Teleorhinus* (of Pronotocrepini) lies within Phylini, and *Lasiolabops* is separated from Phylini. Similary, present analyses argue with the monophyly of Leucophoropterini and Pilophorini.

Key words: Miridae, Molecular Phylogeny, Phylinae, Taxonomy, The Korean Peninsula

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PART I. Taxonomic review of the sub-family Phylinae (Hemiptera: Miridae) in the Korean Peninsula

ABSTRACT

The family Phylinae (Miridae) is revised from the Korean Peninsula. Prior to this study sixty four species in twenty two genera were reported from the Korean Peninsula (Kerzhner and Josifov, 1999; Kwon et al., 2001) but additionally twenty species were added, therefore a total of eighty four species in twenty eight genera are recognized including two new genus and six new species. Six new species including a new genus, *Orthophylus* Duwal and Lee, 2011 are: *Moissonia kalopani* Duwal and Lee, 2011; *M. yasunagai* Duwal and Lee, 2011; *Orthophylus yongmuni* Duwal and Lee, 2011; *Psallus cheongtaensis* Duwal et al., 2012; *P. ernsti* Duwal et al., 2012; and *P. suwonanus* Duwal et al., 2012. Likewise, four genera, *Atractotomoidea* Yasunaga, *Moissonia* Reuter, *Monosynamma* Scott, and *Pseudophylus* Yasunaga each with a species, *A. castanea* Yasunaga, 1999; *M. befui* Yasunaga, 1999; *M. bohemanni* (Fallen, 1826) and *P. stundjuki* (Kulik, 1973) and other species like, *Campylomma chinensis* (Schuh, 1984); *C. miyamotoi* (Yasunaga, 2001); *Europiella artemisiae* (Becker, 1864); *E. kiritshenkoi* Kulik, 1975; *E. miyamotoi* (Kerzhner, 1988); *Psallus cinabarinus* Kerzhner, 1979; *P. flavescens* Kerzhner, 1988; *P. loginovae* Kerzhner, 1988; *P. roseoguttatus* Yasunaga and Vinokurov, 2000; and *Pherolepis kiritshenkoi* (Kerzhner, 1970) are reported for the first time from the Korean Peninsula. A new genus *Euplagiognathus* Duwal n. gen. is erected to accommodate *Plagiognathus lividellus* (Kerzhner, 1979). Moreover, *Hallodapus fenestratus* Linnavuori, 1961 is synonymized to *Hallodapus centrimaculatus* (Poppius, 1914). And *Plagiognathus vitellinus* (Schuh, 2001) is recombined to *Parapsallus* Wagner, 1952. *Europiella albipennis* (Fallen, 1829) is removed

from the Korean list. Keys to genera and species, diagnosis, descriptions, male and female genitalia illustrations for all possible species and short remarks are provided for the Korean phyline fauna.

Keywords: Hemiptera, Heteroptera, Miridae, Phylinae, new genus, new species, new records, revision, the Korean Peninsula.

Historic Review

Linnaeus was first to recognize the higher group "Hemiptera" including the true bugs [Systema Naturae, 1758]. The concept was followed by Fabricius (1803) on monograph of the group as "the Systema Rhyngotorum". Later on, Latreille (1803) formally divided the Hemiptera into two sub-orders, Homoptera and Heteroptera and he further grouped the Heteroptera into Geocorisae and Hydrocorisae. Afterwards, several terminologies were developed on grouping and recgnization of the Heteroptera such as, Amphibicorisae (Dufour, 1833), Gymnocerata and Cryptocerata (Fieber, 1861), etc. The first comprehensive subfamily-group classification of the Heteroptera was published by Amyot and Serville (1843) "The Histoire Naturelle des insects Hemiptéres". Beside such studies, several arguments had been arise on division of Hemiptera by Latreille (Borror, Triplehorn, and Johnson, 1989) which was later on solved by Schuh and Slater (1995), in which they provide strong evidence of monophyletic growth of four groups in Hemiptera as: Auchenorrhyncha, Sternorrhyncha, Coleorrhyncha and Heteroptera. The worthful contributions on Heteropetra by different researchers at various time periods are decribed by Schuh and Slater (1995).

Beside the complexity in classification of family Miridae, Reuter (1905; 1910) figure out the outline mainly based on pretarsal structures which are later on considered as a basic character (Knight, 1941; Leston, 1959; Carvalho and Leston, 1952; Odhiambo, 1961; Schuh, 1974; 1976; Cobben, 1978). This concept was given a refined priority after the comprehensive studies of female (Slater, 1950) and male genitalia (Kelton, 1959), testis follicle numbers (Leston, 1961) and a reevaluation of pretarsal structures (Schuh, 1976). The higher classification proposed by Carvalho (1952) was rearranged by Schuh (1995) in which several placements were re-organized: Isometopinae was transferred into Miridae (Carayon, 1958; Slater and Schuh, 1969), tribe Pilophorini was placed under subfamily Phylinae (Schuh, 1974), family Psallopinae was erected as separate family and reorganization of tribes in family Bryocorinae and Orthotylinae. Recently, Cassis and Schuh (2012) updated the classification of Miridae which recognized eight subfamilies and thirty-five tribes and provided strong morphological characters to support each tribe.

The study of Korean Heteroptera was conducted by Micheal Josifov (North Korea) from 1970 to1990; Izyaslav Moiseevich Kerzhner, (North and South Korea) from 1972 to 1995; Miyamoto and Lee (Jeju-do) in 1966, and later on Korean researchers organized the Korean Heteroptera fauna as catalogue in 1971, 1988, 1994 and 2001. Micheal Josifov had described and reported several new species from North Korea which includes about one hundred and eighteen mirids among which sixty were phyline species (Josifov, 1992). However, Kerzhner, and Miyamoto and Lee comprehensively studied heteropteran bugs from southern region. The complete works can be seen in catalogue by Kerzhner and Josifov (1999). Herein, after a decade, due to recent surveys several new species and reports are added (Duwal et al., 2010a; Duwal and Lee, 2011; Duwal et al., 2012) to the Korean Phylinae fauna.

Introduction

The subfamily Phylinae belongs to family Miridae (Heteroptera: Cimicomorpha) is the second largest group in family miridae, which is described to comprises of six tribes (Wyniger, 2010; Cassis and Schuh, 2012) including tribe Pronotocrepini, but here only five tribes: Auricillocorini, Hallodapini, Phylini, Leucophoropterini, and Pilophorini (Schuh, 1974; 1976 Wyniger, 2010; Menard and Schuh, 2011) (Fig. 1), are considered because during this study, Pronotocrepini shows close affinity to tribe Phylini in the molecular analyses. Among five, only four tribes: Hallodapini, Phylini, Leucophoropterini and Pilophorini exist in Korea.

About two hundred and ninty genera of phyline bugs are described from the world (http://research.amnh.org/pbi/bugs/phylinae.html, 2012), one thousand and eighty six species in one hundred and sixty four genera are described from Palearctic region (Kerzhner and Josifov, 1999), and sixty four species in twenty two genera were recognized in Korea (Kerzhner and Josifov, 1999; Kwon et al., 2001) previously. Additionally, twenty species were added, including a new genus and six new species. Six new species including a new genus *Orthophylus* Duwal and Lee, 2011 are: *Moissonia kalopani* Duwal and Lee, 2011; *M. yasunagai* Duwal and Lee, 2011; *Orthophylus yongmuni* Duwal and Lee, 2011; *Psallus cheongtaensis* Duwal et al., 2012; *P. ernsti* Duwal et al., 2012; and *P. suwonanus* Duwal et al., 2012. Likewise, four genera, *Atractotomoidea* Yasunaga, *Moissonia* Reuter, *Monosynamma* Scott, and *Pseudophylus* Yasunaga each with a species, *A. castanea* Yasunaga, 1999; *M. befui* Yasunaga, 1999; *M. bohemanni* (Fallen, 1826) and *P. stundjuki* (Kulik, 1973) and other species like, *Campylomma chinensis* (Schuh, 1984); *C. miyamotoi* (Yasunaga, 2001); *Europiella artemisiae* (Becker, 1864); *E. kiritshenkoi* Kulik, 1975; *E. miyamotoi* (Kerzhner, 1988); *Psallus cinabarinus* Kerzhner, 1979; *P. flavescens* Kerzhner, 1988; *P. loginovae* Kerzhner, 1988; *P. roseoguttatus* Yasunaga and Vinokurov, 2000; and *Pherolepis* *kiritshenkoi* (Kerzhner, 1970) are reported for the first time from the Korean Peninsula. A new genus, *Euplagiognathus* Duwal n. gen. is erected to accommodate *Plagiognathus lividellus* (Kerzhner, 1979). Therefore, a total of eighty four species in twenty eight genera are finally determined in the temperate and cold temperate regions of the Korean Peninsula. Moreover, *Hallodapus fenestratus* Linnavuori, 1961 is synonymized to *Hallodapus centrimaculatus* (Poppius, 1914) and *Plagiognathus vitellinus* (Schuh, 2001) recombined with *Parapsallus* Wagner, 1952 which keeps resurrection of the original generic status. *Europiella albipennis* (Fallen, 1829) is excluded from the Korean list.

The congeners of Palearctic fauna including few subtropical species are found in the Korean Peninsula, and are common to their neighbouring countries, Japan, Northern China, and Far eastern Russia (which are later on discussed under zoogeography). The phyline bugs inhabited in wide range of circumstances like weeds, grasslands, shrubs, cultivated lands, and over reaching tall trees, etc. These tiny bugs abundantly aggregated on newly growing leaves, flowers, seedlings often causing serious damage on host plant, e.g., *Europiella puspae* (Duwal et al., 2011) however, some were observed predating on Coleopteran or lepidopteran larvae (Wheeler, 2001; Duwal et al. 2012). Therefore, several studies indicated that members of this subfamily favor mixed feeding habit (Schuh, 1974; 1984; Yasunaga, 1999; 2001a; 2001b; Yasunaga and Vinokurov, 2000; Wheeler, 2001, etc.).

In general, these tiny bugs are nearly 2-5 mm in length, variously shaped (females are wider than males), dark to beautifully colored, pronotum without collar except members of tribe Hallodapini which bears distinct neck like upturned collar, ocelli absent, pretarsal segments variously shaped, slender hair like to thick tumoid structures. The general morphological structure of the phyline bugs are given in Figure 2. Male genitalia, endosoma usually sclerotized, simple, slender, S-, or J- or C-shaped with or without secondary gonopores, right and left parameres distinctly assymetical, left paramere large in structure and variously modified depending on genus and species, right paramere simple, leaf like with variously modified apex, and female genitalia, bursa copulatrix with differently shaped small, or medium, or large sclerotized ring, and posterior wall with or without specific semisclerotized structures.

Materials and Methods

About one thousthand and five hundred specimens were examined which were collected between 2008 to 2011, mostly from all provinces of South Korea (Gyeonggi-do, Gangwon-do, Chungcheongbuk-do, Chungcheongnam-do, Jeollabuk-do, Jeollanam-do, Gyeongsanbuk-do, Gyeongsangnam-do, Jeju-do and several Islands) and materials are preserved in the Biosystematics Laboratory, Seoul National University, South Korea (SNU). Additional materials from the following research institutes and personal collections were also examined: National Academy of Agricultural Science, South Korea (NAAS); the private North Korean collection (ex M. Josifov) of E. Heiss, the Tiroler Landesmuseum, Innsbruck, Austria (TLIA); T. Yasunaga's collection, Nagasaki, Japan (TYCN); and a few related specimens collected by I.M. Kerzhner held in the Laboratory of Insect Taxonomy, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (ZISP). Specimens examined are retained in the collections and indicated in the text by their respective institutional acronyms.

For examination of male and female genitalia, pygophore (male) or the whole abdomen (female) is carefully cut off from the body. Each of the cut segments were separately boiled in 10% KOH solution for 30 min (male) and 2-2.30 hours (females) at 70℃ temperature to soften the segment as well as to clear the extraneous materials. After boiling, each softened abdominal segments were washed and dissected in distilled water with the help of fine sharp forceps. From the male abdomen/mostly pygophore, the genital structure, endosoma is carefully pulled out and also parameres and phallotheca are separated and transferred into a glass slide with a drop of glycerin for examination. Similary, for the female genital segment after removing external integuments and wastes, anterior and posterior paired valvifers were carefully separated. Therefore, when separated base of dorsal and ventral sides of first valvifer, brusa copulatrix (dorsal labial plate) and vestibules, and the base of dorsal side of second valvifer, the sclerites in posterior wall were transferred into a glass slide with a drop of glycerin, and were examined under the fine microscope for illustration and/or study and after the observation, finally observed genital structures were preserved into a microvial with a glycerin for further re-examination.

Habitus photographs in figures were prepared using a camera model: “14.2 color mosaic” taken through the objective of a Leica DE/S8 APO microscope. All genitalic illustrations were prepared using a Leica DE/DM 4000B microscope.

All measurements are in millimeters. The terminology of the genitalia mainly follows Cassis (2008) for male, and for female, Davis (1955), Schuh (2006), Schuh & Wu (2009), Wyniger (2006), and Yasunaga & Schwartz (2007). Only selected references are cited in the synonymic list of the known taxa because comprehensive catalogues are now available (Schuh, 1995; Wheeler & Henry, 1992; Kerzhner & Josifov, 1999).

Abbreviations in reference citation:

cat.: catalogue

diag.: diagnosis

desc.: description

disc.: discussion

re-diag.: revised diagnosis

fig.: figure

eng. transl.: english translation

n. gen.: new genus

n. sp.: new species

Abbreviations of depositories

NAAS: National Academy of Agricultural Science, South Korea

SNU: Seoul national University, South Korea

TLIA: Tiroler Landesmuseum, Innsbruck, Austria

TYCN: Tomohide Yasunaga’s collection, Nagasaki, Japan

ZISP: Zoological Institute, St. Petersburg, Russia

Results

Systematic Accounts

Order: Hemiptera

Suborder: Heteroptera

Infraorder: Cimicomorpha

Superfamily: Miroidea

Family: Miridae

Subfamily: Phylinae

Systematics

Subfamily Phylinae Douglas and Scott, 1865 애장님노린재아과

The cosmopolitan group, subfamily Phylinae are recognized by a pronotum without collar (except in tribe Hallodapini and some members of Auricillocorini), setiform paramepodia (except tribe Pilophorini), fleshy pulvilli, claws without tooth, a boat shaped left paramere, a sclerotized C-, or S-, or J-shaped endosoma mesially slightly curved or coiled, anterior wall with variously shaped sclerotized rings, and posterior wall not developed (except in Pilophorini). This subfamily has controversies in tribe lavel grouping, and in recently studies it is considered to consist of six tribes (Cassis and Schuh, 2012): Auricillocorini, Hallodapini, Leucophoropterini, Phylini, Pronotocrepini and Pilophorini. But the molecular dataset analysis in this study shows that a member of tribe Pronotocrepini has close genetic affinity with tribe Phylini, therefore only five tribes are confirmed.

Key to tribes of subfamily Phylinae:

1) The members with flattened or weakly developed pronotal collar 2

− The members without flattened pronotal collar 4

2) Hemelytron with wide or recognizable maculae anteriorly at the level of apex of clavus and corium ....Hallodapini

− Hemelytron with bright coloured transversed patterens, cuneal incisures obsolete, cuneal fracture right angle to the corial margins, and weakly fleshy parempodia convergent apically ....Auricilloroini

3) Base of the claws thickened with series of denticles ....Leucophoropterini

− Base of the claws not toothed 4

4) Parempodia lamellate and convergent, and simple C-or J-shaped endosome with or without median shaft ....Pilophorini

− Parampodia setiform, variously shaped endosoma ....Phylini

Tribe Hallodapini Van Duzee, 1916 꼬마장님노린재족

The members of tribe Hallodapini are usually distinguished by dark coloration with contrasting pale (or white) maculae on hemelytron; pronotum with well developed flattened collar; eyes either contiguous with the anterior margin of pronotum or distinctly removed from the posterior margin of vertex (located anteriorly); pronotum always constricted anteriorly; hemelytron either straight or sinuate laterally; abdomen narrow or constricted basally; parempodia hair-like and parallel; endosoma usually very long, S-shaped, or partially or completely coiled; gonopore usually developed or occasionally indistinct; left paramere always broad; right paramere comparatively small and leaf-like; phallotheca L- or C- shaped with tapering or broad apex.

The Hallodapini, consisting of approximately two hundred and seventy species in forty nine genera (Schuh, 1995; Wyniger, 2006) worldwide, and in Palearctic region eighty seven species in twnety genera (Kerzhner and Josifov, 1999). The habit and habitat of hallodapini are mysterious, however considered as ground dwelling. Females are often brachypterus and rarely macropterous.

Key to Korean genera of tribe Hallodapini

1) Frons with pointed process; dorsum bare or with hardly visible scattered flattened appressed shining setae (Fig. 3A) ……..……………….…………………..*Acrorrhinium*
- Frons without pointed process, dorsum clothed with uniformly distributed setae …...2
2) Eyes contiguous with posterior margin of head; clypeus separated from frons by distinct depression; abdomen not constricted at base; and hemelytron parallel laterally

(Fig. 3C-E) ...……………….……………………………...…………....*Hallodapus*

3) Eyes located anterior than the posterior margin of head; clypeus not separated from frons; abdomen usually constricted at base; hemelytron sinuate (in macropterous forms) (Fig. 3B) ...………………….……………………...……...…..*Systellonotus*

Genus *Acrorrhinium* Noualhier, 1895 산꼬마장님노린재속

Acrorrhinium Noualhier, 1895: 175 (n. gen); Schuh, 1974 (desc.); 1984: 103 (diag.); 1995: 213 (cat.); Kerzhner and Josifov, 1999: 286 (cat.); Yasunaga, 2001a: 152 (diag.); Kwon et al., 2001: 166 (cat.).

Type species: *Acrorrhinium conspersus* Noualhier, 1895; monotypy.

Diagnosis. Recognized by elongated body, nearly parallel sided; yellow or deep brown coloration, either mottled or with contrasting maculae on hemelytron; rounded head; protuberant eyes far from anterior margin of pronotum; strongly convex frons spiniform; long antenna, more or less sub-equal to the body length; flattened collar of pronotum; clear demarcation line between anterior and posterior pronotum; hump like structure on scutellum; shining serious setae short and sparsely distributed; and hair-like parempodia.

Distribution. Afrotropical region, Australian region, Holarctic region, Oriental region.

Remarks. The genus *Acrorrhinium*, is described with twenty eight species in the world and two in the Palearctic region (Schuh, 1995; Kerzhner and Josifov, 1999; Zhang and Liu, 2010). These are widely distributed in the tropical and subtropical climatic conditions therefore, large number were reported from Oriental region. The biology for most species is unknown because all described species were collected on light trap, except few like *A. inexpectatum* was reported on bark and branches of *Quercus* and other deciduous trees

(Kerzhner, 1988c).

The genus is easily distinguished from other genera of Hallodapini by spniform frons.

***Acrorrhinium inexpectatum* (Josifov, 1978) 산꼬마장님노린재**

Figures: 3A, 4A-D

Cinnamus inexpectatus Josifov, 1978: 279 (n. sp.)

Acrorrhinium inexpectatum: Kerzhner, 1988c: 839 (key); Schuh, 1995: 214 (cat.); Kerzhner and Josifov, 1999: 286 (cat.); Yasunaga, 2001a: 152 (diag., fig.); Anufriev et al., 2001: 117 (eng. transl.); Kwon et al., 2001: 166 (cat.); Zhang and Liu, 2010: 31 (diag., figs.).

Diagnosis. Recognized by brown body coloration, small irregular spots on dorsum, spiniform frons with the apex weakly curved and tapering, extremely long labium reaching middle of abdominal segments, sparsely distributed short and sericeous setae, strongly twisted endosoma, and comparatively very small leafy right paramere with elongated apical protuberance (Fig. 4A, C).

Description. *Male*. Body large, elongated. COLORATION (Fig. 3A): Generally dark brown colored; dorsum dark brown, dull with small or larger pale speckles. Anterior region of head dark and posterior region pale; tylus black and shining; genae and gula pale with red margins. Hemelytron blackish brown, or usually dull with posterior margin of corium pale and entirely distributed with small and larger speckles; cuneus blackish and without speckles; membrane dark. Ventral body dark and shining. All antennae dark brown, dull bases and apices of segment I and II pale; segment I with two pale spots at the base of spine. Labium entirely dark. Legs dull; procoxa dark, meso and metacoxa pale; femora dull with pale spots subapically on posterior margin, and tarsus pale. SURFACE AND VESTITURE: Dorsum furnished with scattered minute, flattened shining, setae. STRUCTURE: **Head**: Anterior region of the head with a spine like structure; calli distinct with median demarcation line; larger region of mesoscutum visible dorsally; median region of scutellum somewhat raised; antennal segments comparatively longer, length of segment I more or less equal to the width of head across the eyes; vertex narrow; labium surpass the apex of metacoxae; dorsum completely shagreen. GENITALIA (Fig. 4A-D): **Endosoma**: Very long, twisted, apical processes joined with membranous structure, furnished with minute spines; secondary gonopore located subapically (Fig. 4A). **Phallotheca**: Broad, flattened and with blunt apex (Fig. 4D). **Left paramere**: Body large, structure as in figure 4B. **Right paramere**: Small, bulb like, apically terminates into elongated finger like structure (Fig. 4C).

Female. Not observed.

Specimens examined. South Korea: **Gangwon-do**: 1♂, Samcheok-si, Jeungsan-dong, 8.VIII.2011, on light trap, E.S. Kim. **Gyeongsanbuk-do**: 1♂, Gunwi-gun, Bugye-myeon, Namsan-ri, Mt. Palgong, 27.VII.1998, D.S. Ku.

Distribution. China, Korea, Russia.

Host. *Quercus* spp. (Kerzhner, 1988c)

Remarks. Though this species was reported from *Quercus* (Kerzhner, 1988c), any kind of biology is known in Korea since these were collected in light trap.

Genus *Hallodapus* Fieber, 1858 꼬마장님노린재속

Hallodapus Fieber, 1858: 307 (n. gen.); Schuh, 1974: 91 (desc., disc., key); 1984: 117 (diag.); 1995: 223 (cat.); Kerzhner and Josifov, 1999: 290 (cat.); Yasunaga, 2001a: 152 (diag.); Kwon et al., 2001: 166 (cat.); Wyniger, 2006: 236 (diag., disc.).

Type species: *Capsus coryzoides* Herruch-Schaeffer, 1839; monotypy.

Diagnosis. Recognized by small to medium sized body; basically brown coloration with contrasting white maculae on clavus and corium, flattened collar of the pronotum; a stridulatory device on the inner surface of the metafemora; setiform parempodia; and elongated thread like endosoma with developed subapical secondary gonopore.

Distribution. Afrotropical region, Australian region, Holarctic region, Oriental region.

Remarks. The genus *Hallodapus* is widely distributed in tropics and subtropics however few are described from Holarctic region. It consists of forty seven species described in the world, and three are recorded from the Korean Peninsula (Schuh, 1995, and Kerzhner and Josifov, 1999). Most of the authors described these were collected from meadows and grasslands, macropterous forms are easily attracted to the light.

Key to species of Korean *Hallodapus*

1) Pronotum comparatively smooth; head, pronotum and all appendages orange yellow; antennal segment I tinged with red and ventrally provided with a white stripe; hemelytron brown with two white maculae: anterior one entirely across the hemelytron posterior to the scutellum and posterior one adjacent to the cuneal fracture (Fig. 3D) ………………………..…………………………....*H. linnavuori*

\- Specimens with somewhat darker coloration; pronotum with irregular wrinkles; femora and dorsum reddish brown or more darker, anterior fascia or maculae various …………………...………………………………………………………………………2

2) Major part of hemelytron dull, anterior fascia developed into narrow stripe and not continues across the clavus; antennal segment I white with reddish ring at the base and apex (Fig. 3E) ...…………..…...………………………………..……..*H. pumillus*

- Base of clavus blackish brown, corium brown; anterior macula developed widely, extending from apex of scutellum to the subapical region of clavus; basa of antennal segment I dark brown and apex with red ring (Fig. 3C) ………......*H. centrimaculatus*

Hallodapus centrimaculatus **(Poppius, 1914), 노랑무늬꼬마장님노린재**

Figures: 3C, 4E-H

Tyraquellus centrimaculatus Poppius, 1914: 167 (n. sp.)

Hallodapus fenestratus: Linnavuori, 1961: 165 (n. sp.); Schuh: 1984: 124 (diag., disc.); 1995: 224 (cat.); Kerzhner and Josifov, 1999: 291 (cat.); Yasunaga, 2001b: 153 (diag., fig.); Anufriev et al., 2001: 117 (eng. transl.); Kwon et al., 2001: 166 (cat.). **New synonymy**.

Diagnosis. Recognized by dark brown dorsum with two contrasting white macula: one on the clavus posterior to the scutellum and other on the corium adjacent to the cuneal fracture, deep red cuneus; pale antennae with brown basal 1/3 of segment I and dark femora.

Description. *Male*. Medium sized, elongated oval. COLORATION (Fig. 3C): Generally dark brown body. Head and pronotum dark brown and dull. Hemelytron brown with two macula: one large on clavus posterior to the scutellum, and another on the corium quadrate and adjacent to the cuneal fracture; cuneus deep red. Venter dark brown. Antennae pale; basal half of segment I brown and apical margin with red ring, and segment III and IV tinged with red. Labium shining brown with darker apex. Pro-coxa brown; meso- and metacoxa and all trochanters pale; meta-femora blackish brown and somewhat tinged red at margins, except extreme bases; meta-tibia entirely pale. SURFACE AND VESTITURE: Dorsum furnished with scattered semierect or erect brown setae; head and pronotum completely shagreen. STRUCTURE: **Head**: Head with a median sulcus; length of antennal segment I longer than vertex width; labium reaching apex of metacoxae. GENITALIA (Fig. 4E-H): **Endosoma**: S-like, two apical processes supporting each other; secondary gonopore subapically located. **Phallotheca**: Narrow with pointed apex as in figure 4G. **Left paramere**: Body large with outgrowth protuberances as in figure 4E. **Right paramere**: Small, leaf like as in figure 4F.

Female. Not observed.

Specimens examined. **South Korea**: **Chungcheongbuk-do**: 1♂, Cheongju-si, 7.VII.2009, S. Jung.

Distribution. Japan, Java, Korea, Russia, Taiwan, Tropical Asia.

Host. Unknown.

Remarks. The observed specimen in this study was collected during random sweeping on various shrubs, so the specific host is unable to determine.

Hallodapus centrimaculatus is usually described as Oriental species which is morphologically very similar with the *H. fenestratus*, described from the Palearctic region (Linnavuori, 1961). The description and figure of hemelytron provided by the Linnavuori (1961) resembles the *centrimaculatus* but he didn't provide characteristic genital structure in his study. Consequently, when we examined the male genitalia of collected specimen it was found similar with the *centrimaculatus* as described in Schuh, 1984. Therefore, here *H. fenestratus* is synonymised to *H. centrimaculatus*.

***Hallodapus linnavuori* Miyamoto, 1966 꼬마장님노린재**

Figures: 3D, 5A-D

Hallodapus linnavuori: Miyamoto, 1966:433 (n. sp.); Schuh, 1984: 127 (disc.); 1995: 225 (cat.); Kerzhner, 1988c: 839 (key, figs.); Kerzhner and Josifov, 1999: 292 (cat.); Yasunaga, 2001a: 153 (diag., fig.); Anufriev et al., 2001: 117 (eng. transl.); Kwon et al., 2001:167 (cat.)

Diagnosis. Recognized by orange brown body; shining head and pronotum; brown hemelytron two white transversed macula: anterior one wide and across the corium and clavus and posterior one adjacent to cuneus; pale antennae and tibiae; reddish antennal segment I provided with a white longitudinal stripe ventrally.

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 3D): Generally orange brown body. Head, pronotum and mesoscutum shining, orange brown; and scutellum dark brown. Hemelytron brown with wide pale macula at middle and apex of corium; and cuneus deep red. All antennal segments pale, segment I redddish with white longitudinal stripe on ventral region. Labium pale brown with dark apex. Legs pale; pro- and base of mesocoxae brown; meta-femora pale apically tinged with red; and meta-tibia pale. SURFACE AND VESTITURE: Dorsum furnished with scattered semierect or erect pale brown setae; and head and pronotum partly shagreen. STRUCTURE: **Head**: Length of antennal segment I nearly equal to the width of vertex; labium reaching apex of metacoxae. GENITALIA (Fig. 5A-D): **Endosoma**: S-like, basal and apical curve deep, U-shaped, curved, apical process with a wide chitinized membrane (Fig. 5A). **Phallotheca**: Broad with blunt apex. **Left paramere**: As in figure 5B. **Right paramere**: Small as in figure 5C.

Female. Not observed.

Specimens examined. **South Korea**: **Jeollanam-do**: 1♂, Jangseong-gun, Mt. Bangjang, 24.VI.2010, on light trap, R.K. Duwal. **Jeju-do**: 1♂, Jeju-si, Jocheon-eup, Seanhl-ri, 26.VIII.1997, D.S. Ku.

Distribution. Japan, Korea, Russia.

Host. Unknown.

Remarks. The representative specimen is collected on light trap, so any kind of biology is unknown in Korea.

***Hallodapus pumilus* Horvath, 1901 대륙꼬마장님노린재**

Figures: 3E, 5E-F

Allodapus pumilis Horvath, 1901: 268 (n. sp.)

Hallodapus pumilus: Kerzhner, 1988c: 839 (key, fig.); Schuh, 1995: 226 (cat.); Kerzhner and Josifov, 1999: 292 (cat); Anufriev et al., 2001: 117 (eng. transl.); Kwon et al., 2001: 167 (cat.).

Diagnosis. Recognized by dark brown body and dorsum with two white macula: anterior one narrow, nearly obscure posterior to the scutellum, and posterior one wide, quadrate adjacent to the cuneal fracture; reddish dark antennae with pale segment I provided with red ring on base and apex; femora and basal half of tibiae reddish.

Description. *Female*. Medium sized, elongated. COLORATION (Fig. 3E): Generally brown body. Head, pronotum, mesoscutum and scutellum brown with lateral margins of later two black. Hemelytron brown with two maculae; anterior one narrow posterior to the scutellum and posterior one wide quadrate adjacent to the cuneal fracture; cuneus deep red; membrane greyish with white areas beneath the cuneus. Venter shining brown. Antennae brown; segment I pale with red rings on base and apex; base of segment II pale which gradient darker towards the apex; and segment III and IV tinged with red. Labium shining brown; and segment I and II tinged with red. Legs, pro- and base of mesocoxae brown; remaining parts of coxae and trochanters pale; meta-femora shining brown; meta-tibia pale with red stripe on the basal half region dorsally. SURFACE AND VESTITURE: Dorsum furnished with scattered semierect or erect brown setae; and head and pronotum shagreen.

STRUCTURE: **Head**: labium reaching apex of metacoxae. GENITALIA (Fig. 5E-F): Bursa copulatrix, Sclerotized rings asymmetrical, thin rimmed; dorsal labiate plate with chitinized structures laterally and centrally and furnished with minute spinules (Fig. 5F). Posterior wall with chitinized densely spinulus structure (Fig. 5E).

Male. Unable to observe.

Specimens examined. **South Korea**: **Chungcheongbuk-do**: 1♀, Damyang-gun, Mt. Sobaek (National Park), 25-26.V.2009, R.K. Duwal and S. Jung.

Distribution. Korea, Mongolia, Russia, Siberia.

Host. Grass lands of *Leymus mollis* (Kerzhner, 1988a).

Remarks. The representative specimen in this study was crawling around the sand near the damp where rotten logs were discarded.

Genus *Systellonotus* Fieber, 1858 개미사돈장님노린재속

Systellonotus Fieber, 1858: 326 (n. gen); Linnavuori, 1972: 40 (desc.); Kerzhner, 1988c: 840 (Key); Schuh, 1995: 235 (cat.); Kerzhner and Josifov, 1999: 297 (cat.); Yasunaga, 2001a: 154 (diag.); Kwon et al., 2001: 167 (cat.).

Type species. *Cimex triguttatus* Linnaeus, 1767; monotypy.

Diagnosis. Recognized by elongated body, nearly parallel sided or distinctly sinuate hemelytron, dark coloration of dorsum with contrasting white or pale transverse fascia usually two in number, constricted head behind the eyes seems like a short neck, eyes removed from anterior margin of pronotum, elongated antennae, flattened collar, and hair like parempodia.

Distribution. Holarctic region.

Remarks. The genus *Sytellonotus* is a small group comprises with approximately twenty described species (Schuh, 1995). Members of this genus inhabits in cold climatic conditions rather than tropical and subtropical region, except few exceptional cases of occurrence in South Africa: *S. brincki* (Schuh, 1974). In Korea it is represented with only one species.

Though the habits of *Systellonotus* are unknown, it is believed that they probably live in meadows or grasslands.

Systellonotus malaisei **Lindberg, 1934 개미사돈장님노린재**

Figures: 3B, 5G-K

Systellonotus malaise: Lindberg, 1934: 20 (n. sp.); Kerzhner, 1988c: 840 (key); Schuh, 1995: 236; Kerzhner and Josifov, 1995: 298 (cat.); Yasunaga, 2001a: 154 (diag., fig.); Anufriev et al., 2001: 118 (eng. transl.); Kwon et al., 2001: 167 (cat.).

Diagnosis. Recognized by dark brown body; brown hemelytron with reddish black cuneus and two transverse fascia: anterior one nearly fused in the middle of the clavus and another one adjacent to the cuneal fracture (in males); but in females hemelytron short twice as long as scutellum with continuous transverse fascia.

Description. *Male*. Body medium sized, elongated, and laterally sinuous. COLORATION (Fig. 3B): Generally brown body. Head and pronotum shining dark brown; mesoscutum and scutellum shining black. Hemelytron brown with two transversed fascia: anterior one continuous to middle of clavus and another one adjacent to the cuneal fracture; cuneus reddish black. Venter blackish brown. Antennae brown; segment I and bases of segment II and III pale, segment II dark brown towards the apex. Labium pale brown with dark apex. Pro- and mesocoxa brown, meta-coxae and all trochanters pale; meta-femora and base of tibia brown and tinged with red. SURFACE AND VESTITURE: Dorsum furnished with scattered semierect or erect brown setae. STRUCTURE: **Head**: Eyes smaller, vertex wider; labium reaching apex of mesocoxae. GENITALIA (Fig. 5G-K): **Endosoma**: U-like, apical process with several coiled structure (fig. 5I). **Phallotheca**: As in figure 5G. **Left paramere**: As in figure 5H. **Right paramere**: As in figure 5K.

Female. Not observed.

Specimens examined. **South Korea**: **Chungcheongbuk-do**: 1♂, Mungyeong-si, Gaeun-eup, Wanjangri, 31.V.2008, S.W. Park. **Chungcheongnam-do**: 1♂, Yeongi-gun, Jochiwon-eup, Bongsan-ri, 7.VI.2008, S.W. Park.

Distribution. Japan, Korea, Russia.

Host. Unknown.

Remarks. Kerzhner (1988b) reported this species from meadows. The representative specimens in this study were collected by random sweeping on shrubs and herbs, therefore unable to find specific host.

Tribe Leucophoropterini Schuh, 1974

Members of tribe Leucophoropterini are usually recognized by dark coloration, often with contrasting pale hemelytron maculae; eyes contiguous with anterior margin of pronotum; carinate pronotum (instead of collar); scutellum flat; hemelytron straight or weakly or strongly sinuate laterally; abdomen narrow; parempodia hair-like, rarely fleshy; vesica usually S-shaped, strongly or partially twisted, often U- or J- shaped; secondary gonopore poorly developed or obscure.

Schuh (1974) defined this tribe probably evolved in temperate and subtropical regions due to wide spread of population in New Guinea, New Ireland, Solomon Islands, Borneo and Philippine. It has been reported about one hundred and fourteen species in twenty genera worldwide and nine species in one genus from Palearctic region (Schuh, 1995, Kerzhner and Josifov, 1999; and Yasunaga, 2001).

Tytthus Fieber (1864), which was contained in tribe Leucophoropterini are currently transferred into the tribe phylini (Menard and Schuh, 2011).

Genus *Sejanus* Distant, 1910 고리버들장님노린재속

Sejanus Distant, 1910: 20 (n. gen.); Schuh, 1984: 150 (diag., desc.); 1995: 244 (cat.); Kerzhner and Josifov, 1999: 422 (cat.); Yasunaga, 2001a: 181 (diag.); Kwon et al., 2001: 184 (cat.).

Type species: *Sejanus funereus* Distant, 1910; monotypy.

Diagnosis. Recognized by completely black or castaneous black body and dorsum; thick antennal segment II, somewhat punctate hemelytron; usually ivory spots on the base of cuneus; dorsum often covered with semierect, soft brown setae; C- or J-shaped endosoma without apical spines and obscurely developed secondary gonopore.

Distribution. Australian region, Oriental region, Palearctic region.

Remarks. Members of the genus Sejanus are considered to be host specific. Australian species are regarded as herbivorous (Cassis & Gross, 1995) however most of the species were reported as effective predators feeding on dipteran and lepidopteran larvae, mites, psyllids, etc. (Wheeler, 2001). Hitherto, fifty species described from world, and nine species in Palearctic region (Schuh, 1995; Kerzhner and Josifov, 1999 and Yasunaga, 2001). In Korea represented with one species.

Sejanus potanini (Reuter, 1906) 고리버들장님노린재

Figure: 6A-F

Sthenarus potanini Reuter, 1906: 77 (n. sp.)

Sejanus potanini: Kerzhner, 1988: 76 (n. comb, disc.); Schuh, 1995: 246 (cat.); Kerzhner and Josifov, 1999: 423; 2001b: (diag., fig.); Yasunaga, 2001b: 121 (diag., figs.); Anufriev et al., 2001: 130 (eng. transl.); Kwon et al., 2001: 184 (cat.)

Diagnosis. Recognized by small tiny body, clavate antennal segment II with larger apical region black, short antennal segments III and IV; hemelytron without white ivory spots at the base of cuneus; black femora with pale apices; J-shaped endosoma with obscure secondary gonopore (Fig. 6A).

Description. *Male*. Body small, oval. COLORATION (Fig. 6A): Generally black colored. Entire body dorsally and ventrally shining black. Antennae pale with larger apical region of segment II black. Labium, segment I and IV dark and remaining pale. Legs, all coxae and trochanters and femora black except pale apices of femora; meta-tibia pale with rows of dark brown spines. SURFACE AND VESTITURE: Dorsum uniformly distributed with semierect pale brown soft setae. STRUCTURE: **Head**: Labium reaching apex of mesocoxae, length nearly equal the width of pronotum; antennal segment III and IV shorter, sum of two segments shorter than segment II; antennal segment II clavate. GENITALIA (Fig. 6B-D): **Endosoma**: Shape simple, J-like; secondary gonopore obscure. **Left paramere**: As in figure 6D. **Right paramere**: As in figure 6C.

Female. Similar in color and texture to the male. Genitalia (Fig. 6E-F): Sclerotized rings asymmetrical, smaller and thin rimmed. Posterior wall with chitinized, minutely spinulus structures on either lateral side.

Specimens examined. **Chungcheongnam-do:** 3♀, Danjin-gun, Seongmun-myeon, Nanjido-ri, 18.VIII.2009, R.K. Duwal and S. Jung. **Gyeonggi-do**: 1♂, Paju-si, Musan-eup, Gunnae-myeon, 21.VII.2008, S. Jung; 1♀, Incheon, Gangwa-gun, Hajeom-myeon, Mangwol-ri, 1.VII.2008, R.K. Duwal and S. Jung. **Gyeongsangnam-do**: 1♀, Goeje-si, Geoje Arboretum, 25-27.VIII.2008, R.K. Duwal and S. Jung (SNU).

Distribution. China, Japan, Korea, Russia.

Host. *Salix* sp. (Kerzhner, 1988a).

Remarks. Yasunaga (2001) observed Japanese *S. potanini* feeding on animal food in laboratory test. In Korea, no specific host is detected for this species as these were collected by random sweeping on herbs.

Tribe Phylini Douglas and Scott, 1865 애장님노린재족

Members of tribe Phylini are variously sized (2-5 mm) and colored; pronotum without flattened collar, but anterior margin usually carinate; vestiture variable; females occasionally brachypterous; parempodia hair-like and parallel, or fleshy, uniform in diameter and weakly convergent apically; vesica usually S- or J- or C-shaped, weakly or strongly twisted; secondary gonopore located mesially or subapically; and posterior wall of female genitalia simple membranous, or furnished with simple chitinized wall or spinulus chitinized wall.

The tribe Phylini is the largest group in subfamily Phylinae, which comprises of approximately one thousthand seven hundred and fifty two species in two hundred and twenty four genera in the world (Schuh, 1995) and about nine hundred and thirty three species in one hundred and thirty two genera in Palearctic region (Kerzhner and Josifov, 1999). These phyline bugs are widely distributed in every kind of habitat from tropical, subtropical to the cold temperate meadows. However, most species are restricted due to specific climatic ecozones.

Key to Korean genera of tribe Phylini

1. Body large, longer than 5.0 mm (Fig. 11D-F); rostrum surpass the apex of procoxae …………………………………………………………………………………..*Harpocera*
- Body smaller to medium sized, rostrum reaching or surpass mesocoxae ……………….…..2
2. Antennal segment II thick, swollen, clavate (Fig. 11A) ……………….…….*Atractotomus*
- Antennal segment II slender, cylindrical, or filliform …………………………..…...…3
3. Dorsum dirty reddish yellow or yellowish brown with two pairs of scarlet spots on apices of exocorium and cuneus (Fig. 40A) ……………………..…………..…...*Rubrocuneocoris*
- Apices of exocorium and cuneus without scarlet spots …………………….…………..4
4. Tibiae without spots ………………………………………………………...……….5
- Tibiae usually with spots ………………………………………………………………….9
5. Dorsum uniformly black, or greenish or bluish black, or yellowish with contrast colored margins ………………………………………………………………….…………...6
- Pronotum, mesoscutum, scutellum, clavus and endocorium brown; head, exocorium, cuneus and all appendages faintly orange yellow (Fig. 16C) ……...…………*Orthophylus*
6. Legs darker, antennal segment II partly or completely darker …………………...…….8
- Legs brightly colored (whitish or reddish) …….……………………………...………..7
7. All legs whitish pale, antennal segment I brown or black (Fig. 19I) ……...………*Phylus*
- Pro- and meso- legs and hind tibiae pale or pale yellow, apical half of femora red;

antennal segment I yellowish brown (Fig. 19G-H) …………………….………*Pseudophylus*

8. Base and apex of antennal segment II, base of all tibiae black, dorsum uniformly black and shining (Fig. 19D-E) ……………….……..………………...……..*Orthonotus*

- Basal 1/3 or entire antennal segment II black, tibiae black or greenish black; dorsum greenish black or yellowish with contrast colored margins (Fig. 16A-B) …..….*Macrotylus*

9. Dorsum entirely or except hemelytron distributed with dense spots …………..………10

- Dorsum without spots ……………………………………………………………12

10. Entire dorsum distributed with small spots ………………………………..…………11

- Dorsum except hemelytron distributed with black spots, hemelytron hyaline with spots on apices of clavus and exocorium, and obscure spot on inner middle margin of cuneus (Fig. 16D-F) ....*Moissonia*

11. Body medium sized; dorsum pale, densely distributed with brown spots (Figs. 11B-C, 13A) ………..…………………………………………………………...*Compsidolon*

- Body small tiny sized, dorsum reddish brown and uniformly distributed with black spots (Fig. 7B-C) ……..…………..…………………………………...…..…*Atractotomoidea*

12. Hind femora with elongated longitudinal marginal stripe …….…………....*Plagiognathus*

- Hind femora without marginal longitudinal stripe ……………………..……………..13

13. Antennal segment II shorter than width of head ……………………………..……….14

- Antennal segment II longer than width of head ……………………………...……….15

14. Body and dorsum black, shining, antennal segment I without large black spot ……………………………………………………………………………...…*Chlamydatus*

- Usually body and dorsum pale greenish, antennal segment I with larger black spot (Fig. 7D-I) ……………………………...…………………………………….…*Campylomma*

15. Body medium sized, variously colored, except green; endosoma with complex apex

……….…………………………………………………………………………...…*Psallus*

- Body greenish or tinged with green, or black or brown; endosoma with simple apex ….16

16. Body or dorsum brownish or black ……………………………………...…………17

- Body or dorsum pale or green tinged …………………………………………………20

17. Head and pronotum with pale areas ……….……………………………………….…18

- Head and pronotum without pale areas …………………………………………….…19

18. Dorsum entirely black with pale areas on head, pronotum, mesoscutum and bases of corium and cuneus [in some specimens, dorsum entirely black except pale areas on head and mesoscutum] (Fig. 19A-B) ……………………..…………………….….*Monosynamma*

- Head and pronotum black with white or pale areas; hemelytron pale; legs pale or reddish with black or brown small spot at the base of tibia ……………....……...……..…..*Tytthus*

19. Head, pronotum, mesoscutum, scutellum, cuneus and legs dark brown (or sometimes reddish brown); hemelytron brown; antennal segment I and segment II brown, segment I tinged with red (Fig. 13G) ………………………………..……..………..….*Kasumiphylus*

- Dorsum uniformly orange brown or dark blackish brown, base of antennal segment I, basal 1/2 or 2/3 of segment II black (Fig. 19C) ……………………….…..…..*Parapsallus*

20. Dorsum pale green, apex of scutellum and clavus black; membrane with distinct smoky pattern (Fig. 7A) ……………..………………………………………...……*Atomoscelis*

- Body and dorsum usually pale greenish except few species e.g., Europiella artemisiae, dark brown or black; membrane without smoky pattern ………………………………...21

21. Hind femora with distinct number of spots arranged in anterior and posterior margins ……………...……..……………….……………………………………….....*Eplagiognathus*

- Hind femora with various spots dense or sparse ………………………...…...….*Europiella*

Genus *Atomoscelis* Reuter, 1875 동방장님노린재속

Atomoscelis Reuter, 1875: 100 (n. gen.); Schuh, 1995: 261 (diag.); Kerzhner et Josifov, 1999: 309 (cat.).

Type species: *Agalliastes onustus* Fieber, 1861; subsequent designation.

Diagnosis. Recognized by tiny body, pale or pale green texture; a large black spot on the antennal segment I; dark apices of scutum and clavus; smoky membrane; pale hind femora with distinct large black or dark brown spots, and rows of black or dark brown spots on hind tibia.

Distribution. Holarctic region

Remarks. *Atomoscelis* is a small, morphologically delicate genus with eight described species from Holarctic region and tropical Africa. Josifov (1979) reported *A. asiatica* from the northern part of the Korean Peninsula, but there is no evidence of these bugs in South Korea during field survey from 2008-2011. The current species found was collected at Eastern part of China, around the wet land.

Atomoscelis asiatica (Josifov, 1979) 동방장님노린재

Figures: 7A, 8A-E

Kerzhneriola asiatica Josifov, 1979: 216, 217 (n. sp.)

Atomoscelis asiatica: Kerzhner, 1988b: 856-857 (key); Schuh 1995: 261 (cat.); Kerzhner et Josifov, 1999: 309 (cat.); Anufriev et al., 2001: 136 (eng. transl.); Kwon et al., 2001: 168 (cat.).

Diagnosis. Generally recognized by pale greenish, tiny body about 2.5 mm, dorsum except head, anterior part of pronotum and meso-scutum yellowish, uniformly distributed simple pale setae, and patches of aggregated brown setae on dorsum, distinct spots on apices of scutellum and clavus, and distinct smoky pattern on membrane; and S-shaped endosoma bifurcated apically into unequal processes, secondary gonopore arise from the bifurcated region (Fig. 8A).

Description. *Male*. Body small, oval. COLORATION (Fig. 7A): Generally pale tinged with green; head greenish with pale yellowish vertex, fore head with dark vertical line, tylus dorsally brownish, and laterally and apically green; pronotum green with yellow calli; mesoscutum yellow; and scutellum greenish with dark apex; hemelytron, clavus pale with black apex, corium entirely pale, membrane with smoky pattern, laterally dark and apically darker. Venter greenish. Antennal segment I pale with large black spot and with a pair of black spine, segment II dirty yellow with dark extreme base, and segment III and IV pale brown tinged with green. Labium, segment I green, segment II pale, segment III and IV brown with dark apices. All coxae and trochanters pale; meta-femora pale with large dark spots on the distal half; meta-tibia pale with large black spots at the base of black spine; and tarsus brown with darker apices. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed semierect dark brown and pale setae. STRUCTURE: **Head**: Projecting anteriorly, convex; labium reaching apex of metacoxae. GENITALIA (Fig. 8A-D): **Endosoma**: Shape simple, S-like, with two apical processes; secondary gonopore subapically located (Fig. 8A). **Phallotheca**: As in figure 8C. **Left paramere**: Body large, structure as in figure 8B. **Right paramere**: Broad, elongated oval, leaf like, margins irregular (8D).

Female. Similar in color and texture. Genitalia (Fig. 8E): Asymmetrical sclerotized rings somewhat triangular shaped, and with curved margins.

Specimens examined. For reference:- **China**: **Tianjin**: 18♂, 5♀, Wuging Country, Dahuangpu, E 177°10'33"-177°19'58" N 39°21'04"-39°30'27", 18.VII.2010, R.K. Duwal and S.H. Lee.

Distribution. China, Korea, Russia, Tadzhikistan.

Host. *Artemisia* sp. (Asteraceae) (Josifov, 1979).

Remarks. The representative species is collected on the Asteraceous plant in South-eastern Wet land of Tianjin, China. Both adults and nymphs were aggregated in large number.

Genus *Atractotomus* Fieber, 1858 사방장님노린재속

Atractotomous Fieber, 1858: 317 (n. gen.); Schuh, 1995: 263 (cat.); Kerzhner, 1988b: 848 (key); Kerzhner and Josifov, 1999: 310 (cat.); Yasunaga 2001a: 155 (diag.); Anufriev et al., 2001: 127 (eng. transl.); Kwon et al., 2001: 168 (cat.).

Type species: *Capsus magnicornis* Fallen, 1807; monotypy.

Diagnosis. Recognized by medium sized, oval elongated body about 4.0 mm in length; clavate or fusiform antennal segment II, short antennal segment III and IV; densely distributed silvery scales on dorsum; simple, strongly twisted endosoma, with apical or subapical gonopore followed by minute sclerites (Stonedahl, 1990).

Distribution. Holarctic region.

Remarks. Stonedahl (1990) described this genus as a Holarctic fauna inhabiting widely on various hosts: *Quercus*, *Salix*, etc. or polyphagous. This genus reported with nearly forty eight species (Schuh, 1995) in the world. Though some species of this genera are serious pest of economic plants e.g., apple, pear, few are considered as predatory group as they were found feeding on aphids, eggs of different insects, honeydew, lepidoptera, mites, psyllids, etc (Wheeler, 2001).

***Atractotomus morio* Sahlberg, 1883 사방장님노린재**

Figures: 11A, 12A

Atractomomus morio: Sahlberg, 1883: 94-95 (n. sp.); Kerzhner, 1988b: 849 (key); Schuh 1995: 267 (cat.); Kerzhner et Josifov, 1999: 312 (cat.); Yasunaga, 2001a: 155 (diag., figs); Anufriev et al., 2001: 127 (eng. transl.); Kwon et al., 2001: 168 (cat.).

Diagnosis. Recognized by black, shining body and appendages; thick and fusiform antennal segment II, segment III and IV short and yellowish (Fig. 11A); mesial region of endosoma U-shaped, a finger like membranous process at the apex and the subapically located gonopore without sclerites (Stonedahl, 1990: 75 (149)); more or less symmetrical, thin rimmed, large sclerotized rings (Fig. 12A) of female genitalia..

Description. *Female*. Body large, elongated. COLORATION (Fig. 11A): Generally black; completely black dorsum, with posterior margin of the vertex pale brown; membrane grey. Antennal segment I and II black, segment III and IV pale brown. Labium shining black. Legs black, with dark brown trochanters. SURFACE AND VESTITURE: Head with semierect pale brown setae; pronotum uniformly distributed with soft appressed brown setae; mesoscutum, scutellum and hemelytron with both soft appressed brown setae and shining flat scale like setae; pronotum shagreened. STRUCTURE: **Head**: Projecting anteriorly, convex; antennal segment II short, fusiform, segment III and IV short; labium reaching apex of meta-coxae; callus region somewhat raised. GENITALIA (Fig. 12A): Sclerotized rings elongate oval, with broad posterior margin.

Male. Stonedahl (1990) provided description, SEM pictures of metafemur, paramere and illustrations of antennae and endosoma (Figs. 31, 67, 115, 146).

Specimens examined. **South Korea**: **Gangwon-do**: 2♀, Honcheon-gun, Sambong natural forest, 26.VI.2003, J.W. Seong (SNU).

Distribution. Finland, Korea, Russia, Sweden.

Host. *Picea* sp. (Pinaceae) (Kerzhner, 1988b; Josifov, 1992; Stonedahl, 1990).

Remarks. Any kind of biology is unknown in Korea, since the specimen is without host label.

Genus *Atractotomoidea* Yasunaga, 1999

Atractotomoidea Yasunaga, 1999: 190 (n. gen.); 2001a: 154 (diag.); 2010: 51 (diag.); Duwal et al, 2010b: 7 (diag.); Duwal and Lee, 2011: 47 (diag.).

Type species: *Atractotomoidea castanea*, original designation.

Diagnosis. Generally recognized by chestnut brown, tiny body; uniformly distributed minute dark spots on dorsal surface furnished with simple, pale and sub-erect pubescence; antennal segment III as long as segment VI; hooked process of left paramere; mesial coiled endosoma bifurcate apically. For detail see Yasunaga (1999).

Distribution. Japan, Korea, Nepal, Thailand.

Remarks. This species is described with only five species from tropics, subtropics and temperate regions of Asia, i.e., Japan, Korea, Nepal and Thailand, where these were inhabited on various host plants and were also presumed as predators (Yasunaga, 1999; 2010; Duwal et. al. 2010b).

***Atractotomoidea castanea* Yasunaga, 1999**

Figures: 7B-C, 8F-J

Atractotomoidea castanea Yasunaga, 1999: 190-191 (n. sp., diag., desc., figs.); Yasunaga, 2001: 155 (diag., figs.); Duwal and Lee, 2011: 47 (diag., figs).

Diagnosis. Generally recognized by small, oval, chestnut brown body tinged with red; dark brown antenna, pale basal 2/3 of segment II; uniformly distributed dark convex spots on hemelytron (Fig. 7B-C); distinctly coiled endosoma bifurcated apically (Fig. 8F); and small and asymmetrical sclerotized rings (Fig. 8J) of female genitalia.

Description. *Male*. Body tiny, oval. COLORATION (Fig. 7B-C): Generally brown; head, pronotum, mesoscutum, and scutellum dark brown (sometimes tinged red); hemelytron entirely brown with uniformly distributed convex spots; membrane gray. Venter castaneous. Antennal segment I castaneous, apical half of segment II, segment III and IV black. Labium either pale or pale tinged with red. All coxae castaneous; trochanters pale tinged with red; meta-femora castaneous; basal half of meta-tibia reddish which degraed to pale towards the distal region. SURFACE AND VESTITURE: Dorsum entirely furnished with semierect simple pale setae, and pronotum only with soft appressed pubescence. STRUCTURE: **Head**: Convex, projecting anteriorly; antennal segment II cylindrical; labium reaching apex of metacoxae. GENITALIA (Fig. 8F-I): **Endosoma**: Shape S-like, medially twisted, apical region C-shaped and bifurcated into two processes subapically; secondary gonopore located subapically (Fig. 8F). **Phallotheca**: narrow, apically similar in size with base (Fig. 8I). **Left paramere**: Body broad, anterior process elongated with hook like curved apex (Fig. 8H). **Right paramere**: Body elongated, apically developed short finger like protuberance (Fig. 8G).

Female: Not sexually dimorphic, color and texture similar to male. GENITALIA (Fig. 8J): Bursa copulatrix with asymmetrical sclerotized rings and concave chitinized plates.

Specimens examined. **South Korea**: **Gyeonggi-do**: 35♂, 16♀, Anyang-si, SNU Gwanak Arboretum, 9.VII.2008, on *Wisteria floribunda* (Willd.) DC. (Fabaceae), R.K. Duwal and S. Jung.

Distribution. Japan, Korea.

Host. *Rhododendron* spp. (Ericaceae), *Quercus mongolica* (Fagaceae), *Chamaecyparis obtuse* (Cupressaceae), *Abies sachalinensis* (Pinaceae), *Cephalotaxus harringtonia* (Cephalotaxaceae) (Yasunaga, 1999), and *Wisteria floribunda* (Fabaceae) (Duwal et al., 2011).

Remarks. Large number of nymphs and adults were collected on the host *Wisteria floribunda*, at the time of fruiting season.

Genus *Campylomma* Reuter, 1878 독도장님노린재속

Campylomma Reuter, 1878: 52 (n. gen.); Kerzhner, 1988b: 788 (key); Schuh, 1995: 278 (cat.); Kerzhner and Josifov, 1999: 318 (cat.); Yasunaga, 2001a: 156 (diag.); 2001c: 113 (diag.); 2010: 57 (diag.); Duwal et. al., 2010a: 10 (diag.); Kwon et al., 2001: 168 (cat.).

Type species: *Campylomma nigronasuta* Reuter, 1878; subsequent designation.

Diagnosis. Generally recognized by small shiny, ovoid body; usually short antennal segment II, length shorter than width of head; row of tiny dark spines on distal half of the dorsal surface of metafemur; S- shaped endosoma with short and compact apical blades (Figs. 9, 10).

Distribution. Cosmopolitan.

Remarks. This genus is one of the largest groups in tribe Phylini, including nearly about one hundred and forty described species (Schuh; 1995; 2001; Yasunaga, 2001a; Duwal et. al., 2010a). These tiny bugs show various feeding habits, Malipati (1992) described

Campylomma liebknechti as generalist feeder, whereas Duwal et al. (2010b) observed *C. lividum* feeding on animal food (unidentified aphid), but large number of these are recognized for serious pest. During the field survey only two species of *Campylomma* are found commonly occurred in Korea, *Campylomma chinense* in *Artemisia* (Asteraceae) and *C. miyamotoi* in *Albizia julibrissin* Durazz (Fabaceae) while other two species, *C. annulicorne* and *C. lividicorne* (Kerzhner and Josifov, 1999; Kwon et. al., 2001) were not observed during field investigation 2008-2011, but possibly exist as they were found in neighboring countries Japan and China.

Key to species of Korean *Campylomma*.

1. Genital capsule with short thumb like process (Fig. 7I). Male genitalia (Fig. 9G-I): Endosoma S-shaped, with elongated curved apical processes embaded with membranes and furnished with minute spinules (Fig. 9I). Female genitalia (Fig. 9J): Bursa copulatrix laterally furnished with minute spinules on either lateral side at anterior region of sclerotized rings; sclerotized rings nearly symmetrical and rectangular ....*C. chinense*

\- Male genital capsule without thumb like process ……………………………………...2

2. Antennal segment II thick and entirely black (in male), and only extreme base black (in female) (Fig. 7D-E). Male genitalia (Fig. 9A-D): Endosoma of male genitalia with moderately short and curved apical processes (Fig. 9A). Female genitalia (Fig. 9E): Sclerotized rings elongated oval, narrow towards the apex ……….......……*C. annulicorne*

\- Antennal segment II pale in both male and female except dark extreme base …………...3

3. Dorsum pale green or yellow, labium shorter, not exceeding apex of mesocoxa. Male genitalia (Fig. 10E-G): Endosoma with short and stout apical processes (Fig. 10F). Female genitalia (Fig. 10H): Sclerotized rings thick, oval anteriorly and posterior margin

straight ……………………………………………………………...…..……………*C. miyamotoi*

- Dorsum dirty yellow or orange often darkened. Male genitalia (Fig. 10A-C): Endosoma with distinct apical processes (Fig. 10A). Female genitalia (Fig. 10D) Sclerotized rings asymmetrical, elongated, broad and anteriorly oval …………….…………...*C. lividicorne*

***Campylomma annulicorne* (Signoret, 1865) 검은촉각장님노린재**

Figures: 7D-E, 9A-E

Capsus coerulescens Scholtz, 1846: 54 (n. sp.)

Litocoris annulicornis Signoret, 1865: 126 (n.sp.)

Campylomma viridula Jakovlev, 1880: 143 (n. sp.)

Campylomma annulicornis: Kerzhner, 1988b: 857 (key); Linnavuori, 1993: 268 (host); Schuh 1995: 277 (cat.); Kerzhner et Josifov, 1999: 319 (cat.); Yasunaga, 2001a: 156 (diag., fig.); Anufriev et al., 2001: 135 (eng. transl.); Kwon et al., 2001: 168-169 (cat.).

Diagnosis. Recognized by small pale greenish body; antennal segment II entirely black in male and in females only base black; S-shaped endosoma with complex apex, further extended to three apical processes (Fig. 9A).

Description. *Male*. Body small, oval. COLORATION (Fig. 7D-E): Generally pale greenish; head, pronotum, and mesoscutum, yellowish (or greenish), and scutellum and hemelytron pale or pale greenish; membrane resembles the color of elytra. Venter greenish. Antennal segment I pale with large black spot ventrally, segment II entirely black, segment III and IV brownish. Labium pale with dark brown apex. All coxae and trochanters pale; meta-femora pale or greenish and tinged with yellow; meta-tibia pale with dark spots at the base and the spots obscure towards the distal end. SURFACE AND VESTITURE: Dorsum entirely furnished with simple soft pale and dark setae. STRUCTURE: **Head**: Convex, projecting anteriorly; antennal segment II tumuid, cylindrical, and nearly equal to the length of pronotum; labium reaching apex of mesocoxae. GENITALIA (Fig. 9A-D): **Endosoma**: Shape S-like, complex apex with 3 short and elongated processes as in figure 9A. **Phallotheca**: Narrow, slightly bend and tapered towards the apex as in figure 9D. **Left paramere**: Left parameres as in figure 9B. **Right paramere**: Right paramere as in figure 9C.

Female: Similar in color and texture as male, except the antennal segment II pale with black base. GENITALIA (Fig. 9E): Bursa copulatrix with nearly symmetrical sclerotized rings; the sclerotized rings small, thin rimmed and elongated.

Specimens examined. For reference:- **China**: **Tianjin**: 1♂, 5♀, Wuging Country, Dahuangpu, E 177°10'33"-177°19'58" N 39°21'04"-39°30'27", 18.VII.2010, on *Salix* sp., R.K. Duwal (SNU).

Distribution. Britain, China, European continents, Iraq, Korea, Russia, Uzbekistan.

Host. *Salix* sp. (Saliaceae) (Kerzhner, 1988b).

Remarks. This species was reported from the North Korea but are found not distributed in Southern part.

***Campylomma chinense* Schuh, 1984**

Figures: 7H-I, 9F-J

Campylomma chinensis: Schuh, 1984: 269 (n. sp., diag., desc., figs.); Schuh 1995: 278 (cat.)

Campylomma chinense Kerzhner et Josifov, 1999: 320 (cat.); Yasunaga, 2001a: 157 (diag., fig.).

Diagnosis. Recognized by small greenish brown body; dark bases of antennal segment

I and II; thumb like process at the base of pygophore; distinct apex of the endosoma (Fig. 9I).

Description. *Male*. Body small, oval. COLORATION (Fig. 7H-I): Generally greenish brown; head brownish, pronotum greenish, mesoscutum, scutellum and entire hemelytron yellowish brown. Venter pale yellowish (or brown). Antennae pale (greenish or brownish), segment I and base of segment II dark, except the apex of segment I pale. Labium shining, pale with brown apex of segment IV. All coxae and trochanters pale; meta-femora pale, tinged with yellow or dirty brown; tibia pale with large black spots at the base, obscure towards the apex. SURFACE AND VESTITURE: Dorsum entirely furnished with soft pale setae, and simple brown setae. STRUCTURE: **Head**: Convex, projecting anteriorly; antennal segment II cylindrical, nearly equal the width of head; vertex width equal the length of antennal segment IV; labium reaching apex of metacoxae; abdomen with a small thumb like protuberance at the base of pygophore. GENITALIA (Fig. 9G-I): **Endosoma**: Shape S-like, apical sclerotized processes embedded with membranous structure and margin furnished with minute spinules as in figure 9I. **Phallotheca**: Narrow, tapered towards the apex as in figure 9H. **Left paramere**: Left paramere as in figure 9G.

Female: Similar in color and texture as male. GENITALIA (Fig. 9J): Sclerotized ring of the bursa copulatrix symmetrical, somewhat rectangular, thick rimmed, and the bursa copulatrix with minute spinules on either lateral side.

Specimens examined. South Korea: **Gyeongsangnam-do**: 1♀, Goeje-si, Geoje Arboretum, 25-27.VIII.2008, R.K. Duwal and S. Jung (SNU); 3♂, 7♀, Goeje-si, Irun-myeon, Jisimdo, 28-29.VIII.2008, on *Artemisia* spp. (Asteraceae), R.K. Duwal and S. Jung (SNU). **Jeju-do**: 5♂, 2♀, Gujwa-eup, Kimryung, 19.IX.1996, S.B. Ahn (SNU); 46♂, 42♀, Seogwipo, 30-31.X.2009, on *Artemisia* spp. (Asteraceae), R.K. Duwal (SNU). **Japan**: 5♂, 8♀, Shikoku, Kochi, 23.I.2008, T. Yasunaga.

Distribution. China, Japan, Korea, Taiwan.

Host. *Artemisia* spp (Asteraceae).

Remarks. In Korea, *Campylomma chinense* is distributed in Southern region including Jeju Island where large number of adults and nymphs were collected together by sweeping on *Artemisia*.

Campylomma lividicorne Reuter, 1912 독도장님노린재

Figures: 7F, 10A-D

Campylomma lividicornis: Reuter, 1912: 65 (n. sp.); Schuh 1984: 284-285 (diag., desc., figs.); 1995: 281 (cat.); Kerzhner and Josifov, 1999: 321 (cat.); Kwon et al., 2001: 169 (cat.); Duwal et al., 2010b: 14 (diag., figs.).

Diagnosis. Recognized by pale greenish body; a narrow basal ring on the antennal segment II; without thumb like process on pygophore; comparatively small endosoma, with apical processes of variable length (Fig. 10A).

Description. *Male*. Body small, oval. COLORATION (Fig. 7F): Generally greenish or yellowish; dorsum entirely yellowish or greenish, posterior margin of vertex pale. Antennae pale or yellowish, segment I with dark spot ventrally, segment II with black ring. Labium pale with dark brown apex. Venter greenish yellow. Legs pale, coxae pale tinged with yellow, meta-femora yellowish. SURFACE AND VESTITURE: Dorsum entirely furnished with soft pale setae, and simple brown setae. STRUCTURE: **Head**: Convex, projecting anteriorly; antennal segment II cylindrical; labium nearly reaching apex of metacoxae. GENITALIA (Fig. 10A-C): **Endosoma**: Shape S-like, elongated apical processes as in figure 10A. **Left paramere**: Left paramere as in figure 10C. **Right paramere**: Body elongated, oval as in figure 10B.

Female: Similar in color and texture. GENITALIA (Fig. 10D): Sclerotized rings elongated, oval and posterior margin somewhat straight.

Specimens examined. For reference:- **Japan**: 11♂, 2♀, Shikoku, Kochi, 23.I.2008, T. Yasunaga (SNU).

Distribution. Caroline Is., India, Japan, Marshall Is., Nepal, New Guinea, Philippine Is., Wake Is.,.

Host. *Chrysanthemum* spp., *Artemisia* spp. (Asteraceae) and also observed on *Lantana camara* (Verbenaceae) and *Sambucus adnata* (Sambucaceae) [Duwal et al., 2010b].

Remarks. This species in Korea reported from Northern part (or North Korea) (Kwon et al., 2001), and are not distributed in Sourthern part (or South Korea).

***Campylomma miyamotoi* Yasunaga, 2001**

Figures: 7G, 10E-H

Campylomma miyamotoi Yasunaga, 2001b: 116 (n. sp., diag., desc., figs.); 2001a: 158 (diag., fig.).

Diagnosis. Recognized by pale greenish or brownish body; shining dorsum; large dark spot at the base of segment I, and black basal ring of segment II; short rostrum reaching mesocoxa; completely pale legs; and short and broad apical process of endosoma.

Description. *Male*. Body small, oval. COLORATION (Fig. 7G): Generally pale greenish or brownish; dorsum completely pale green. Venter greenish. Antennae pale, segment I with large black spot ventrally, segment II with black extreme base. Labium pale with dark apex. Legs pale; coxae somewhat greenish; meta-femora yellowish bright.

SURFACE AND VESTITURE: Dorsum entirely furnished densely distributed simple brown pale setae, and soft pale setae. STRUCTURE: **Head**: Antennal segment II cylindrical, equal the width of head; vertex width equal the length of antennal segment IV; labium reaching apex of mesocoxae. GENITALIA (Fig. 10E-G): **Endosoma**: Shape S-like, apical processes short as in figure 10F. **Phallotheca**: Phallotheca as in figure 10G. **Left paramere**: Left paramere as in figure 10E.

Female: Similar in color and texture as male. GENITALIA (Fig. 10H): sclerotized rings more or less symmetrical, comparatively small, oval, and thick rimmed.

Specimens examined. **South Korea**: **Chungcheongnam-do**: 4♂, 7♀, Boryeong-si, Ocheon-myeon, Wonsando-ri, 5.VIII.2008, on *Albizia julibrissin* Durazz. (Fabaceae), R.K. Duwal (SNU).

Distribution. Japan, Korea.

Host. *Albizzia julibrissin* Durazz. (Fabaceae) [Yasunaga, 2001b].

Remarks. In Korea, this species is collected in the same host defined by Yasunaga (2001c), and abundantly found during flowering time.

Genus *Chlamydatus* Curtis, 1833 사촌애장님노린재속

Chlamydatus Crutis, 1833: 198 (n. gen.); Schuh, 1995: 288 (cat.); Kerzhner, 1988b: 788 (key); wheeler and Henry, 1992: 156 (dist.); Kerzhner and Josifov, 1999: 325 (cat.); Kwon et al., 2001: 169 (cat.); Schuh and Schwartz, 2005: 12 (re-diag.).

Type species: *Chlamydatus marginatus* Curtis, 1833; monotypy.

Diagnosis. Generally recognized by small, elongate oval body; submacropterous with shortened membrane, just covering abdomen, or brachypterous; usually dark brown or black coloration; large eyes; antennal segment II not longer than width across hemelytron; vestiture of dorsum comprises of simple dark setae and somewhat flattened golden or silvery soft setae. For detail description see Schuh and Schwartz, 2005.

Distribution. Holarctic region.

Remarks. This genus is described as a Holarctic group (Linnavuori, 1998) and comprises of thirty two species (Schuh, 1995; Kerzhner and Schuh, 2001; Schuh and Schwartz, 2005). Various hosts are reported: Asteraceae, Lamiaceae, Polemoniaceae, Fabaceae, Ranunculaceae and Rosaceae (Schuh and Schwartz, 2005). In Korea two species are reported from the northern part (Kwon et al., 2001).

Key to species of Korean *Chlamydatus*

1. Body black, posterior margin of head pale, femora black with yellow apices, spots on tibia small. Male genitalia: Endosoma twisted medially, with whip like process apically (for detail see Kerzhner, 1978: 44) …………………..…...………………..…….*Ch. pulicarius*

\- Body black, posterior margin of head black, femora black with yellow apices, spots on tibia larger. Male genitalia: Endosoma twisted medially, with short a apical process (for detail see Kerzhner, 1964: 999) ………...………………………………………*Ch. pullus*

***Chlamydatus pulicarius* (Fallen, 1807) 큰사촌애장님노린재**

Lygaeus pulicarius Fallen, 1807: 95 (n. sp)

Chlamydatus pulicarius pseudopulla Stichel, 1956: 350 (n. form)

Chlamydatus pulicarius: Carvalho, 1958: 33 (cat.); Schuh, 1995: 291 (cat.); Kerzhner, 1988b: 855 (key); Wheeler and Henry, 1992: 156 (note); Kerzhner et Josifov, 1999: 326 (cat.); Anufriev et al., 2001: 134 (eng. transl.); Kwon et al., 2001: 169 (cat.); Schuh and Schwartz, 2005: 43 (diag., figs.).

Diagnosis. Moderate sized oval body; usually black dorsum and ventral side of body with pale posterior margin of vertex; pale or dark antennae and legs, usually with pale tibiae; wrinkled posterior pronotum; simple tubular endosoma elongated and curved, with a apical process; secondary gonopore medially located. For detail description and figures see Schuh and Schwartz, 2005: 42 (Fig. 2, 3, 5).

Distribution. Azerbaijan, China, European continents, Georgia, Kazakhstan, Korea, Mongolia, Russia.

Host. Fabaceae [Kerzhner, 1964], *Artemisia* sp., *Hieracium* sp. (Asteraceae), *Stellaria longifolia* (Caryophyllaceae), *Lathyrus* sp., *Vicia* sp., (Fabaceae), *Ranunculus* sp. (Ranunculaceae), and *Potentilla argentea* (Rosaceae) [Schuh and Schwartz, 2005].

Remarks. This species in Korea was reported from northern region (Josifov, 1992) which is unable to collect or observe in Sourthern region.

***Chlamydatus pullus* (Reuter, 1870) 사촌애장님노린재**

Agalliastes pullus Reuter, 1870: 324 (n. sp.)

Chlamydatus pullus: Stichel, 1956: 351 (n. form); Schuh, 1995: 292 (cat.); Kerzhner, 1988b: 855 (key); Wheeler and Henry, 1992: 156 (dist., host); Kerzhner and Josifov, 1999: 326 (cat.); Anufriev et al., 2001: 134 (eng. transl.); Kwon et al., 2001: 169 (cat.); Schuh and Schwartz, 2005: 47 (diag., figs.).

Diagnosis. Recognized by small oval body, blackish brown dorsum and venter, females sub-macroptery or brachyptery, dark antennae and legs always with pale tibiae. For detail descriptions and for male genital structures see Schuh and Schwartz, 2005: 47 (Fig. 2, 3, 6).

Distribution. Azerbaijan, China, European continents, Georgia, Iran, Kazakhstan, Korea, Mongolia, N. America, Pakistan, Russia, Uzbekistan.

Host. *Artemisia* sp., (Asteraceae), *Lupinus* sp. (Fabaceae), *Rosa* sp. (Rosaceae) and *Salix* sp. (Saliaceae) [Kelton, 1965].

Remarks. In Korea, this species was reported from northern region (Josifov, 1992) which is unable to collect or observe in Southern region.

Genus *Compsidolon* Reuter, 1899 버들애장님놀니재속

Compsidolon Reuter, 1899: 147 (n. gen); Schuh, 1995: 294 (cat.); Kerzhner, 1988b: 787 (key); Yasunaga, 1999: 188 (note); 2001a: 159 (note); Kerzhner and Josifov, 1999: 328 (cat.); Kwon et al., 2001: 170 (cat.).

Type species: *Compsidolon elegantulum* Reuter, 1899; monotypy.

Diagnosis. Generally recognized by pale, elongated body; pale dorsum distributed with dense or scattered spots (Figs. 11B-C, 13A); S-shaped endosoma with elongated apical process and peculiar protuberance like structure apically or subapically; asymmetrical sclerotized rings of female genitalia (Fig. 12B). For detail description see Yasunaga, 1999.

Distribution. Ethiopian region, Palearctic region.

Remarks. This species comprises of about sixty species (Schuh, 1995; Yasunaga, 1999), distributed in Palearctic and Ethiopian regions and two species were reported from the Korean Peninsula (Kerzhner and Josifov, 1999; Cho et al, 2009). Species of *Compsidolon* are variously sized.

Key to species of Korean *Compsidolon*.

1. Body larger, yellowish white dorsum slightly tinged with green, and densely distributed with dark, small spots except on calli and cuneus with sparsely arranged spots (Fig. 11B-C). Male genitalia: Endosoma with hook like structure subapically (for detail see Yasunaga, 1999:188) ……….………………………..…………………....*C. elaegnicola*

- Body small, pale dorsum with densely distributed dark, small spots (Fig. 13A). Male genitalia (Fig. 12C-F): Endosoma with hook like structure apically. Female genitalia (Fig. 12B): Sclerotized rings elongated, oval, with narrow anterior region ………*C. salicellum*

Compsidolon elaegnicola **Yasunaga, 2001**

Figrue: 11B-C

Compsidolon elaegnicola Yasunaga, 1999: 188-190 (n. sp., diag., desc., figs.); 2001a: 159 (diag., fig).

Diagnosis. Recognized by large, elongated size, pale body and dorsum; slightly tinged yellow, dorsum densely distributed with brown spots except on cuneus with spars distributed spots; four anterior dark spots on mesoscutum usually concealed by posterior margin of pronotum; pale brown antennae and legs with larger dark/or brown spots on tibia at the base of dark brown spines; simple endosoma, partially twisted mesially and upturned apex like hook.

Description. *Male*. Body large, parallel laterally. COLORATION (Fig. 11B-C): Generally pale; dorsum entirely pale, tinged with yellow and provided with brown spots; head with pale brown markings on frontal region; membrane pale brown. Venter pale and shining. Antennae pale or pale brown, and segment III and IV dark. Labium brown. All legs pale; all femora ventrally with densely distributed brown spots on distal half region and scattered towards the base; and meta-tibia with rows of brown spots at the base of dark brown spine. SURFACE AND VESTITURE: Dorsum furnished with semierect dark brown and appressed flat, pale serious setae. STRUCTURE: Head projecting anteriorly; vertex wide, nearly equal in length to the antennal segment IV; labium reaching apex of mesocoxae; calli somewhat raised than the surface; head, and pronotum partly shagreened. GENITALIA : See Yasunaga, 1999: 188 (Fig. 2B-D).

Female. Similar in color and texture. Genitalia: Unable to examined due to transparent forms.

Specimens examined. **South Korea**: **Chuncheongbuk-do**: 1♀, Danyang-gun, Mt. Sobaek (National Park), 25-26.V.2009, R.K. Duwal and S. Jung. **Paratypes**: **Japan**: 1♂, 1♀, Kumamoto Pref., Izumi Vil., Momiki, Mt. Shiratori, 24-25.V.1990, T. Yasunaga, det. by T. Yasunaga, 1999.

Distribution. Japan, Korea.

Host. *Elaeagnus umbellate* Thunb. (Elaeagnaceae) [Yasunaga, 1999].

Remarks. This species was collected on random sweeping on herbs within preserved area of National Park in Korea. Therefore, specific host is unknown in Korea.

***Compsidolon salicellum* (Herrich-Schaeffer, 1841) 버들애장님놀니재**

Figures: 12B-F, 13A

Capsus salicellus Herrich-Schaeffer, 1841: 47 (n. sp.)

Psallus salicellus Carvalho 1958: 130 (cat.)

Compsidolon salicellum: Wagner and Weber 1964: 489 (syn., desc., fig); Schuh, 1995: 298 (cat.); Kerzhner, 1988b: 850 (key); Kerzhner and Josifov, 1999: 334 (cat.); Yasunaga, 1999: 188 (diag., figs.); 2001a: 159; Anufriev et al., 2001: 128 (eng. transl.); Kwon et al., 2001: 170

(cat.).

Diagnosis. Recognized by small size, slender, yellowish or pale brown body with pale areas on vertex, and anterior margin of pronotum; densely distributed dark spots except the base and apex of hemelytron and cuneus; dark distal region of metafemora; pale tibiae with dark spots; and inverted U-shaped distal region of endosoma with small protuberance apically (Fig. 12D).

Description. *Male*. Body medium sized, parallel laterally. COLORATION (Fig. 13A): Generally yellowish or pale brown; dorsum usually yellowish or pale brown with bright pale areas at central region of vertex, anterior margin of pronotum; head, pronotum, mesoscutum and scutellum with very few scattered spots; hemelytron, densely distributed with dark spots except the base and cuneus without spots, membrane greyish, and bears a distinct dark area beneath the cuneus. Venter pale or tinged with brown. Antennae pale, segment I, III and IV somewhat darker. Labium pale with brown apex. All legs pale; distal half of meta-femora fuscous, and ventrally provided with small spots; and meta-tibia with large dark brown spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with semierect pale brown setae and appressed, flat, serious setae. STRUCTURE: Head projecting anteriorly, convex; width of vertex nearly equal to the length of the antennal segment I; length of antennal segment II, width of hemelytron, and length of metafemora nearly equal; labium surpass apex of metacoxae. GENITALIA (Fig. 12C-F): **Endosoma**: Shape simple, S-like, broad, medially partly twisted, apical process elongated with hook like structure apically 12D. **Phallotheca**: Narrow, as in figure 12F. **Left paramere**: As in figure 12C. **Right paramere**: As in figure 12E.

Female. Similar in color and texture as male. Genitalia (Fig. 12B): Bursa copulatrix bears semi-sclerotized structures at posterior region; sclerotized rings asymmetrical, elongated, narrow towards anterior region, thick rimmed, and with irregular margins.

Specimens examined. **South Korea**: **Gyeonggi-do**: 3♂, 1♀ Yangpyeong-gun, Mt. Yongmun, 11.VI.-10.VIII.2009, on light trap, R.K. Duwal and S. Jung. **Japan**: 4♂, Hokkaido, Hattari, Atsuta vil. Ishikari, 7.VIII.1998, T. Yasunaga, det. by T. Yasunaga.

Distribution. Azerbaijan, European continents, Japan, Korea, N. America, Russia.

Host. *Juglans mandschurica* Maxim. (Juglandaceae), and also collected on A*rtemisia* spp. (Asteraceae), *Rubus* spp. (Rosaceae) and *Salix* sp. (Salicaceae) [Yasunaga, 1999].

Remarks. As all specimens in Korea were collected in light trap, biology is unknown.

***Euplagiognathus* Duwal n. gen.**

Europiella Reuter: Schuh et al., 1995: 379 (n. syn., diag., disc.)

Plagiognathus Fieber: Schuh, 2004: 55 (disc.)

TYPE SPECIES: *Europiella lividellus* (Kerzhner, 1979).

Diagnosis. Generally distinguished by small, oval body, entirely pale antennal segments and legs, ventrally furnished with few large black spots on metafemur arranged on anterior and posterior margin; long labium reaching apex of metacoxa.

Description. *Male*. Body small, oval. COLORATION (Fig. 13H): Generally greenish; head, pronotum, mesoscutum and scutellum green, tinged with yellow; hemelytron pale. Venter greenish. Antennae pale brown, segment I and base of segment II tinged with green. Labium pale, segment I tinged with green, and apex of segment IV brown. All legs pale; meta-femora ventrally with one large dark spot on anterior margin and three large dark spots on posterior margin; and tarsal segment III dark. SURFACE AND VESTITURE: Dorsum furnished with appressed, flat serious setae, semierect simple dark setae and soft pale setae. STRUCTURE: Head projecting anteriorly, convex; labium reaching apex of metacoxae. GENITALIA (Fig. 15A-D): **Endosoma**: Shape S-like, partly twisted medially, unequal apical processes bind with membrane and sawlike projections present at the edge of one process (seems like serrated edge) (Fig. 15A). **Phallotheca**: Simple, attenuated towards apex, with blunt end (Fig. 15D). **Left paramere**: Simple, anterior process elongated, somewhat curved, and posterior process short and thumb like (Fig. 15C). **Right paramere**: Simple, leafy with narrow apex (Fig. 15B).

Female. Similar in color and texture as males. Genitalia (Fig. 15E): Bursa copulatrix trapezoidal and centrally with semi-sclerotized plates, sclerotized rings asymmetrical, somewhat triangular and lateral margins curved.

Etymology. Named after the combine generic names, *Europiella* and *Plagiognathus* with which current new genus show close morphological relation.

Discussion. As *Europiella*, a tiny representative species of *Euplagiognathus*, are inhabited in various species of *Artemisiae* (Asteraceae). The external morphology are extremely closely related with *Europiella*, however, the sawlike serrated edge of the endosoma is regarded as an autapomorphic character.

***Euplagiognathus lividellus* (Kerzhner, 1979), n. comb.**

Figures: 13H, 15A-E

Plagiognathus lividellus: Kerzhner 1979: 51 (desc., figs.); 1988a: 855 (key)

Europiella lividella: Schuh et al., 1995: 391 (n. comb.); Schuh, 1995: 316 (cat.); Kerzhner and Josifov, 1999: 346 (cat.); Yasunaga, 2001: 162 (diag., fig.); Kwon et al., 2001: 172 (cat.).

Plagiognathus lividellus: Schuh, 2004 (re-comb)

Diagnosis. Generally distinguished by small, and oval body, usually greenish coloration, entirely pale antennal segments and legs; ventrally few large black spots on metafemur, arranged one on anterior and three on posterior margin; long labium reaching apex of metacoxa.

Description. See generic description.

Measurements. (2♂/ 2♀). Body length 3.08-3.17/ 3.16-3.20; head width across eyes 0.68-0.72/ 0.68-0.72; vertex width 0.32-0.35/ 0.37-0.41; lengths of antennal segments I-IV: 0.25-0.26, 0.93-0.97, 0.62-0.63, 0.47-0.43/ 0.27-0.28, 0.91-0.92, 0.59-0.60, 0.43-0.44; total length of labium 1.15-1.25/ 1.26-1.32; mesal pronotal length 0.46-0.49/ 0.46-0.49; basal pronotal width 1.06-1.04/ 1.02-1.05; width across hemelytron 1.31-1.32/ 1.35-1.37; and lengths of metafemur, tibia and tarsus: 1.02-1.15, 1.70-1.72, 0.48-0.49/ 1.13-1.19, 1.60-1.71, 0.45-0.46.

Specimens examined. **South Korea**: **Gangwon-do**: 1♂, Taebaek, Mt. Hambaeksan, 14.IX.1999, on Tobaceae and Artemisia princeps, G.S. Lee, det. by T. Yasunaga (NAAS). Gyeonggi-do: 1♀, Yangpyeong-gun, kangsang-myeon, sewol-ri, 30.VI.2008, R.K. Duwal and S. Jung; 1♂, 1♀, Yangpyeong-gun, Mt. Yongmun, on light trap, 24.VI.2009, same collectors. **Gyeongsangnam-do**: 2♂, 2♀, Sancheong-gun, Sincheon-myeon, Jungsan-ri, Mt. Jung, 29.VI.20Euplagiognathus, R.K. Duwal (SNU); 1♂, 2♀, same data as above, on light trap. **Jeollanam-do**: 1♀, Danyang-gun, Danyang-eup, 27.VII.20, R.K. Duwal; 1♂, 1♀, Jangseong-gun, Mt. Bangjang, 24.VI.2010, on light trap, R.K. Duwal. **Japan**: 2♀, Honshu, Komori, Ohtoh vil. Wakayama, 10.VI.1998, T. and M. Yasunaga, det. by T. Yasunaga, 2000.

Distribution. China, Korea, Russia.

Host. *Artemisia gigantea* Kitamura (Asteraceae) [Kerzhner, 1978].

Remarks. The specimens were collected from the different kinds of Asteraceous plant on random sweeping as well as in light trap, so specific breeding host is unknown.

Genus *Europiella* Reuter, 1909 밝은다리장님노린재속

Europiella Reuter, 1909: 83 (n. gen.); Schuh et al., 1995: 379 (diag.); Schuh, 1995: 312 (cat.); Kerzhner and Josifov, 1999: 343 (cat.); Yasunaga, 2001a: 162 (note); Duwal et al., 2010b: 21 (diag.); Kwon et al., 2001: 170 (cat.).

Type species: *Agalliastes stigmosus* Uhler, 1893; subsequent designation.

Diagnosis. Recognized by completely black or green or pale coloration, oval or elongated oval body, small to medium sized 2-4.5 mm; simple dark and sericeous setae on dorsum; distinctly distributed spots on metafemora; medially twisted or sub-twisted endosoma with two apical processes, and subapically located secondary gonopore; bursa copulatrix of female gnitalia semitransparent with or without minute spicules; sclerotized rings asymmetrical, thin rimmed. For detail description see Schuh, Lindskog and Kerzhner, 1995.

Distribution. Holarctic region, Nepal.

Remarks. This genus represented as a Holarctic fauna (Schuh, Lindskog and Kerzhner, 1995) however, few species were described from Oriental region e.g., Nepal, where these were observed at temperate to sub-boreal regions above 1,000 m (Duwal et. al., 2010b). Most of species in this group are associated with Asteraceae (Yasunaga, 2001b; Schuh, 2004). Among the five species of *Europiella* in Korea, two species; *E. artemisiae* and *E. kirishenkoi* were commonly occurring and were collected from various species of *Artemisia*.

Key to species of Korean *Europiella*.

1. Antennal segment II with dark wide basal region (1/3-2/3) …..…………..……………....2

- Antennal segment II with extreme base darker or entirely pale …………………………..3

2. Body small, darker; dorsum brown, or greenish brown, or black; head, pronotum and mesoscutellum darker except pale spots, a pair of spots at inner side of eyes, anterior corner of pronotum and mesoscutellum; antennal segment I darker. Male genitalia (Fig. 14A-D): Endosoma with two unequal apical processes, short process curved backwards of the long one (Fig. 14A). Female genitalia (Fig. 14E): Sclerotized rings basally straight and oval towards the apex ….…………….……………………………….….…*E. artemisiae*

- Body large, uniformly pale green texture, basal 1/3 of antennal segment II black or dark, segment I with large dark spot; hind femora with distinct black spots. Male genitalia (Fig. 14F-I): Endosoma twisted medially, and apical processes curved inwardly to C-Shaped structure (Fig. 14F). Female genitalia (Fig. 14J): Sclerotized rings oval …. *E. kiritshenkoi*

3. Body medium sized dorsum often brownish green, hind femora entirely with numerous small and few large spots apically. Male genitalia (Fig. 14K-N): Endosoma with leaf like broad structure arise medially, apical processes broad and curved (Fig. 14L). Female genitalia (Fig. 14O): Sclerotized rings distinctly asymmetrical and ovoid …..*E. miyamotoi*

- Body medium sized, hind femora with aggregated minute spots arranged in rows ………5

4. Body pale green, hind femora with large and small black spots distally arranged randomly which is followed by two rows of aggregated minute spots subapically. Female genitalia (Fig. 15H): Sclerotized rings oval, with wide posterior region and narrow anterior region …………………………………………………………………………….…… *E. gilvus*

- Body pale brown, cuneus darker than corium, hind femora with aggregated minute spots ventrally and few distinct spots subapically on dorsal side. Female genitalia (Fig. 15F-G)

Sclerotized ring narrow, ovoid apically, and straight posterior margin …………...*E. livida*

Europiella artemisiae **(Becker, 1864)**

Figures: 13B, 14A-E

Capsus artemisiae Becker, 1864: 487 (n. sp.)

Plagiognathus solani Matsumura, 1917: 432 (n. sp.)

Plagiognathus albipennis antennaria Stichel, 1934: 282 (n. form)

Europiella artemisiae: Schuh et al., 1995: 385 (n. syn., figs.); Schuh, 1995: 313 (cat.); 2001: 251 (n. syn.); Yasunaga, 2001a: 162 (diag., fig.); Kerzhner and Josifov, 1999: 344 (cat.).

Diagnosis. Generally distinguished by small, oval shaped body; variously colored (pale brown, brown to dark black,); entirely dark dorsum with pale areas on inner lateral side of eyes, meso-scutellum and base of cuneus; length of labium nearly equal to the length of femur; width of vertex equal to the length of antennal segment IV; pale (or dirty yellow) anterior pairs of legs, and fuscous (or black) meta-femur.

Description. *Male*. Body small, oval. COLORATION (Fig. 13B): Variously colored (brown, dark brown or black); dorsum entirely brown, or dark brown or black; a pair of pale spots on inner lateral side of eyes and lateral margins of meso-scutellum pale; hemelytron , apical 1/3 of clavus, inner margins of corium darker, base of cuneus pale; membrane grey. Venter dark brown or black. Antennae darker, segment I and segment II (entirely or, 1/2-1/3 from base) black. Labium shiny and dark. Fore and middle legs paler than hind legs. SURFACE AND VESTITURE: Dorsum furnished with semierect simple dark and soft pale setae, and appressed flat serious setae. STRUCTURE: Head projecting anteriorly, convex; labium reaching apex of metacoxae. GENITALIA (Fig. 14A-D): **Endosoma**: Shape S-like, slightly twisted medially, and provided with two apical processes, short process somewhat curved backward (Fig. 14A). **Phallotheca**: As in figure 14B. **Left paramere**: As in figure 14C. **Right paramere**: As in figure 14D.

Female. Similar in color and texture as male. Genitalia (Fig. 14E): Bursa copulatrix somewhat rectangular, central large part occupied with semi-sclerotized plates furnished with minute spines; sclerotized rings apically asymmetrical, oval and straight posterior margin.

Specimens examined. **North Korea**: **Hamgyeongbuk-do**: 3♂, 1♀, Cheongjin-si, Jikha-ri, (label data: Dzikha-ri, 16 km, Südl. Chongdzin), 31.VIII.1970, M. Josifov. **South Korea**: **Chungcheongbuk-do**: 4♂, 3♀, Okcheon-gun, Annemyeon, Hyeon-ri, 30.VII.2005, on light trap, S.H. Lee. **Chungcheongnam-do**: 1♂, 1♀, Boryeong-si, Ocheon-myeon, Wonsando-ri, 5.VIII.2009, R.K. Duwal; 3♂, 4♀, Danjin-gun, 9.X.2008, R.K. Duwal and S. Jung; 3♂, 1♀, Danjin-gun, Seongmun-myeon, Nanjido-ri, 18.VIII.2009, R.K. Duwal and S. Jung; 1♂, Danjin-gun, Myeoncheon-myeon, Seongsang-ri, 12.X.2006, S.H. Lee; 2♂, 3♀, Seosan-si, Unsan-myeon, Anho-ri, 31.VIII.2006, S.H. Lee; 2♂, Taean-gun, Iwon-myeon, Nae-ri, 31.VIII.2006; 10♂, 5♀, Yesan-gun, Sinam-myeon, Yonggung-ri, 3.VII.2006, J.W. Seong; 1♂, 1♀, Yesan-gun, Deoksan-myeon, Sacheon-ri, Sudeoksa, 11.VII.1991, collector unknown. **Gangwon-do**: 1♀, Gangneung-si, Myeongju-dong, Songnim-ri, Yeongokchaen, 27.V.1993, D.S. Gu; 4♂, 4♀, Honcheon-gun, Sambong Natural forest, 27.VI.2003, J.W. Seong; 2♀, Hongcheon-gun, Nae-myeon, Changchon-ri, 5.VII.2007, Y.J. Lee;4♂, 4♀, Wonju-si, Munmak-eup, 1.V.2009, R.K. Duwal and S. Jung; 6♂, 2♀, same data as above, 27.V.2009; 4♂, 6♀, Pyeongchang-gun, Daegwanryeiong-myeon, Hoenggye 3-ri, 11.VIII.2006, J.W. Seong; 1♂, Pyeongchang-gun, Jinbu-myeon, Dongsan-ri, 30.VII.2007, J.W. Seong; 1♀, Taebaek-si, Mt. Hambaek, 14.IX.1999, G.S. Lee (NAAS); 1♂, Yeongwol-gun, Sangdong-eup, Naedoek-ri, 24.V.2001, J.Y. Choi. **Gyeonggi-do**: Annyang-si, Gwanak

Arboretum, 9.VII.2008, on light trap, R.K. Duwal and S. Jung; 1♂, 3♀, Icheon-si, Mt. Manhyeong, 1.VII.2008, R.K. Duwal and S. Jung; 2♂, Yangpyeong-gun, Mt. Yongmun, 11.VI.2009, on light trap, R.K. Duwal and S. Jung; 2♂, same data as above, on light trap, 18.VIII.2009; 1♂, 3♀, Incheon, Gangwa-gun, Hajeom-myeon, Mangwol-ri, 1.VII.2008, R.K. Duwal and S. Jung; 1♂, 1♀, Gapyeong-gun, Mt. Yumyeong, 14.VI.1997, S.B. Ahn; 1♂, Goyang-si, Deokyanggu, Gwansandong, 19.VII.2008, S.W. Park; 2♂, 1♀, Incheon, Ganghwa-gun, Yangdo-myeon, Samheung-ri, 10.VI.2007, J.W. Seong; 1♀, Gwanju-si, Docheok-myeon, Sangnim-ri, Mt. Taehwa, 25.IX.2003, Jung and Chansik; 1♂, Suwon, NAAS, 25.VII.1997, J.Y. Choi (NAAS); 2♂, Yangpyeong-gun, Gangsangmyeon, Sewol-ri, 30.VI.2008, R.K. Duwal and S. Jung.**Gyeongsangbuk-do**: 1♀, Andong-si, Seokdong-dong, 6.VI.2008, J.O. Lim; 1♀, Andong-si, Yean-myeon, Ingye-ri, 6.VI.2008, J.O. Lim; 1♂, Mungyeong-si, Buljeong-dong, Buljeonsa, 9.VIII.2007, J.W. Seong; 1♂, Yeongyang-gun, Cheonggi-myeon, Jeongjok-ri, 7.VI.2008, J.O. Lim. **Gyeongsangnam-do**: 1♂, Geoje-si, Geoje Arboretum, 25-27.VIII.2008, on *Artemisia* sp., R.K. Duwal and S. Jung; 7♂, 1♀, Goeje-si, Irun-myeon, Jisimdo, 28-29.VIII.2008, on *Artemisia*, R.K. Duwal and S. Jung. **Jeollanam-do**: 2♂, 1♀, Gwangyang-si, Ongnyong-myeon, Chusan-ri, 16-19.VI.2008, R.K. Duwal and S. Jung; 1♀, Hwasun-gun, Hwasun-eup, Suman-ri, 12.IX.1996, M.L. Lee. **Jeju-do**: 3♂, Jeju-si, Mt. Headong, Eosungseong, 27.VIII.1997, S.B. Ahn; 1♂, Jeju-si, Gujwa-eup, Gimnyeong-ri, 27.VIII.1997, S.B. Ahn; Jeju-si, Mt. Haeandong, Eorimog, 27.VIII.1994, D.S. Gu; 2♀, Jeju-si, Aeweol-eup, Eoeum-ri, 14.V.2003; 24♂, 12♀, Jeju-si, 12-15.V.2008, on *Artemisia* sp., T. Yasunaga, R.K. Duwal and S. Jung; 1♀, Seogwipo-si, Andeok, 15.V.2003, J.W. Seong. **Japan**: Hokkaido, Yunotai, Hiyama, 19.VIII.1994, T. Yasunaga, det. by T. Yasunaga, 2008.

Distribution. Azerbaijan, China, European continents, Georgia, Japan, Kazakhstan, Korea, Russia, Uzbekistan, N. America.

Host. *Artemisia absinthium* L. and *A. vulgaris* L. (Asteraceae) [Wagner, 1975b].

Remarks. *Europiella artemisiae* is the most common, predominantly distributed species in the Korea, breeding on *Artemisia* spp., and abundantly emerge from early spring to late autumn. It is assumed that Kwon et al. (2001) might misidentified *E. artemisiae* with *E. albipennis* because recent survey (2008-2009) shows no evidence of *E. albipennis* in Korea

Europiella gilva (Kulik, 1965) 고구려다리장님노린재

Figures: 13C, 15H

Plagiognathus gilvus: Kulik, 1965: 155 (n. sp., desc., figs.); Kerzhner, 1988b: 855 (key)

Europiella gilva: Schuh et al., 1995: 390 (n. com.); Kerzhner and Josifov, 1999: 345 (cat.); Kwon et al., 2001: 171 (cat.).

Diagnosis. Generally recognized by medium sized, elongated oval body; entirely pale greenish coloration; pale dorsum with dark areas underneath apex of cuneus; ventrally distributed dense spots at distal region of metafemora, arranged in two rows towards the base.

Description. *Female*. Body medium sized, elongated oval. COLORATION (Fig. 13C): Generally pale greenish; dorsum entirely pale; membrane pale with dark areas on either sides beneath the cuneus. Venter greenish. Antennae pale, segment III and IV darker. Labium pale with dark apex. All legs pale; meta-femora ventrally with two rows of spots, not continuous to the base, and densely scattered apically; and meta-tibia with small brown spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished semierect dark setae and soft pale setae, and appressed flat serious setae. STRUCTURE: Head projecting anteriorly, convex; labium reaching apex of metacoxae; head, pronotum, mesoscutum and scutellum partly shagreened. GENITALIA (Fig. 15H): Bursa copulatrix with semi-sclerotized areas on posterior regions beneath the sclerotized rings, the sclerotized rings somewhat oval shaped, broad circles and thin rimmed.

Male. For description and figures of male genitalia see Kerzhner 1979: 51.

Specimens examined. South Korea: **Gangwon-do**: 5♀, Honcheon-gun, Sambong Natural forest, 25.VI.2003, on light trap, J.W. Seong. **Jeollanam-do**: 1♀, Jangseong-gun, on light trap, R.K. Duwal. **Gyeongsangnam-do**: 1♀, Goeje-si, Irun-myeon, Jisimdo, 28-29.VIII.2008, R.K. Duwal and S. Jung.

Distribution. Korea, Russia.

Host. *Radbosia excisa* (Maxim.) H. Hara (Lamiaceae) [Kerzhner, 1988b].

Remarks. In Korea, *Europiella gilva* is recognized with few female specimens on light trap, so that biology is unknown.

***Europiella kiritshenkoi* Kulik, 1975**

Figures: 13D, 14F-J

Plagiognathus kiritshenkoi: Kulik, 1975: 587 (n. sp.); Kerzhner, 1988b: 855 (key)

Europiella kiritshenkoi: Schuh et al., 1995: 390 (n. comb.); Schuh, 1995: 513 (cat.); Kerzhner and Josifov, 1999: 345 (cat.).

Diagnosis. Generally recognized by large sized body; usually greenish coloration; large black spot on antennal segment I, and one half or one third basal region of segment II black; length of segment II nearly equal to the length of meta-femur; short labium reaching apex of mesocoxae; yellowish metafemora ventrally with two rows of spots.

Description. *Male*. Body comparatively large, more or less parallel laterally.

COLORATION (Fig. 13D): Generally greenish; head, pronotum, mesoscutum and scutellum green (or in some specimens tinged with yellow); hemelytron entirely pale; membrane grayish. Venter entirely green (or in some specimen abdomen tinged with yellow). Antennae brownish, segment I ventrally with large black spot, one half or one third of segment II black. Labium pale, segment I greenish, apex of segment IV darker. Procoxa pale, and meso- and metacoxae greenish; trochanters pale yellow; metafemora yellowish with two rows of spots on either lateral margins ventrally; metatibia pale with large black spots. SURFACE AND VESTITURE: Dorsum furnished with semierect simple dark setae, soft pale setae and appressed flat serious setae. STRUCTURE: Head projecting anteriorly, convex; labium nearly reaching apex of mesocoxae; head, pronotum, mesoscutum and scutellum partly shagreened. GENITALIA (Fig. 14F-I): **Endosoma**: Shape S-like, completely twisted medially, apical processes curved, short process curved like upwardly (Fig. 14F). **Phallotheca**: Broad, short and apically narrow as in figure 14H. **Left paramere**: As in figure 14I. **Right paramere**: Broad, elongated, nearly parallel laterally and margins not uniform 14H.

Female. Similar in color and texture as male. Genitalia (Fig. 14J): Bursa copulatrix with centrally located semi-sclerotized plates, and sclerotized rings somewhat oval shaped.

Specimens examined. **South Korea**: **Gangwon-do**: 7♂, 17♀, Wonju-si, Munmak, 27.V.2009, on Artemisia sp. R.K. Duwal and S. Jung; 49♂, 42♀, same data as above except date, 27.V.2009. **Gyeonggi-do**: 1♀, Yangpyeong-gun, 11.VI.2009, on light trap, same collectors.

Distribution. China, Korea, Russia.

Host. *Artemisia vulgaris* L. (Asteraceae) [Kulik, 1975].

Remarks. Large number of *Europiella kiritshenkoi* were aggregated on *Artemisia* under the bridge along the river and were also attracted to the light.

Europiella livida (Reuter, 1906) 다리장님노린재

Figures: 13G, 15F-G

Plagiognathus lividus: Reuter, 1906: 73 (n. sp.); Kerzhner, 1988b: 855 (key)

Europiella livida: Schuh et al., 1995: 390 (n. comb.); Schuh 1995: 316 (cat.); Kerzhner and Josifov, 1999: 346 (cat.); Kwon et al., 2001: 171 (cat.).

Diagnosis. Generally distinguished by moderate, elongated oval body; usually pale greenish coloration; somewhat darker cuneus (than corium), almost grayish; metafeomra ventrally with few dark spots, arranged in rows towards the base; and tibiae with a black spot or ring at their base.

Description. *Female*. Body small, oval. COLORATION (Fig. 13G): Generally pale greenish; dorsum entirely pale; membrane greyish. Venter greenish. Antennae pale, segment III and IV somewhat darker. Labium pale with dark apex. All legs pale; metafemora ventrally with two rows of small aggregated spots and dorsally with few spots in three rows (Kerhner, 1979: 53 (181-182); and metatibia with black base. SURFACE AND VESTITURE: Dorsum furnished with semierect dark setae and soft pale setae, and appressed flat serious setae. STRUCTURE: Head projecting anteriorly, convex, labium nearly reaching apex of metacoxae. GENITALIA (Fig. 15F-G): Bursa copulatrix delicate, sclerotized rings somewhat elongate oval, and thin rimmed.

Male. Not observed. GENITALIA . See Kerzhner 1979: 53.

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♀, Yangpyeong-gun, Kangsang-myeon, sewol-ri, 22.VIII.2011, R.K. Duwal.

Distribution. China, Russia, Korea.

Host. *Artemisia gigantea* Kitamura (Asteraceae) [Kerzhner, 1988b].

Remarks. The biology is unknown as the specimen was collected on light.

***Europiella miyamotoi* (Kerzhner, 1988)**

Figures: 13E-F, 14K-O

Plagiognathus miyamotoi Kerzhner 1988b: 64 (n. sp.)

Europiella miyamotoi: Schuh et al., 1995: 391 (n. comb.); Schuh, 1995: 316 (cat.); Kerzhner and Josifov, 1999: 346 (cat.); Yasunaga, 2001a: 164 (diag., fig.).

Diagnosis. Generally recognized by large body; usually pale yellow coloration; entire antennae and legs pale; antennal segment II nearly equal to the width of pronotum; short labium reaching apex of mesocoxa; ventrally scattered spots on distal half of metafemora, and dorsally with few minute spots subapically; length of metafemora nearly equal to the length of pronotum.

Description. *Male*. Body relatively large and parallel laterally. COLORATION (Fig. 13E-F): Generally pale yellowish; dorsum entirely yellowish pale; membrane greyish. Venter greenish yellow. Antennae pale, segment III and IV slightly darker. Labium pale, shining with dark apex. All legs pale; metafemora provided with small, scattered spots on distal region ventrally and dorsally with few minute spots subapically; and metatibia with large spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with semierect, simple dark and soft pale setae, and appressed flat sericeous setae. STRUCTURE: Head projecting anteriorly, convex; labium reaching apex of the mesocoxae; head, pronotum, mesoscutum and scutellum shagreened. GENITALIA (Fig. 14K-N): **Endosoma**: Shape S-like, with two broad and sub-equal apical processes, from the basal curving area, a membranous slender leafy structure arises (Fig. 14L). **Phallotheca**: large, basally broad and narrow towards apex (Fig. 14M). **Left paramere**: Body large, structure as in figure 14K. **Right paramere**: Broad, elongated and margin not uniform as in figure 14N.

Female. Similar in color and texture as male. Genitalia (Fig. 14O): Bursa copulatrix with semi sclerotized plates, and sclerotized rings asymmetrical, elongated oval.

Specimens examined. **South Korea**: **Gyeongsangbuk-do**: 1♀, Eulseong, 24.V.2000, on *Boehmeria nivea* (L.) Gaudich (Urticaceae), S.H. Lee. **Japan**: 1♂, Hokkaido, Etanbetsu, Asahikawa C., 18.VII.1998, T. and M. Yasunaga, det. by T. Yasunaga, 2008; 1♀, Hokkaido, Aoyama, Tobetsu T., 2.VIII.1997, R. Endoh, det. by T. Yasunaga, 2008.

Distribution. Japan, Korea, Russia.

Host. *Artemisia gigantea* Kitamura (Asteraceae) [Kerzhner, 1988a].

Remarks. The single specimen observed was confirmed after comparing with reference specimens (Japanese specimens from Yasunaga). Though the label data inform that, it was collected on *Boehmeria nivea* (L.) Gaudich (Utricaceae), the specific breeding host is unknown.

Genus *Harpocera* Curtis, 1838 고려애장님노린재속

Harpocera Curtis, 1838: 709 (n. gen.); Schuh, 1995: 322 (cat.); Kerzhner, 1988b: 786 (key); Kerzhner and Josifov, 1999: 351 (cat.); Kwon et al., 2001: 172 (cat.); Vinokurov, 2006: 83 (Key, desc.).

Type species: *Harpocera burmeisteri* Curtis, 1838; original designation.

Diagnosis. Recognized by large sized body, longer than 5 mm; distinctly pale median strip on dorsum; stout antennae with cylindrical segment I and hatched shaped segment II (in male) or simple elongated (in female); usually short rostrum exceeding apex of procoxae; anteriorly narrow thorax extended broad posteriorly, and calli different in color than surrounding regions; and elongated, flat hind femora.

Distribution. Mediterranean region, Palearctic region.

Remarks. This genus consist of seven described species, inhabiting various species of oak trees (Schuh, 1995; Kerzhner and Josifov, 1999; Vinkurov, 2006). Vinokurov (2006) recently clarify the status of three Palearctic species of *Harpocera*: *H. choii, H. koreana and H. orientalis* with their descriptions and male genital structures from Far eastern Russia. In this study two species of *Harpocera*, *H. choii*, *H. koreana* are found exist in Korea.

Clear sexual dimorphism is found in this genus, male somewhat dark and stout bodied and females are orange red or brighter colored than males and have simple and slender antennal segments.

Key to species of Korean *Harpocera*.

1) Antennal segments in both sexes black, distinctly swollen at apex; head yellowish brown, with genae, lora, stripes on frons, lateral side of vertex black; dorsum darker with mesial and lateral margin of pronotum, pale (Fig. 11D) ………………..……..…………..*H. choii*

- In males, all antennal segments black and stout, segment II thickened apically, and body dark brown or black; in females, all antennal segments pale with brown apices and pale regions of appendages with minute dark spots, and dorsum orange red. ..……..*H. koreana*

Harpocera choii **Josifov, 1977 최고려애장님노린재**

Figure: 11D

Harpocera choii: Josifov, 1977: 50 (n. sp., desc., fig.); 1992: 115 (list); Kerzhner 1988a: 841 (key); Schuh, 1995: 322 (cat.); Kerzhner and Josifov, 1999: 352 (cat.); Anufriev et al., 2001: 119-120 (eng. transl.); Kwon et al., 2001: 172 (cat.); Vinokurov, 2006 (key, desc., figs).

Diagnosis. Recognized by large, shining body; a distinct yellow or orange mesial strip extended from head to scutellum; entirely stout and shining black antennae.

Description. *Female*. Large, elongated. COLORATION (Fig. 11D): Generally shining brown body. Head, and anterior pronotum brown tinged with orange color; posterior pronotum, mesoscutum and scutellum darker; hemelytron dark brown with base of cuneus pale. Antennae entirely black. Labium pale with dark apex. Legs usually pale with distal half of metafemora orange red and tibia with minute pigment like spots. SURFACE AND VESTITURE. Dorsum entirely furnished with simple dark setae and lanceolate setae. STRUCTURE: Head smooth; pronotum partly shagreen; labium slightly surpass apex of procoxae. GENITALIA: Not observed due to teneral form.

Male. Not observed. For detail descriptions and genital structures of male see Vinokurov, 2006: 83 (Fig. 1-6).

Specimens examined. **South Korea**: **Chuncheongbuk-do**: 1♀, Chunju-si, Salmi-myeon, 8.V.1997, H.M. Jung, det. by T. Yasunaga, 1999 (NAAS). **Gyeonggi-do**: 1♀, Paju-si, Musan-eup, Gunnae-myeon, 21.VII.2008, S. Jung.

Distribution. Korea.

Host. *Quercus* sp. (Fagaceae) [Josifov, 1977].

Remarks. The biology is unknown in Korea.

***Harpocera koreana* Josifov, 1977 고려애장님노린재**

Figures: 11E-F, 12G-K

Harpocera koreana: Josifov, 1992: 115 (list); Schuh, 1995: 322 (cat.); Kerzhner and Josifov, 1999: 352 (cat.); Kwon et al., 2001: 172 (cat.); Vinokurov, 2006 (key, desc., figs).

Diagnosis. Recognized as sexually dimorphic group; In males, black body and antennae, brown hemelytron with blackish cuneus, stout antennae with thickened apex of segment II; In females, orange red or yellow body and dorsum with black stripes on head and anterior protnotum, pale antennae with brown minute spots; in both male and female legs pale with dark distal half of femora, and tibiae provided with minute small spots (Fig. 11E-F).

Description. *Male*. large, elongated. COLORATION (Fig. 11E-F): Generally brown body. Head, anterior pronotum, mesoscutum and scutellum black with a pale posterior margin of pronotum; a median pale stripe extended from head to thoracic regions and mesoscutum laterally with pale areas; hemelytron brown; cuneus dark brown with pale base. Antennae entirely shining black. Labium pale with dark apex. All legs pale, with distal half of metafemora darker; distal parts of all femora and all tibiae spotted. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed simple dark setae and lanceolate pale setae; pronotum, mesoscutum, scutellum and hemelytron shagreen. STRUCTURE: Antennae stout, segment II thickened apically; labium slightly surpass the apex of procoxa. GENITALIA (Fig. 12H-K): **Endosoma**: S-shaped; apex short; and secondary gonopore small and subapically located as in figure 12J. **Phallotheca**: As in figure 12H. **Left paramere**: As in figure 12I. **Right paramere**: As in figure 21K.

Female. Sexual dimorphism found in this group. Body and dorsum orange red with pale median strip extended from head to scutellum. Antenna pale and segment II with minute spots. Labium pale with dark apex. Legs pale, femora with darker apices; and all tibiae with dark minute spots. GENITALIA (Fig. 12G): Sclerotized rings asymmetrical; oval with narrow anterior region and wide base.

Specimens examined. **South Korea**: **Gangwon-do**: 4♂, Inje-gun, Girin-myeon, Jindong-ri, Mt. Jumbong; 24.V.2011, on light, S. Jung. **Gyeonggi-do**: 1♂, Anyang-si, 8.V.1990, J.W. Kim; 1♀, Suwon-si, NAAS, 8.V.2001, G.M. Kwon; 1♂, 1♀, Yeoncheon-gun, Baekhak-myeon, 20.V.2008, S. Jung. **Jeollabuk-do**: 3♀, Muju-gun, Seolcheon-myeon, Samgong-ri, 19.V.2007, J.W. Seong.

Distribution. Korea, Russia.

Host. *Quercus aliena* Blume (Fagaceae) [Josifov, 1977].

Remarks. As the specimens were collected on light, biology is unknown in Korea.

Genus *Kasumiphylus* Schwartz and Stonedahl, 2004 동해애장님노린재속

Phoenicocoris Yasunaga, 1999: 191 (disc.)

Kasumiphylus Schwartz and Stonedahl, 2004: 42 (n. gen., diag., desc.).

Type species: *Psallus kyushuensis* Linnavuori, 1961.

Diagnosis. Recognized by elongated, oval body; generally brown dorsum with somewhat paler hemelytron, dorsum entirely covered with brown to black simple reclining setae and silvery setae. For detail descriptions see Yasunaga, 1999 (as *Phoenicocoris*) and Schwartz and Stonedahl, 2004.

Distribution. Palearctic region.

Remarks. Schwartz and Stonedahl (2004) described *Kasumiphylus* as new genus, which was previously placed under *Phoenicocoris*, and is represented with only two species.

Kasumiphylus kyushuensis is widely distributed on *Pinus densiflora* and *P. koraiensis* (Pinaceae) from late June to early September in Korea during field survey.

Kasumiphylus kyushuensis **(Linnavuori, 1961) 동해애장님노린재**

Figures: 13G, 17A-E

Psallus kyushuensis Linnavuori, 1961: 168 (n. sp.)

Phoenicocoris kyushuensis: Kerzhner 1988a: 850 (key, figs.); Schuh, 1995: 374 (cat.); Kerzhner and Josifov, 1999: 387 (cat.); Yasunaga, 1999: 192 (desc., figs.); 2001a: 168 (diag., fig.).

Kasumiphylus kyushuensis Schwartz and Stonedahl, 2004: 44 (diag., desc., figs.).

Diagnosis. Generally recognized by brown (in pale specimen) or, dark brown (in dark brown specimen) head, pronotum and hind femora; brown scutellum and hemelytron usually pale and reddish cuneus; S- shaped endosoma with delicate, membranous sub-equal apex (Fig. 17B); and female genitalia small, oval sclerotized rings with narrow apex (Fig. 17E).

Description. *Male*. Body small, elongated. COLORATION (Fig. 13G): Generally brown; head brown with anterior region castaneous; pronotum blackish; mesoscutum and anterior margin of scutellum brown tinged with red; hemelytron, clavus either uniformly brown or with darker base, corium uniformly brown, membrane pale brown. Venter red, or castaneous. Antennal segment I pale tinged with red, segment II pale brown, segment III and IV black. Labium pale with brown apex. All coxae and trochanters pale; meta-femora brown tinged with red; meta-tibia pale with small brown spots at the base of pale brown spine. SURFACE AND VESTITURE: Dorsum uniformly distributed with both semierect simple black setae and flat shining pale setae; head and pronotum shagreen. STRUCTURE: **Head**:

Convex, projecting anteriorly; labium slightly surpass the apex of metacoxae. GENITALIA (Fig. 17A-D): **Endosoma**: Shape S-like, with complicated apex; secondary gonopore subapically located, infolded with membrane (Fig. 17B). **Phallotheca**: Narrow, curved and tapered towards the apex (Fig. 17A). **Left paramere**: Body large, anterior process thick and flat (Fig. 17C). **Right paramere**: Elongated, leaf like (Fig. 17D).

Female. Similar in color and texture. GENITALIA (Fig. 17E): Sclerotized rings asymmetrical, thin rimmed, and more or less triangular.

Specimens examined. **South Korea**: **Gangwon-do**: 1♀, Hongcheon-gun, Sambong Natural forest, 26.VI.2003, J.W. Seong; 10♀, Chunju-si, Miwon-myeon, Miwon-ri, (19-2).VIII-(2-9)-IX.2005, J.W. Seong. **Gyeonggi-do**: 1♀, Suwon-si, NAAS, 24.VII.1997 (NAAS). **Gyeongsangbuk-do**: 1♂, Sancheong-gun, Sicheon-myeon, Mt. Jiri, 26.VIII.1999, on *Pinus densiflora* Siebold and Zucc. (Pinaceae), S.H. Lee (NAAS); **Gyeongsangnam-do**: 1♂, 1♀, Goeje Arboretum, 25-27.VIII.2008, on *Pinus* sp., R.K. Duwal. **Japan**: 1♂, Kyushu, Kônoura, Sotome, Nagasaki Pref., 1.VIII.1996, T. Yasunaga, det. by T. Yasunaga, 2008.

Distribution. Japan, Korea, Russia.

Host. *Pinus densiflora* Siebold and Zuccarini (Japan), *P. koraiensis* Siebold and Zuccarini (Korea), *P. densiflora* var. funebris (Russia) [Schwartz and Stonedahl, 2004].

Remarks. The individuals of *Kasumiphylus kyushuensis* are aggregated in new branches or buds of the Pine trees.

Genus *Macrotylus* Fieber, 1858 큰애장님노린재속

Macrotylus Fieber, 1858: 325; Schuh, 1995: 334 (cat.); Kerzhner, 1988b: 788 (key); Kerzhner and Joisfov, 1999: 360 (cat.); Kwon et al., 2001: 334 (cat.).

Type species: *Macrotylus luniger* Fieber, 1858; subsequent monotypy.

Diagnosis. Generally recognized by elongated body, parallel laterally, variously colored dorsum from blackish, or brownish, or reddish, or yellowish, with or without dark spots, or with distinct marginal lines on the hemelytron; usually with whitish large spot near cuneus.

Distribution. Ethiopian region, Holarctic region.

Remarks. *Macrotylus* is a large group comprises of nearly seventy species, distributed widely in a Holarctic region. Two species has been reported from the northern Korean Peninsula (Kwon et al., 2001), however, there is no evidence of existence in Southern part during the field survey from 2008-2011.

Key to species of Korean *Macrotylus*.

1) Body blackish green; head, calli and legs black; membrane gray with pale vein. Male genitalia (Fig. 17F-I): Endosoma simple, S-shaped; secondary gonopore mesially located; right paramere flat and with blunt apex. Female genitalia (Fig. 17J): Sclerotized rings asymmetrical, oval and thick rimmed ………………...………………………*M. cruciatus*

\- Antennal segment I with longitudinal black stripe, hemelytron yellowish with black margins on clavus and corium; membrane pale with black stripe between white spots; all femora with black stripe on both anterior and posterior margins, fore and meso tibiae and entire hind tibiae black (for detail see Kerzhner, 1988b) …………………...*M. mundulus*

Macrotylus cruciatus (Sahlberg, 1848) 이질풀큰애장님노린재

Figures: 16A-B, 17F-J

Lopus cruciatus Sahlberg, 1848: 89 (n. sp.)

Macrotylus cruciatus: Kerzhner, 1988b: 841 (key); Schuh, 1995: 335 (cat.); Kerzhner and Josifov, 1999: 364 (cat.); Anufriev et al., 2001: 119 (eng. transl.); Kwon et al., 2001: 173 (cat.).

Diagnosis. Recognized by large size, dirty coloration of body, dirty greenish hemelytron with remarkably pale margins or veins; entire dorsum, except mesoscutum and scutellum shagreen; simple, S-shaped endosoma as in figure 17G.

Description. *Male*. Body huge, laterally parallel. COLORATION (Fig. 16A-B): Generally dirty coloration, greenish or bluish; head fuscous; pronotum greenish; mesoscutum, and scutellum pale yellowish with dark anterior margins; hemelytron dirty greenish with remarkable pale veins and margins. Venter fuscous. Antenna entirely black, or segment I and base of segment II back, and remaining dark brown. Labium black. All legs fuscous. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed semierect black setae. STRUCTURE: Head projecting anteriorly; labium reaching apex of metacoxae; dorsum completely shagreened, except meso-scutum and scutellum smooth and shining. GENITALIA (Fig. 17F-I): **Endosoma**: Shape simple, S-like, not twisted; secondary gonopore medially located (Fig. 17G). **Phallotheca**: As in figure 17I. **Left paramere**: As in figure 17H. **Right paramere**: As in figure 17F.

Female. Similar in color and texture as male. GENITALIA (Fig. 17J): sclerotized rings asymmetrical, thick rimmed, nearly oval with one end narrow and another broad or somewhat circular.

Specimens examined. **North Korea**: **Yanggang-do**: 1♂, Sinsa-dong (in label: Jangkangdo, Sinsodong), 1400m, 17.VII.1974, M. Josifov, det. by M. Josifov; 1♀, Samjiyeon (in label: Samdzijôn), 13-19.VII.1974, M. Josifov, det. by M. Josifov.

Distribution. Finland, Georgia, Kazakhstan, Korea, Mongolia, Russia, Siberia.

Host. *Geranium sylvaticum* L. (Geraniaceae) [Kerzhner, 1988b].

Remarks. The biology is unknown.

***Macrotylus mundulus* (Stal, 1858) 큰애장님노린재**

Leptomerocoris mundulus Stal, 1858: 188 (n. sp.)

Macrotylus mundulus: Kerzhner, 1988b: 841 (key); Schuh, 1995: 338 (cat.); Kerzhner and Josifov, 1999: 362 (cat.); Anufriev et al., 2001: 119 (eng. transl.); Kwon et al., 2001:173 (cat.).

Diagnosis. Recognized by yellowish dorsum with dark veins and white cuneus; a black longitudinal strip of antennal segment I; white spot of the membrane with brown strip across the spot; pale legs with dark stripes on anterior and posterior margins.

Description. *Male*. Body large, laterally parallel. COLORATION: Generally yellowish; head, pronotum, mesoscutum and scutellum completely yellow; hemelytron pale with dark margins and veins, cuneus white; membrane pale brownish with large white spot beneath the cuneus and a dark longitudinal margin across the spot. Antennae dark, segment I pale with black longitudinal line, base and sub-apical region of segment II black, segment III and IV brown. All coxae and trochanters pale; meta-femora pale with black anterior and posterior margin; meta-tibia black. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed semierect pale brown setae. STRUCTURE: Head projecting anteriorly, small eyes, and wide vertex. [For detail description and genital structure see Kerzhner, 1988].

Specimens examined. Not observed.

Distribution. China, Korea, Mongolia, Russia.

Host. *Potentilla tanacetifolia* (Rosaceae) [Kerzhner, 1988b].

Remarks. This species was reported from the northern Korea (Kwon et al., 2001) was not observed in South Korea.

Genus *Moissonia* Reuter, 1894

Moissonia Reuter, 1894: 148 (n. gen.)

Ellenia Reuter: Schuh, 1984: 366 (diag.)

Moissonia Reuter: Schuh, 1995: 353 (cat.); Kerzhner and Josifov, 1999: 372 (cat.); Yasunaga, 1999: 195 (diag.); 2001a: 166 (diag.); 2010: 75 (diag.); Duwal *et al*. 2010b: 26 (diag.); Duwal and Lee, 2011: 48 (diag.).

Type species: *Agalliastes punctatus* Fieber, 1861; monotypy.

Diagnosis. Generally recognized by pale or green coloration, small and oval body; weakly concave head, sub-hyaline to hyaline hemelytron; ventral longitudinal keel on male genital capsule, and the single apical process of endosoma furnished with a series of notches subtending secondary gonopore. For detailed descriptions see Schuh (1984).

Distribution. Japan, Korea, Nepal, Old World tropics and subtropics.

Remarks. The genus *Moissonia* is one of the morphologically confusing group, comprising of nearly forty two described species (Schuh, 1995; Kerzhner and Josifov, 1999; Yasunaga, 1999; 2010; Duwal et al., 2010b; Duwal and Lee, 2011) and widely distributed in tropical, subtropical and temperate regions. Most of these are inhabited in flowering trees and creepers, though few of them also observed on Asteraceous herbs, e.g. *Bidens* sp. (Duwal et al, 2010b).

Key to species of Korean *Moissonia*.

1. Spots on pronotum sparsely distributed; pro- and mesocoxae, trochanters and femora pale; larger basal region of metafemora pale and towards the apex brownish (in some apical half brown). Male genitalia (Fig. 18A-D): Apex of endosoma, short and stout (Fig. 18A); right paramere with spiral outer margin subapically. Female genitalia (Fig. 18E): Sclerotized rings thick rimmed and nearly quadrate ……………………..…....*M. kalopani*

\- Spots on pronotum medium or densely distributed; pro- and mesocoxae, trochanters and femora darker (brown, or grayish i.e. similar to that of metafemora) …………………….2

2. Metafemora dark brown. Male genitalia: Apex of endosoma with apical elongated process (Yasunaga, 1999:191). Female genitalia (Fig. 18K): Sclerotized rings thick rimmed and as in figure ………………………………………..………………………..……*M. befui*

\- Metafemora entirely grayish (except in some brown tinged with red apically). Male genitalia (Fig. 18F-I): Apex of endosoma with short, slender and curved apical process; right paramere with triangular protuberance on inner apical margin (Fig. 18F). Female genitalia (Fig. 18J): Sclerotized rings thin rimmed as in figure …………......*M. yasunagai*

***Moissonia befui* Yasunaga, 1999**

Figures: 16D, 18K

Moissonia befui Yasunaga, 1999: 196 (n. sp., diag., desc., figs.); 2001b: 166 (diag., fig.).

Diagnosis. Recognized by small, oval, pale-green body; semitransparent dorsum furnished with short reclining pubescence and dark setae; shining pronotum with numerous dark spots; and dark brown femora with a large black spot apically.

Description. *Female*. Body small, oval. COLORATION (Fig. 16D): Generally pale green; head, pronotum, mesoscutum, and scutellum shining, greenish yellow, with dark spots, mesoscutum and scutellum usually widely darkened mesally; hemelytron hyaline, with 3 pairs of spots at apices of corium, embolium and inner mesial parts of cuneus; membrane brownish hyaline. Ventrally, thoracic region unicolorously brownish and abdomen green. Antennae pale brown, segment I with two discontinuous dark rings, base and apex of segment II black, and segment III and IV dark brown. All femora brown with dark spots apically; meta-tibia pale with dark spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with semierect dark setae and silvery, short, reclining setae. STRUCTURE: Head projecting anteriorly, convex; labium reaching apex of mesocoxae. GENITALIA (Fig. 18K): Sclerotized rings thick rimmed, dorsal labiate plate with somewhat sclerotized vertically U-shaped structure in middle, furnished with minute spines and laterally attached with membranes.

Male genitalia: See Yasunaga, 1999: 196.

Specimens examined. **South Korea**: **Gyeongsangbuk-do**: 1♀, Ulleungdo, 8.VIII.2010; R.K. Duwal.

Distribution. Japan, Korea.

Host. Unknown.

Remarks. In Korea, this species emerged at late spring and was collected on a unknown wild flowering creeper.

***Moissonia kalopani* Duwal and Lee, 2011**

Figures: 16E, 18A-E

Moissonia kalopani Duwal and Lee, 2011: 50 (n. sp)

Diagnosis. Recognized by small, oval, pale body; yellowish dorsum with few scattered spots on pronotum; pale entire legs, except apex of metafemora brownish (Fig. 16E); short and stout apical process of endosoma (Fig. 18A); winding outer margin of right paramere subapically (Fig. 18C); structure of left paramere (Fig. 18B); and quadrate, thick rimmed, sclerotized rings of bursa copulatrix (Fig. 18E).

Description. *Male*. Body small, oval. COLORATION (Fig. 16): Dorsum generally greenish yellow, shiny; mesoscutum and scutellum brown or dark brown with yellow lateral margins and middle of first one; head, pronotum, mesoscutum and scutellum provided with moderately scattered dark brown spots; hemelytron hyaline, apices of clavus and exocorium, inner mesial margin of cuneus with distinct dark brown spots, inner base and apex of cuneus with obscure spots, membrane pale and shagreen. Ventral side of body generally pale (or in some specimens somewhat tinged with orange) and abdomen green. Antenna blackish brown, segment I yellowish brown, with brown rings on base and apex ventrally, segment II yellowish brown except base and apical 1/3 dark brown, and extreme base and apex pale, and segment III and IV dark brown except extreme base and apex of the segment III pale. Labium pale with dark apex. All legs pale, except metafemora gradually brownish towards apex (or in few specimens apical half completely brown); all tibia with black spots. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed simple black, sub erect setae and sericeous setae; ventrally covered with shining pale pubescences. STRUCTURE: Head projecting ventrally; labium short, reaching apex of mesocoxae; pronotum convex, lateral margins curved; labium as long as metafemora. GENITALIA (Fig. 18A-D): **Endosoma**: U-shaped, apical process short and stout, 4-5 notches subtending secondary gonopore (Fig. 18A). **Phallotheca**: Attenuated and slender on apical half region (Fig. 18D). **Left paramere**: As in figure 18B. **Right paramere**: With winding outer margin sub-apically (Fig. 18C).

Female. Not significantly different from male in color and vestiture, except slightly wider abdomen. GENITALIA (Fig. 18E): Sclerotized rings thick rimmed and nearly quadrate; and dorsal labiate plate with semi-sclerotized, inverted U-shaped structure, and at middle region embedded with transparent membrane.

Specimens examined. **South Korea**: **Gyeonggi-do:** 9♂, 3♀, Suwon-si, SNU Arboretum, 20.VIII.2009, on *Kalopanax septemlobus* (Thunb. Ex Murray) (Araliaceae), R.K. Duwal and S. Jung; 1♂, Yangpyeong-gun, Mt. Yongmun, 10.VIII.2009, on light trap, same collectors. **Chungcheongnam-do**: Dangjin-gun, 18.VII.2009, on light trap, same collectors (Holo- and paratype specimens).

Distribution. Korea.

Host. *Kalopanax septemlobus* (Thunb. Ex Murray) (Araliaceae).

Remarks. Specimens were collected from inflorescences of *Kalopanax septemlobus* (Thunb. Ex Murray) (Araliaceae).

***Moissonia yasunagai* Duwal and Lee, 2011**

Figures: 16F, 18F-J

Moissonia yasunagai Duwal and Lee, 2011: 52

Diagnosis. Recognized by yellowish green dorsum; numerous dark spots on pronotum; usually grayish (or brown) pleura, coxae, trochanters, base of pro- and mesofemora, and entire metafemora; short and stout apical processes of endosoma (Fig. 18F) comparatively curved; apical outgrowth on inner margin of right paramere (Fig. 18I); structure of left paramere as in figure 18G; and thin rimmed, oval shaped sclerotized rings of bursa copulatrix (Fig. 18J).

Description. *Male*. Body small, oval. COLORATION (Fig. 16F): Generally greenish yellow, and shiny; head and pronotum greenish yellow, mesoscutum and scutellum brown or dark brown with yellow lateral margins and medial region of first one, and head, pronotum, mesoscutum and scutellum provided with numerous dark brown spots; hemelytron hyaline, apices of clavus and exocorium, inner mesial margin of cuneus with distinct dark brown spots, inner base and apex of cuneus with obscure spots, membrane pale and shagreen. Ventral side of the body grayish (or brownish) and abdomen green. Antenna blackish brown, segment I yellowish brown, with brown rings on base and apex ventrally, segment II yellowish brown except base and apical one quarter dark brown and extreme base and apex pale, and segment III and IV dark brown with pale extreme base and apex of segment III. Labium pale brown with dark apex. All coxae and trochanters grayish (or brownish); larger basal part of pro- and mesofemora grayish and apex pale, metafemora entirely grayish (or brown tinged with red apically); all tibia pale with black spots. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed simple black, sub-erect setae and sericeous setae; ventrally with shining pale pubescences. STRUCTURE: Head projecting ventrally; labium short, reaching apex of mesocoxae; pronotum convex, lateral margins curved. GENITALIA (Fig. 18F-I): **Endosoma**: U-shaped, apical process short, slender and curved, 5-6 notches subtending secondary gonopore (Fig. 18F). **Phallotheca**: As in figure 3H. **Left paramere**: As in figure 18J. **Right paramere**: With small, triangular protuberances at inner margin apically (Fig. 18I).

Female. Not significantly different from male in color and vestiture except slightly wider abdomen. GENITALIA (Fig. 18J): Sclerotized rings comparatively thin rimmed and posteriorly oval; and dorsal labiate plate with semi-sclerotized, inverted U-shaped structure at middle.

Specimens examined. **South Korea**: **Gyeonggi-do,** 1♂, 6♀, Suwon-si, SNU Arboretum, 20.VIII.2009, on *Kalopanax septemlobus* (Thunb. Ex Murray) (Araliaceae), R.K. Duwal and S. Jung (Holo- and Paratype specimens).

Distribution. Korea.

Host. *Kalopanax septemlobus* (Thunb. Ex Murray) (Araliaceae).

Remarks. Specimens were collected on *Kalopanax septemlobus* (Thunb. Ex. Murray).

Genus *Monosynamma* Scott, 1864

Monosynamma Scott, 1864: 159; Kerzhner, 1988b: 789 (key); Schuh, 1995: 357 (cat.); Kerzhner and Josifov, 1999: 374 (cat.); Yasunaga, 2001b: 166 (note).

Type species: *Monosynamma scotti* Scott, 1864; monotypy (= *Phytocoris bohemanni* Fallen, 1829).

Diagnosis. Generally recognized by black, elongated, sub-oval body, and black or fuscous or brown dorsum; pale inner margins of eyes, and base of vertex; broad pronotum; black or dark brown or brown femora with pale apices, pale or pale brown tibiae with dark brown spots; hemelytron furnished with uniformly distributed simple, pale brown setae; simple S- shaped endosoma with elongated apical processes.

Distribution. Holarctic region.

Remarks. Species of this genus are described as willow inhabitants and widely distributed to Holarctic region (Wheeler and Henry 1992).

***Monosynamma bohemanni* (Fallen, 1826)**

Figures: 19A-B, 20A-F

Phytocoris bohemanni Fallen, 1829: 106 (n. sp.)

Monosynamma scotti Scott, 1864: 160 (n. sp.)

Monosynamma bohemanni: Hobertandt 1956: 7 (dist.); Kerzhner, 1988b: 851 (key); Wheeler and Henry, 1992: 168 (dist., host); Schuh, 1995: 357 (cat.); Kerzhner and Josifov 1999: 374 (cat.); Yasunaga, 2001a: 166 (diag., fig.); Anufriev et al., 2001: 119 (eng. transl.); Duwal and Lee, 2011: 53 (daig., figs.).

Diagnosis. Recognized by elongate, oval, and variously colored body (black, fuscous or brown with pale brown spots); pale inner margin of eyes and base of the vertex; most of the specimens with uniformly black dorsum except two lateral brown spots on mesoscutum, or other individuals with numerous pale or brown spots, at base and center of pronotum, and medially on scutellum, base of clavus and hemelytron, and base of cuneus (Fig. 19A-B); distinctly S-shaped endosoma, with two apical processes (Fig. 20A)

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 19A-B): Generally black; head shining black, except inner margins of eye and posterior margin of vertex pale; pronotum, mesoscutum, and scutellum black, meso-scutellum laterally brown; hemelytron, either entirely black or with pale areas, (in the specimens with pale regions: inner margin of clavus, base of corium, and base of cuneus pale); membrane grayish. Venter shining black. Antennal segment I and II with pale apices, segment III and IV dirty pale. Labium shining, segment I black, segment II and III and base of IV pale. Basal larger region of all coxae black; trochanters pale; meta-femora black except the pale apices, meta-tibia pale with rows of small black spots. SURFACE AND VESTITURE: Dorsum uniformly distributed with appressed simple soft pale setae; pronotum, mesoscutum, and scutellum shagreen. STRUCTURE: **Head**: Convex, projecting anteriorly; labium reaching apex of meta-coxae; calli somewhat raised than the surface of pronotum. GENITALIA (Fig. 20A-D): **Endosoma**: Shape S-like, slightly twisted, with two apical processes; secondary gonopore subapically located (Fig. 20A). **Phallotheca**: Narrow, elongated and curved as in figure 19C. **Left paramere**: As in figure 20D. **Right paramere**: Small oval and leaf like as in figure 20B. *Female*: Not sexually dimorphic, color and texture similar to male except more flat and large in size. GENITALIA (Fig. 20E-F): Bursa copulatrix with very large, symmetrical sclerotized rings; membranous and sclerotized structures observed on dorsal labiate plate furnished with numerous spinules (Fig. 20E). Posterior wall with distinct inter-ramal lobe, laterally and centrally provided with semi sclerotized plate, furnished with numerous minute spinules (Fig. 20F).

Specimens examined. **South Korea**: **Gangwon-do**: 30♂, 68♀, Wonju-si, Munmak, 1.VI.2009, on *Salix* sp. (Salicaceae), R. K. Duwal and S. Jung.

Distribution. Azerbaijan, European continents, Kazakhstan, Korea, Japan, Mongolia, N. America, Russia.

Host. *Salix* spp. (Salicaceae).

Remarks. Large numbers of adults and nymphs were collected on *Salix* sp. (Salicaceae) along a small river bank. They were aggregated in some branches in shade with large number of ants.

Genus *Orthonotus* Stephens, 1829 큰애장님노린재속

Orthonotus Stephens, 1829: 344 (n. gen.); Kerzhner, 1988b: 787 (key); Schuh, 1995: 367 (cat.); Kerzhner and Josifov, 1999: 381 (cat.); Yasunaga, 2001b: 167 (note); Kwon et al., 2001:173 (cat.).

Type species: *Capsus rufifrons* Fallen, 1807; subsequent designation.

Diagnosis. Recognized by black elongated (macropterous), or ovoid (barcheopterous) body (Josifov, 1964; 1968); mostly with shining black dorsum except some species with pale base or pale entire cuneus (Kerzhner, 1988b; Josifov, 1964; Reuter, 1878; Fallén, 1807); slender antennal segments longer like in Orthotylinae, legs without dark spots and peculiar apex of endosoma, furnished with either few or numerous spinules. For detail description see Kerzhner, 1988b.

Distribution. Holarctic region.

Remarks. This Holarctic genus inhabits on various herbs and oak trees (Kerzhner, 1988b; Reuter, 1878) and described as polyphagous. In Korea one species, *Orthonotus bicoloriceps* was collected on *Quercus* sp. and surrounding herbs.

Orthonotus bicoloriceps Kerzhner, 1988 콘애장님노린재

Figures: 19D-E, 20K-O

Orthonotus bicoloripes: Kerzhner, 1988a: 62 (n. sp., desc., figs.); 1988a: 849 (key); Schuh, 1995: 368 (cat.); Kerzhner and Josifov, 1999: 381 (cat.); Yasunaga, 2001b: 167 (diag., fig.); Anufriev et al., 2001: 127 (eng. transl.); Kwon et al., 2001: 173 (cat.).

Diagnosis. Generally recognized by black, shining body; black antennal segment I and base and apex of segment II, all coxae, entire pro- and mesofemora, hind femora except the apex, and bases of tibiae; boat shaped endosoma with stout apex (Fig. 20K); narrow and elongated sclerotized rings of dorsal labiate plate of female posteriorly thickened (Fig. 20O).

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 19D-E): Dorsum entirely black or dark brown. In dark brown specimens: head brown, tylus black;

pronotum, mesoscutum, scutellum, clavus and cuneus brown, tinged with red, corium brown with lateral sides darker; membrane gray. Venter black (in black specimen) or black tinged with red (in brown specimen). Antennal segment I, base and apex of segment II black, and remaining part regions dirty yellow or pale. Labium shining, segment I, base of segment II pale black tinged with red, segment III and IV pale except apex of segment IV dark. All coxae black tinged red; trochanters castaneous; all femora black with pale apices; meta-tibia pale with black base. SURFACE AND VESTITURE: Head and thoracic regions dorsally with semierect simple pale setae and flat shining setae; and hemelytron covered with flat shining setae and simple black setae; dorsum entirely shagreen. STRUCTURE: **Head**: Convex, projecting anteriorly; antennal segment II cylindrical and relatively longer; labium reaching apex of metacoxae; femora slender. GENITALIA (Fig. 20K-N): **Endosoma**: Shape boat-like, with blunt apex; secondary gonopore subapically located (Fig. 20K). **Phallotheca**: Broad, curved, and tapers towards the apex (Fig. 20C). **Left paramere**: Body large, anterior processes short (Fig. 20D). **Right paramere**: Elongated, one margin straight and another slightly splayed out and apex tapered (Fig. 20B).

Female. Similar in color and texture, except broad abdomen. GENITALIA (Fig. 20O): Bursa copulatrix with semi-sclerotized plate furnished with spinules; sclerotized rings symmetrical, narrow with broad margins.

Specimens examined. **South Korea**: **Gyeonggi-do**: 3♂, Hanam-si, Cheonhyeon-dong, N 37°31’33” E 127°14’01”, alt. 79m, 3.VI.2007, S.W. Park; 8♀, Gwangju-si, Namhansansung, 27.VI.2008, on *Quercus* sp. (Fagaceae), R.K. Duwal and S. Jung (SNU); 1♂, Gapyeong-gun, 11.VI.2009, R.K. Duwal (SNU); 1♂, Yangpyeong-gun, Mt. Yongmun, 11.VI.2009, on light trap, R.K. Duwal and S. Jung (SNU). Incheon-si: 1♂, Ganghwa-gun, Songhae-myeon, Dangsan-ri, 10.VI.2007, J.W. Seong (SNU). **Gangwon-do**: 2♂, 4♀, Honcheon-gun, Sambong Natural forest, 26.VI.2003, J.W. Seong (SNU).

Distribution. Japan, Korea, Russia.

Host. *Quercus* sp. Thunb. (Fagaceae).

Remarks. During this study individuals of *Orthonotus bicoloriceps* were collected on *Quercus* sp. and surrounding herbs, and many of them were attracted to light.

Genus *Orthophylus* Duwal and Lee, 2011

Orthophylus Duwal and Lee, 2011: 55 (n. gen.).

Type species**:** *Orthophylus yongmuni* Duwal and Lee, 2011.

Diagnosis. Generally recognized by elongated, parallel sided, uniformly pale body; pale yellowish brown dorsum furnished with uniformly distributed silvery setae and simple dark setae; elongated, long antenna (reminiscent of some orthotyline species); slender and yellow legs; Z-shaped curved endosoma, with two unequal processes supported by membranes, secondary gonopore located between two processes (Fig. 20G).

Distribution. Korea.

Remarks. The new genus is morphologically very similar to Orthotylinae as well as phyline genus, *Phylus* Hahn, from which it is distinguished by the simple, sclerotized, Z-shaped endosoma with two unequal apical processes which are supported by membranes.

Orthophylus yongmuni Duwal and Lee, 2011

Figures: 16C, 20 G-J

Orthophylus yongmuni Duwal and Lee, 2011: 55 (n. sp., desc. figs.)

Diagnosis. Distinguished by medium sized, pale body, laterally parallel dorsum yellowish and furnished with uniformly distributed simple silvery setae and dark setae, entirely yellow antennal segments and legs, and pale brown hemelytron; Z-shaped endosoma with two unequal processes, secondary gonopore lies medially between processes (Fig. 20G).

Description. *Male*. Generally medium sized, slender, parallel sided. COLORATION (Fig. 16C): Body yellow, shiny; posterior pronotum, mesoscutum, scutellum and hemelytron pale brown except lateral sides of pronotum, exocorium and cuneus yellow, and base of the cuneus pale; membrane grayish. Ventral side of body pale and abdomen yellowish green. All antennal segments yellow, segment I with a pair of pale brown elongated spine dorsally. Labium pale brown, with dark apex. All coxae, trochanters, femora and tibiae yellow, without any spots, tibiae furnished with pale brown spines. SURFACE AND VESTITURE: Head distributed with pale brown erect and white semierect shining setae; dorsum covered with uniformly distributed simple dark, sub-erect setae and pale setae; ventrally furnished with shining pale pubescences. STRUCTURE: Head narrow, elongated, projecting ventrally; vertex narrow, eyes large; labium short, slightly surpass apex of mesocoxae; antennal segment II as long as metafemora. Pronotum anteriorly narrow and posteriorly broad (more or less flask shaped), width of pronotum twice as long as mesial pronotal length. GENITALIA (Fig. 20G-J): **Endosoma**: Z-shaped, with two unequal processes, short process reaching or slightly surpassing bending point of elongated process; secondary gonopore lies between processes (Fig. 20G), a tube like structure developed at base of gonopore. **Phallotheca**: Slender and attenuated towards apex (Fig. 20I). **Left paramere**: With a short posterior process, anterior process thick and broad (Fig. 20J). **Right paramere**: Narrow at base, middle region gradually wider and subapically triangular with a finger-like protuberance apically (Fig. 20H).

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, Yangpyeong-gun, Mt. Yongmun, 24.VI.2009, on light trap, R. K. Duwal and S. Jung (Holotype specimen).

Distribution. Korea.

Host. Unknown.

Remarks. The biology is unknown for this new species as it was collected at light.

Genus *Parapsallus* Wagner, 1952 어리애장님노린재속

Psallus Parapsallus Wagner, 1952: (n. subgen.)

Parapsallus: Carvalho, 1958: 112 (cat.); Schuh, 1995: 371 (cat.); Kerzhner, 1988b: 789 (key); Kerzhner and Josifov, 1999: 385; Yasunaga, 2001a: 168 (note); Kwon et al., 173 (cat.)

Type species: *Capsus vitellinus* Scholtz, 1847; original designation.

Diagnosis. Recognized by orange brown or black shagreened body; brown antennal segments and rostrum; arrangements of rows of spots on femora; and Z-shaped endosoma with distinctly unequal apical processes. For detail description see Henry and Wheeler, 1973.

Distribution. Holarctic region.

Remarks. *Parapsallus* represented by only one species is believed to inhabit conifers trees (Henry and Wheeler, 1973).

Parapsallus vitellinus (Scholtz, 1847), revised combination 어리애장님노린재

Figures: 19C, 21A-F

Capsus vitellinus Scholtz, 1847: 130 (n. sp.)

Psallus vitellinus: Carvalho, 1958: 134 (cat.)

Parapsallus vitellinus: Kerzhner, 1988b: 852 (key); Schuh, 1995: 371 (cat.); Kerzhner and

Josifov, 1999: 385 (cat.); Yasunaga, 2001a: 168 (diag., fig.); Anufriev et al., 2001: 130 (eng. transl.: key to Fareast USSR); Kwon et al., 2001: 174 (cat.)

Plagiognathus vitellinus: Schuh, 2001: 243 (n. comb.)

Diagnosis. Recognized by orange brown or blackish brown coloration, shagreened body, brown antennal segments and rostrum (but in dark specimen antennal segment I and base of segment II black); black spots on femora and tibiae; Z-shaped endosoma with distinctly unequal apical processes (Fig. 21A); parameres and phallotheca as in figure 21B-D; thin rimmed sclerotized ring asymmetrical (Fig. 21F); and semitransparent structure developed below the interramal sclerite structure on posterior wall (similar with the K-structure in Orthotylinae) (Fig. 21E).

Description. *Male*. Body medium sized, elongated. COLORATION (Fig. 19C): Dorsum generally brown, or dark brown, or blackish; head brown; in fuscous specimens: pronotum, meso-scutellum, scutum and clavus black, and in brown specimens: pronotum, mesoscutum, scutellum and clavus dark brown except the anterior margin of pronotum black; hemelytron, corium entirely brown or dark brown, membrane gray. Venter, sternum and pleuron brown or dark brown, abdomen blackish brown. Antennae variously colored, either entirely brown with extreme base darker, or segment I and base of segment II black. Labium shining pale except dark apex. All coxae fuscous (in black specimens) and pale yellow (in brown specimens); trochanters pale; meta-femora brown or fuscous with rows of black spots; meta-tibia brown or pale brown with black spots and base either with or without large black spot. SURFACE AND VESTITURE: Dorsum furnished with semierect brown setae; dorsum shagreen. STRUCTURE: **Head**: Convex, projecting anteriorly, labium reaching apex of metacoxae. GENITALIA (Fig. 21A-D): **Endosoma**: Shape S-like, medially slightly twisted;

secondary gonopore locate at the middle on apical half of endosome (Fig. 21A). **Phallotheca**: Basally broad, subapically narrow and tapered towards the apex (Fig. 21B). **Left paramere**: Body large, anterior process with hooked apex (Fig. 21C). **Right paramere**: Elongated, broad width and margins irregular (Fig. 21D).

Female. Similar in color and texture. GENITALIA (Fig. 21E-F): Bursa copulatrix with numerous spinules on upper wall; Sclerotized rings asymmetrical, thin rimmed and with broad width. Posterior wall with distinctly shaped semisclerotized structures (may be representatives of K-structure as in Orthotylinae) with numerous spinules.

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, Yangpyeong-gun, Mt. Yongmun, 11.VI.2009, on light trap, R.K. Duwal and S. Jung. **Gangwon-do**: 6♂, 7♀, Honcheon-gun, Sambong Natural forest, 26.VI.2003, J.W. Seong; 1♂, Donghae, Mt. Duta, 16.V.2001, on light trap (NAAS). **Jeollanam-do**: 1♀, Jangseong-gun, Mt. Bangjang, 24.VI.2010, on light trap, R.K. Duwal. **Japan**: 3♂, Hokkaido, Kyowa-Nakazono, Etanbetsu, Asahikawa C., 5.VII.1997, T. Yasunaga, det. By T. Yasunaga, 2008.

Distribution. European continents, Japan, Korea, N. America, Russia.

Host. *Abies* spp. (Pinaceae) [Kerzhner, 1988b].

Remarks. All specimens in this study were collected in light trap, so the biology is unknown in Korea.

Schuh (2001) defined this species under *Plagiognathus vitellinus*, which is here again transferred to *Parapsallus vitellinus* because of several reasons: 1) apex of endosoma and position of secondary gonopore different than in *Plagiognathus*; 2) posterior wall with distinct chitinized structure nearly developed as K-structure as in Orthotylinae.

Genus *Phylus* Hahn, 1831 애장님노린재속

Phylus Hahn, 1831: 26 (n. gen.); Schuh, 1995: 376 (cat.); Kerzhner, 1988b: 788 (key); Kerzhner and Josifov, 1999: 389 (cat.); Yasunaga, 1999: 182 (note); 2001a: 169 (note); Kwon et al., 2001: 174 (cat.).

Type species: *Phylus pallipes* Hahn, 1831; monotypy.

Diagnosis. Recognized by elongated, laterally parallel sided, black body; shining, black dorsum; brown or black antennal segment I, entirely black segment II, pale segment III and IV; pale legs except apex of tarsus dark; delicate, S-shaped endosoma (Fig. 20G).

Distribution. Palearctic region.

Remarks. This genus comprises of nine species described from world (Schuh, 1995). Though, Kerzhner and Josifov, 1999 listed two species from Korea, only *Phylus coryloides* found to exist in southern and central Korea during the survey from 2008-2010. We were unable to observe any of specimens of *Ph. nigricapsus* in this study.

Key to the species of Korean *Phylus*

1. Antennal segment I brown with dark extreme base. Male genitalia (Fig. 21G-J): Endosoma S- shaped with two apical processes and basal curve is boat shaped (Fig. 20G); Female genitalia (Fig. 20K): Sclerotized rings asymmetrical and very small ………………………………………………………….………...……*Ph. coryloides*

\- Pronotum wide, antennal segment I entirely black and apical process of male genital structure thick and with short secondary process (For detail see Kerzhner, 1988b) ……………………………………………………………………..*Ph. nigricapsus*

Phylus coryloides **Josifov et Kerzhner, 1972 애장님노린재**

Figures: 19I, 21G-K

Phylus (*Teratoscopus*) *coryloides* Josifov and Kerzhner, 1972: 173 (n. sp., figs.); Kerzhner, 1988b: 843 (key); Schuh, 1995: 377 (cat.); Kerzhner and Josifov, 1999: 390 (cat.); Anufriev et al., 2001: 121 (eng. transl.); Kwon et al., 2001: 175 (cat.).

Diagnosis. Recognized by elongated body; laterally parallel hemelytron; completely black body and dorsum; pale legs; antennae, segment I brown, segment II black and remaining pale, and structure of endosoma (Fig. 21G).

Description. *Male*. Large, elongated; laterally parallel. COLORATION (Fig. 19I): Dorsum and Venter completely shining black. Antennae; segment I dirty brown; segment II entirely black; and segment III and IV pale. Labium pale with dark apex. All legs pale. SURFACE AND VESTITURE: Dorsum furnished with simple dark setae and short but flattened lanceolate setae. STRUCTURE: Head, pronotum, mesoscutum and scutellum partly shagreen; labium reaching apex of mesocoxae. GENITALIA (Fig. 21G-J): **Endosoma**: Boat shaped, apical curve inverted U-shaped, furnished with a membrane at middle region; Secondary gonopore large and medially located. **Phallotheca**: As in figure 21J. **Left paramere**: As in figure 21H. **Right paramere**: As in figure 21I.

Female. Similar color and texture to male. GENITALIA (Fig. 21K). Sclerotized rings assymetrical and very small.

Specimens examined. **South Korea**: **Gangwon-do**: 1♀, Donghae, Mt. Duta, 16.V.2001, on light trap, members of NAAS (NAAS). **Gyeonggi-do**: 4♂, 4♀, Suwon-si, Mt. Gwanggyo, Baeknyeongsu, 23.V.2003, on *Corylus heterophylla* Fisch. Ex. Trautv. (Betulaceae), J.W. Seong (SNU); 1♂, Namyangju, Onam-eup, Palhyeong-ri, 26.V.2006, on light trap, J.W. Seong.

Distribution. China, Japan, Korea, Russia.

Host. *Corylus* sp. (Betulaceae) [Josifov and Kerzhner].

Remarks. In Korea, individuals of *Phylus coryloides* were collected from, *Corylus heterophylla* (Betulaceae) and light traps, but breeding host is unknown.

Phylus nigriscapus Kerzhner, 1988 떡갈애장님노린재

Phylus nigriscapsus: Kerzhner, 1988a: 56 (n. sp., desc., figs.); 1988a: 843 (key); Schuh, 1995: 377 (cat.); Kerzhner and Josifov, 1999: 389 (cat.); Anufriev et al., 2001: 121 (eng. transl.); Kwon et al., 2001: 174 (cat.)

Diagnosis. Morphologically similar to *P. coryloides* except black antennal segment I; and different forms of endosoma (Kerzhner, 1988).

Description. *Male*. Large, elongated; laterally parallel. Dorsum and Venter completely shining black. Antennae; segment I and II completely black; and segment III and IV pale or brownish. Legs completely pale. SURFACE AND VESTITURE Dorsum furnished with simple dark setae and short but flattened lanceolate setae; head, pronotum, mesoscutum and scutellum partly shagreen. GENITALIA: **Endosoma**: Boat shaped, apically extended with a single elongated process furnished with a short sickle like secondary process. For detail description and male genital structures see Kerzhner, 1988a: 56 (Fig. 219-244).

Distribution. Korea, Russia.

Host. *Quercus dentata* Thunb. (Fagaceae) [Kerzhner, 1988b].

Remarks. This species was reported in Korea from northern part which was not found at southern region during survey.

Genus *Pseudophylus* Yasunaga, 1999

Pseudophylus Yasunaga, 1999: 183 (n. gen.); 2001a: 178 (diag.)

Type species: *Phylus stundjuki*, 1973: 183.

Diagnosis. Recognized by elongated or sub-oval body; uniformly distributed dark, sub erect setae on dorsum; short head, narrow vertex; short antennal segment II; short rostrum, reaching apex of mesocoxa; and simple and broad endosoma nearly J-shaped (Fig. 22A) and secondary gonopore located subapically.

Distribution. Palearctic region.

Remarks. Kulik (1973) described the type species of this genus as *Phylus stundjuki* due to similar morphological appearance. Subsequently, Yasunaga (1999) erect *Pseudophylus* to accommodate the species showing differences like, small size, short head and antennal segment II, and shape of endosoma.

Pseudophylus stundjuki (Kulik, 1973)

Figures: 19G-H, 22A-E

Heterocordylus flavipes: Notibe, 1906, junior secondary homonym of *Cimex flavipes* Scopoli, 1763; Miyamoto and Yasunaga, 1989: 163.

Phylus stundjuki: Kulik, 1973: 22; Schuh, 1995: 390 (cat.); Yasunaga et al., 1996: 93 (n. syn.).

Pseudophylus stundjuki Yasunaga 1999: 183 (n. comb.); 2001a: 179 (diag., fig.).

Diagnosis. Male recognized by elongated body, laterally parallel black dorsum; pale or yellow legs except red hind femur (Fig. 19G-H); J-shaped endosome with subapically located, secondary gonopore (Fig. 22A). Detail descriptions provided by Yasunaga (1999).

Description. *Male*. Body medium sized, elongated, laterally somewhat parallel. COLORATION (Fig. 19G-H): Generally black; dorsum entirely black; hemelytron entirely black, and membrane grey. Venter shining black. Antennal segment I dirty yellow, segment II black, segment III and IV pale brown. Labium brown, segment I and IV dark. All coxae pale with black bases and trochanters whitish; base of meta-femora pale and apical half red; meta-tibia pale brown; tarsus pale brown with dark apex . SURFACE AND VESTITURE: Dorsum uniformly distributed with semierect simple pale setae; vertex, pronotum, mesoscutum, scutellum shagreen. STRUCTURE: **Head**: Small, projecting anteriorly, convex; labium short, reaching apex of mesocoxae. GENITALIA (Fig. 22A-D): **Endosoma**: Shape J-like, with simple process; secondary gonopore apically located (Fig. 22A). **Phallotheca**: Narrow, tapers towards the apex as in figure 22D. **Left paramere**: As in figure 22B. **Right paramere**: Elongated, leaf like, margins irregular as in figure 22 C.

Female. Similar in color and texture, except broad and flat abdomen. GENITALIA (Fig. 22E). Bursa copulatrix comparatively small and delicate; sclerotized rings asymmetrical, small and elongate oval.

Specimens examined. **North Korea: Yanggang-do**: 1♂, Bosôk-ri, 1000m, 1.VI.1974, M. Josifov. **Pyeongyangnam-do**: 1♀, Pyeoongyang, Daeseong-san (in label: Tesong-san, Bei Phjongjang), 1.VI.1987, M. Josifov. **South Korea**: **Gyeonggi-do**: 46♂, 50♀, Suwon-si, SNU Arboretum, 20.V.2009, on *Pyrus ussuriensis* Maxim. Var. (Rosaceae), R. K. Duwal.

Distribution. Japan, Korea, Russia.

Host. *Pyrus ussuriensis* Maxim. Var. (Rosaceae).

Remarks. Yasunaga (1999) cited this species as a serious pest on apples and additionally listed other hosts, *Pyrus ussuriensis*, *Marus sieboldi* (Rosaceae), *Maackia* *amurensis* (Leguminosae) and *Artemisia* sp. (Compositae). In this current study, large numbers of specimens were collected from a individual of *Pyrus ussuriensis* Maxim. (Rosaceae) which was found seriously damaged. The field survey suggests that, they have one generation per year in Korea.

Genus *Plagiognathus* Fieber, 1858 다리장님노린재속

Plagiognathus Fieber, 1858: 320 (n. gen.); Kerzhner, 1988b: 787 (key); Schuh, 1995: 380 (cat.); Kerzhner and Josifov, 1999: 391 (cat.); Yasunaga, 1999: 184 (note); 2001a:168 (note); Kwon et al., 2001:177 (cat.); Duwal et, 2010a: 325 (diag., desc., figs.).

Type species: *Lygaeus arbustorum* Fabricius, 1784; subsequent designation.

Diagnosis. Male. Generally recognized by elongate body, pale, green, brown to black coloration; uniformly distributed dark simple setae on dorsum; partial or complete stripe dorsally on metafemur at anterior or posterior margins or both, and ventrally with distinct large spots and clavate pretarsal segments; sclerotized vesica, S-shaped, weakly twisted medially, and bifurcated into two distinct unequal processes apically, secondary gonopore located medially or sub-apically; sclerotized rings of female genitalia assymetrical, distinctly shaped (circular, or oval or elongate oval, etc.) in each examined species.

Distribution. Holarctic region.

Remarks. Members of this group are mostly associated with *Artemisia* spp. (Asteraceae). However, some species were also collected from plants like *Brassica campestris* L. (Brassicaceae), *Humulus* sp. (Cannabaceae), *Raphanus sativus* L. (Brassicaceae) and *Galium spurium* L. (Rubiaceae), etc. During this study two species, *P. amurensis* Reuter, 1883 and *P. yomogi* Miyamoto, 1969, were found more common than other two species *P.*

chrysanthemi (Wolff, 1778) and *P. collaris* (Matsumura, 1911).

Key to species of Korean *Plagiognathus*.

1. Dorsal surface uniformly pale green, comparatively larger; arrangements of spots and stripes on hind femur dorsally and ventrally; vesica of male genitalia much curved at apical half region, bifurcated processes tumid, secondary gonopore positioned lower to the bifurcation point, and sclerotized ring of female genitalia, nearly circular (Fig. 22F) ………………………………………………………………….………… *P. chrysanthemi*

- Dorsal surface either black or variable in color; vesica of male genitalia bifurcated more or less at same level as the base of the secondary gonopore …… ………………………………2

2. Dorsal surface entirely dark ....……… ……………………………………………………3

- Wide variation in color, body pale or brownish or blackish (Fig. 23A-B); cuneus paler at base and apex; extreme base of meso- and metacoxa black; metafemur dorsally with short stripe apically on posterior margin and ventrally with irregular large spots; vesica of male genitalia with short processes, longer one slightly curved inward apically (Fig. 24A); and sclerotized ring of female genitalia elongated, oval and anteriorly pointed (Fig. 24E) ………………………………………………………………………………*P. amurensis*

3. Comparatively small, 2.91-3.16 mm, hemelytron shiny black; basal half of mesocoxa and entire metacoxa black; and metafemur with stripes dorsally on anterior and posterior both margins at apical half region and ventrally with rows of large spots; vesica of male genitalia bifurcated at 1/3 from the apex, both the processes are slender, apically not curved (24K); wall of female genitalia comparatively smaller, sclerotized ring oval, anteriorly extended into a thumb like outgrowth (Fig. 24N) ……………………….....……………………..… *P. yomogi*

- Comparatively larger, 3.91- 4.93 mm, dorsum uniformly black shiny; rostrum black except extreme base; basal half of all coxa dark; and metafemur with stripes dorsally on anterior and posterior both margins, stripe on anterior margin basally and at sub-apical region, and with few large and small black spots ventrally; vesica of male genitalia with flat base on the processes, which tapers towards the apex and shorter process curved like S- shape (Fig. 24F), and sclerotized ring of female genitalia elongated and oval (Fig.24I) …..…..……. *P. collaris*

Plagiognathus amurensis **Reuter, 1883 발해다리장님노린새**

Figures: 23A-B, 24A-E

Plagiognathus amurensis: Reuter, 1883: 454 (n. sp.); Kerzhner, 1988b: 853 (key, figs.); Schuh, 1995: 381 (cat.); 2001: 246 (note, fig.); Kerzhner and Josifov, 1999: 391 (cat.); Yasunaga, 2001a: 169 (diag., fig.); Anufriev et al., 2001: 130 (eng. transl.); Kwon et al., 2001: 176 (cat.); Duwal et, 2010a: 326 (diag., desc., figs.).

Diagnosis. Recognized by elongated oval body; variously colored from pale; dark to black with pale areas on vertex; anterior margin of pronotum, base and apex of cuneus; and short strip on posterior margin of metafemora apically; and structure of male genitalia (Fig. 24A-D).

Description. *Male*: Body elongate, ovoid. COLORATION (Fig. 23A-B). Variously colored from pale, brownish to blackish; vertex, gena and lora pale; pronotum near to anterior margin, scutellum with black or dark patches medially at anterior margin (in brownish or pale individuals); hemelytron blackish or brownish or pale; base and apex of cuneus pale. Ventral side of body black. Antennae, segments I and II dark, except for the extreme apices, segments III and IV largely pale. Labium, except extreme base of segment I and apex of segment IV, dark. Legs yellow; procoxa and large part of mesocoxa pale apically, base of meso- and metacoxa dark; metafemur with short longitudinal black stripe dorsally at apical 1/3 of the posterior margin, and ventrally with irregular large dark spots. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed dark simple setae. STRUCTURE: Head projecting ventrally; and reaching apex of the metacoxa; length of labium nearly subequal to the length of femur; length of antennal segment II subequal to the width of pronotum. GENITALIA (Fig. 24A-D): **Endosoma**: Apical bifurcation of vesica comparatively short, both of the processes are somewhat uniform in width but unequal in length, and with pointed endings, short process curved backward while long process slightly curved inward; secondary gonopore subapically located just beneath the starting point of the bifurcation (Fig. 24A). **Phallotheca**: As in figure 24B. **Left paramere**: As in figure 24C. **Right paramere**: As in figure 24D.

Female: Very similar to male in coloration; body 3.08- 3.84 mm in lengths slightly oval, and pronotum 1.05- 1.37 mm wide. GENITALIA (Fig. 24E): Sclerotized ring more or less oval shaped, narrow anteriorly.

Specimens examined. **South Korea**: **Chungcheongbuk-do**: 12♀, Chungju-si, Jungsan-ri, 12.VII.2004, on *Humulus japonicus* Sieb. & Zucc., J.W. Sung. **Chungcheongnam-do**: 1♂, Chanan-si, Agriculture centre, 9.V.2003, J.W. Seong; 4♂, 3♀, Boryeong-si, Cheongra-myeon, 10.X.2003, on *Humulus japonicus* Sieb. & Zucc., J.W. Seong; 5♂, 7♀, same locality as above, 21.X.2007, on *Galium spurium* L., S. Jung; 1♂, 5♀, Geunhong-myeon, Jeongjuk-ri, 31.VIII.2006, S. Lee; 20♂, 35♀, Yesan-gun, Sinam-myeon, 12.VI.2007, on *Brassica campestris* L., S. Jung; 3♂, 6♀, Yesan-gun, Deoksan-myeon, 4.VI.2007, on *Chenopodium album* var. *centrorubrum* (Amaranthaceae), J.W. Seong; 2♂, 3♀, Nangi-do, 18.VIII.2009, *Artemisia* spp., R.K. Duwal and S. Jung. **Gangwon-do**: 1♂, Yangyang-gun, 26.V.2003, on *Raphanus sativus* L., J.W. Seong; 12♂, 16♀, Hongcheon-gun, 30.VII.2007, on light trap, S. Jung; 25♂, 38♀, Donghae-si, 11.XII.2007, on light trap, S. Jung; 2♂, 8♀, Wonju-si, Munmak, 27.V.2009, R.K. Duwal and S. Jung; 20♂, 14♀, same locality as above, 1.VI.2009, on light trap. **Gyeonggi-do**: 1♂, Suwon-si, 22.VI.1987, C.J. Kim; 1♂, 1♀, same locality as above, 9.VII.1988, C.H. Jung; 1♀, same locality as above, 21.IX.2001, C.H. Jung; 1♀, same locality as above, 25.VI.2009, on light trap, R.K. Duwal; 1♂, Gwangju-si, 25.IV.1992, C.M. Park; 1♂, Gwacheon-si, 22.IX.2000, H.G. Kwang; 1♀, Yongin-si, 16.IX.2000, M.S. Kim; 1♀, Yeoncheon-gun, 3.X.2000, S. Lee and S.W. Park; 1♀, Paju-si, Gyoha-eup, 6.VI.2003, J.W. Seong; 4♂, 1♀, Yangpyeong-gun, Kangsang-myeon, Sewol-ri, 1.VII.2008, on *Artemisia* sp., S. Jung and R.K. Duwal; 1♂, Yangpyeong-gun, Mt. Yongmun, 11.VI.2009, on light trap, R.K. Duwal and S. Jung; 1♂, 1♀, Icheon, Mt. Mangwol, 1.VI.2008, on *Artemisia* sp., S. Jung and R.K Duwal; 1♂, same locality as above, 1.VII.2008. **Gyeongsangbuk-do**: 15♂, 6♀, Andong-si, Waryong-myeon, 6.VI.2008, on Malaise trap, J.O. Lim; 1♂, Yeongyang-gun, Cheonggi-myeon, 7.VI.2008, on Malaise trap, J.O. Lim. **Gyeongsangnam-do**: 1♀, Hapcheon-gun, 10.X.2000, T.H. Kim. **Jeju-do**: 1♂, Bukjeju-gun, Eoeum-eup, Aewol-ri, 14.V.2003, J.W. Seong. **Jeollanam-do**: 1♂, Gurye-gun, 4.VIII.1996, M.A. Kim; 1♂, 1♀, Gurye-gun, Mt. Nogodan, 29-30.VII.1996, M. Kim; 4♂, Gwanyang-si, Choosan, 16-19.VI.2008, S. Jung and R.K. Duwal.

Distribution. China, Korea, Russia, Uganda.

Host. *Artemisia vulgaris* L. (Asteraceae) [Kerzhner, 1988b; Schuh, 2001].

Remarks. Due to wide color variations of the dorsum from black or brown to pale, this species is very hard to distinguish by its dorsal color pattern, but mostly pale labium, darkened bases of meso- and metacoxa, and spots and short stripe on posterior margin dorsally on the metafemur are important distinguishing characters. According to the collection data blackish individuals dominated during July.

Our survey indicated that this species is widely spread in various plants like *Humulus japonicus* Seib. (Cannabaceae), *Brassica campestris* L. (Brassicaceae), *Chenopodium album* L. (Amaranthaceae), *Galium spurium* L. (Rubiaceae), and *Artemisia* spp. (Asteraceae). Also it is frequently attracted to light and Malaise traps.

***Plagiognathus chrysanthemi* (Wolff, 1778)**

Figures: 22F-J, 19F

Cimex femorepunctatus Goeze, 1778: 266 (n. sp.).

Miris chrysanthemi Wolff, 1804: 157 (n. sp.).

Plagiognathus chrysanthemi: Miyamoto, 1969: 88 (syn.); Kerzhner, 1988b: 854 (key, fig.); Schuh, 1995: 383 (cat.); 2001: 59 (diag., figs.); Kerzhner and Josifov, 1999: 393 (cat.); Yasunaga, 1999: 184 (diag.); 2001a: 170 (diag., fig.); Anufriev et al., 2001: 130 (eng. transl.); Duwal et, 2010a: 330 (diag., desc., figs.).

Diagnosis. Recognized by pale greenish body and appendages with contrasting dark setae on dorsum; dark apex of tylus, base of antennal segment I and base and apex of segment II; stripes and spots on the metafemur; and structure of male genital structures (Fig. 22F-I).

Description. **Male**: Body slender, elongated. COLORATION (Fig 19F): Body and dorsum completely pale green, Clypeus with black apex. Antenna pale brown; segment I with black ring at the base and apex, and segment II black basally. Legs pale; coxa entirely pale, metafemora dorsally with short subapical stripe on posterior margin and ventrally with a row of large dark spots on upper margin followed by aggregation of small spots in another row. SURFACE AND VESTITURE: Dorsum with uniformly distributed black setae. GENITALIA (Fig. 22F-I): **Endosoma**: Apex of vesica divided into two unequal processes, both of the processes are tumuid, short one develops as a branch from the longer one, secondary gonopore medially located. **Phallotheca**: As in figure 22H. **Left paramere**: As in figure 22I. **Right paramere**: As in figure 22G.

Female: Very similar to male in coloration, slightly smaller, body length 3.17- 3.60 in length, and width across pronotum 1.04-1.90. Antennal segment II darkened on basal half. GENITALIA (Fig. 22J): Sclerotized ring distinct, nearly rounded; dorsal and ventral labiate plates, seminal depositories, lateral oviducts, and common oviduct are as in Fig. 22J.

Specimens examined. **South Korea**: **Gyeonggi-do**: 2♀, Suwon-si, NAAS, 5-8.VI.1997, on light trap. **Japan**: **Hokkaido**: 2 ♂, Ishikari, Kari-river, 17.VII.1994, T. Yasunaga.

Distribution. Canada, Europe, Iraq, Japan, Korea, Mongolia, Russia, USA.

Host. Asteraceae [Leston, 1961].

Remarks. *Plagiognathus chrysanthemi* is the only green species found in Korea, so it can be easily distinguished from other species of this genus occurring in this territory. But, unfortunately only few specimens have been collected through light trap, so its biology is still unknown.

Plagiognathus collaris **(Mastsumura, 1911) 쑥다리장님노린재**

Figures: 23C, 24F-I

Plagiognathus arbustorum Reuter, 1906: 75 (n. var.)

Chlamydatus collaris Matsumura, 1911: 40 (n. sp.)

Plagiognathus collaris: Miyamoto, 1969: 86 (n. comb.); Kerzhner, 1988b: 853 (key, figs.); Kerzhner and Josifov, 1999: 393 (cat.); Schuh, 1995: 384 (cat.); 2001: 246 (disc., fig.); Yasunaga, 1999; 185 (diag.); 2001a: 170 (diag., fig.); Anufriev et al., 2001: 30 (eng. transl.);

Kwon et al., 2001: 176 (cat.); Duwal et, 2010a: 330 (diag., desc., figs.).

Diagnosis. Recognized by elongated, large size; completely black body and dorsum; elongated stripes on the anterior and posterior margins of the metafemur; and male genital structure (Fig. 24F-H).

Description. *Male*: Body elongated in length. COLORATION (Fig. 23C): Body and dorsum uniformly shining fuscous. Antennae black, segment III black basally and gradually pale towards the apex. Labium black except the extreme bases and apices of segments II and III pale. Legs pale; all coxa black on basal half; metafemur with thick black stripe dorsally on anterior and posterior margins, stripe on anterior margin at base to apex, and ventrally with rows of large, black spots. SURFACE AND VESTITURE: Dorsum furnished with dark simple setae. STRUCTURE: Length of femur equal to the width across the hemelytron. GENITALIA (Fig. 24F-H): **Endosoma**: Apex of the vesica largely bifurcated into two apical process, both of the processes are slightly curved inward, shorter process curved like S- shape, secondary gonopore medially located. **Phallotheca**: As in figure 24G. **Left paramere**: As in figure 24H.

Female: No significant difference with male. GENITALIA (Fig. 24I): Sclerotized rings oval, and joined together by a distinct, concave membrane.

Specimens examined. **South Korea**: **Gangwon-do**: 2♂, 1♀, Mt. Gariwang, 1.VII.2009, on Malaise trap, J.O. Lim. **Gyeongsangbuk-do**: 2♂, Mungyeong-si, 9.VIII.2007, on light trap, S. Jung. **Japan**: **Gunma Pref**.: 1♂, 1♀, Tsumagoi, 20.VIII.1985, T. Yasunaga. **Hokkaido**: 1♀, Asahikawa, Etanbetsu, 5.VII.1997, T. Yasunaga.

Distribution. China, Japan, Korea, Russia.

Host. *Filipendula* sp., Rosa sp. (Rosaceae), *Geranium* sp. (Geraniaceae), Apicaceae

[Schuh, 2001].

Remarks. This species was reported by Kerzhner et Josifov (1999) from northern part of Korea, but the locality and the host plant were not clarified. Also, examined individuals were collected in light trap, and Malaise traps, so the host is unknown.

Plagiognathus yomogi **Miyamoto, 1969 닮은다리장님노린재**

Figures: 23D, 24J-N

Plagiognathus yomogi Miyamoto, 1969: 88 (n. sp.); Kerzhner, 1988b: 853 (key, figs.); Schuh, 1995: 392 (cat.); 2001: 249 (disc., fig.); Kerzhner and Josifov, 1999: 395 (cat.); Yasunaga, 1999: 187 (diag.); 2001a: 171 (diag., fig.); Anufriev et al., 2001: 130 (eng. transl.); Kwon et al., 2001: 177 (cat.); Duwal et, 2010a: 330 (diag., desc., figs.).

Diagnosis. Recognized by small oval, completely black body and dorsum with pale areas beneath the apex of cuneus; distinct black stripe at apical half of anterior and posterior margins of the femur and male genital structures (Fig. 24J-M).

Description. Male: Body elongated, comparatively small, size. COLORATION. Body and dorsum uniformly shining and black with slightly brownish posterior margin of vertex. Antenna dark, except extreme apex of segment II, and segment III-IV pale. Labium pale, segment I, extreme base of segment II and apex of segment IV fuscous. Legs pale; procoxa and the base of mesocoxa pale, and metacoxa entirely black; metafemur dorsally with distinct black stripe at apical half of anterior and posterior margins, and ventrally with rows of large spots. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed dark setae. STRUCTURE: Labium reaching apex of metacoxa. GENITALIA (Fig. 24J-M): **Endosoma**: Apical portion of vesica divided by short bifurcation into two unequal processes, one short and broad while another slender and elongated, and secondary gonopore positioned sub-apically. **Phallotheca**: As in figure 24L. **Left paramere**: As in figure 24J. **Right paramere**: As in figure 24M.

Female: Very similar to male, body length 2.89- 3.23 mm, and pronotum 1.06- 1.16 mm wide. GENITALIA (Fig. 24N): Genital structures are comparatively smaller than other species, sclerotized ring oval and extremely pointed (finger like outgrowth) anteriorly.

Specimens examined. **South Korea**: **Gangwon-do**: 4♂, 2♀, Hongcheon-gun, 26.VI.2003, on *Sorbaria sorbifolia* var. *stellipila* (Rosaceae), J.W. Sung; 3♂, 7♀, Icheon-si, 12.VI.2007, on *Artemisia* spp., S. Jung; 5♂, 4♀, Mt. Chiak, 11.VI.1988, C.H. Jung; 2♂, 1♀, Wonju-si, Munmak, 1.VI.2009, on *Artemisia* spp., R.K. Duwal and S. Jung; 1♂, Pyeongchang, Mt. Gariwang, 1.VII.2009, on Malaise trap, J.O. Lim. **Gyeonggi-do**: 8♂, 4♀, Yangpyeong-gun, Kangsang-myeon, Sewol-ri, 30.VI.2008, on *Artemisia* sp., S. Jung and R.K. Duwal; 1♀, same locality as above, 24.VI.2009, on light trap S. Jung and R.K. Duwal; 4♂, 2♀, same locality as above, 16.VII.2009, S. Jung and R.K. Duwal; 1♂ same locality as above, 27.VII.2009, S. Jung and R.K. Duwal; 6♀, same locality as above, 10.VIII.2009, S. Jung and R.K. Duwal; 3♂, 1♀, Icheon, Mt. Mangwol, 1.VII.2008, on light trap, S. Jung and R.K. Duwal; 4♂, 1♀, Mt. Namhansansung, 27.VII2008, on *Artemisia* sp., S. Jung and R.K. Duwal. **Japan**: **Hokkaido**: 1♂, 1♀, Tobetsu, 6.VIII.1997, R. Endoh. **Honshu**: 1♂, Shingu, Wakayama City, 16-17.VII.1997, Y. Nakatani.

Distribution. China, Japan, Korea, Russia.

Host. *Artemisia rubripes* Nakai (Asteraceae) [Kerzhner, 1988b], *Artemisia* spp. [Yasunaga, 1999, Schuh, 2001].

Remarks. This species is recorded by Kerzhner et Josifov (1999) but the locality data and the host plant were not clarified. During this study specimens were collected on

Artemisia spp. (Asteraceae) and surrounding bushes; and were also attracted to light. It is distinguished from *P*. *amurensis* by its shiny black dorsum, distinct dark spots on the metafemora, and the structure of the male genitalia.

Genus *Psallus* Fieber, 1858 우리장님노린재속

Psallus Fieber, 1858: 321; (n. gen.); Schuh, 1995 (cat.); Kerzhner and Josifov, 1999: 399 (cat.); Yasunaga and Vinokurov, 2000: 653 (diag.); Yasunaga 2001a: 171 (diag.); Kwon et al., 177 (cat.); Duwal et al., 2012: 604 (diag.)

Type species: *Lygaeus sanguineus* Fabricius, 1794, (= *Cimex haematodes* Gmelin, 1790), subsequent designation by Reuter, 1888: 412).

Diagnosis. *Male*: Body varying in color from uniformly yellow, orange, red, pale or dark brown to black, sometimes variously spotted or mottled, rarely tinged with green; body shape oval to elongate oval with length from 2.9 to 5.5 mm; dorsal surface with uniformly distributed, simple setae and with silvery scale-like setae that often easily abraded; dorsal surface of head, pronotum, scutellum, and hemelytron weakly shagreen; metafemora incrassate and tumid; endosoma C- or J-shaped, with a complex apical section; secondary gonopore located medially or sub-apically.

Female: Generally similar to male, but body usually shorter, more oval and sometimes paler in coloration. Bursa copulatrix variable in size; dorsal labiate plate mostly furnished with clusters of spinules laterally and with variously membranous folding; sclerotized rings distinct with diverse shape being small or large, oval, elongate oval or circular.

Distribution. Thailand, Holarctic region.

Remarks. Most members of *Psallus* are associated with broadleaf host plants. A few species were reported as a serious pests, e.g., *P*. *ambiguus*, caused stony pit in pears (Taksdal,

1983) and nymphs of the same species were also observed feeding on animal food (Wheeler, 2001). Feeding on entomophagous sources was confirmed by the first author as she observed nymphs of *P. ater* feeding on coleopteran and lepidopteran larvae during laboratory rearing. All members of this genus are frequently attracted to light.

Remarks. The genus *Psallus* (Miridae: Phylinae: Phylini) is a large Holarctic genus, comprising approximately one hundred and forty four species (Schuh, 2003), most of which were recorded from temperate and cold temperate climatic zones, except for *P*. (*P*.) *buddha* Yasunaga, that was recently described from Thailand but considered as a relic of Palearctic element (Yasunaga, 2010). In eastern Asia, forty four species of *Psallus* have been reported (Kerzhner and Josifov, 1999; Yasunaga & Vinokurov, 2000), and the regional faunas have been documented from the Russian Far East (Kerzhner and Josifov, 1966; Kerzhner, 1978; 1979; 1988a; Vinokurov, 1998), continental China (Zheng and Li, 1990), the northern Korean Peninsula (Josifov, 1983; 1992), and Japan (Muramoto, 1973; Yasunaga and Vinokurov, 2000).

Seven of eight subgenera (except subgenus *Subpsallus*) exist in the Korean Peninsula with total of twenty six species. And most of the members are common to the fauna of neighboring countries China, Japan and the Far East Russia.

Key to subgenera *Psallus* in Korea.

1. Endosoma lacking lateral processes ……………………………………………….2

- Endosoma with one or two or several lateral processes ………………………………...3

2. Endosoma simple, tubular without spinulus or serrated structures ……….*Mesopsallus*

- Endosoma with wide base tapering towards the apex, and apical process with serreted lateral margin ………………………………………………………………..*Pitypsallus*

3. Apex of endosoma broader with single apical process …………………......................4

- Apex of endosoma narrow with two or more apical processes …………………………5

4. Apex of the secondary gonopore continuous with the spinulus semisclerotized membrane …………………………………………………………………..…*Apocremnus*

- Apex of endosoma blunt with spinulus semisclerotized membranes ……….*Callopsallus*

5. Base or subapical region of apical process with semisclerotized spinulus structure …...…………………………………………………………………………*Hallopsallus*

- Semisclertized spinulus structure arises separately from the main apical process ……..6

6. Apical process seems continuous process from the base ………………..……..*Phylidea*

- Apical process seems separately appear from the apical disc of endosoma ……...*Psallus*

Key to species of Korean *Psallus*.

1. Antennal segment II pale, yellow, or brown …………………………………………2
- Antennal segment II entirely fuscous or black, either base or apex or both black ….21
2. Antennal segment I pale or with dark base ……………………………………...3
- Antennal segment I entirely black ……………………………………………..22
3. Dorsum variously colored without speckles …….…………………………………...7
- Dorsum pale with red or orange speckles ……………………………………………4
4. Head without brown spots; anterior pronotum with numerous brown or orange red spots (Fig. 34F-G). Male genitalia (Fig. 36B-D): Endosoma C-shaped, secondary elongated process extends through the blunt apex; right paramere with tooth-like out growth near apex. Female genitalia (Fig. 36E): Dorsal labiate plate with rectangular membranous folding posteriorly and furnished with numerous spines around sclerotized rings ……………..…………………………………………….*P. amoenus*

- Head and pronotum with brown spots ……………………………………….…………5

5. Mesoscutum and scutellum densely distributed with brown spots but without speckles; cuneus with a few speckles or speckles only at base (Fig. 29C-D). Male genitalia (Fig. 30A-D): Endosoma C-shaped, body of apex blunt with numerous spinules, and subapical elongated secondary process short; right paramere apically extending to an elongated protuberance. Female genitalia (Fig. 30E): Sclerotized rings very small, lateral oviducts posteriorly supported by bowl shaped membranous folding, cluster of spinules at dorsal labiate plate located far from sclerotized rings ……….…...*P. clarus*

- Mesoscutum and scutellum only with red or orange speckles ………………………6

6. Femora pale, apically tinged with red, ventrally with densely distributed large and small fused spots, dorsally with a few spots at sub-apical region (Fig. 29A-B). Male genitalia (Fig. 28F-H): Endosoma C-shaped, apex broad and furnished with spinules, elongated secondary process perpendicular to position of primary process and also furnished with tooth like spines at curved inner margin. Female genitalia (Fig. 28I): Sclerotized rings comparatively small, lateral oviducts positioned within roughly heart shaped folding, posterior portion of dorsal labiate plates wide and furnished with spinules laterally ……………………………………………......*P. roseoguttatus*

- Femora pale ventrally with numerous small spots at distal half and dorsally with few spots subapically (Fig. 29E-F). Male genitalia (Fig. 30F-I): Endosoma J-shaped, broad, apex of main body with several short and blunt processes, with spinose margins, inner process somewhat elongated and with only one spine apically. Female genitalia (Fig. 30J): Sclerotized rings ovate but posterior margin straight, lateral oviduct seems supported by membranous folds ……………………..*P. tesongsanicus*

7. Dorsum dark, brown or black or castaneous …...……………………………………8

- Dorsum pale or with various bright colors …..………………….….…….………..10
8. Tibial spots obscure or small ………………………………………………………9
- Tibial spots large ……………………………………….………………………16
9. Dorsum fuscous brown or black; in brownish individuals head, pronotum and scutellum blackish shagreened; femora fuscous with rows of dark brown spots at distal half region, tibia pale brown with small obscure spots at base of black spines (Fig. 37B-C). Male genitalia (Fig. 38E-H): Endosoma s-shaped, apex extends to form elongated process furnished with toothed spinules on outer margin; Female genitalia (Fig. 38I): Structures are very delicate, with a socket like membranous folding ……………………………...…………………………………….……….*P. vittatus*
- Dorsum brown; head, pronotum, mesoscutum and scutellum dark brown or fuscous; femora pale brown, ventrally with dark brown spots on apical half region, tibiae with small brown spots at the base of brown spine (Fig. 37A). Male genitalia (Fig. 38A-D): Endosoma s-shaped, apex extends to form elongated process, furnished with spinules on basal half on outer margin, and a membrane reaching half the length of endosoma, with serrated lateral margin …………….………………………..……....*P. luridus*
10. Body red or orange or orange red ………………………………………………...11
- Body uniformly pale (or somewhat pale yellowish), genital segment with a pair of protuberances (Fig. 37H). Male genitalia (Fig. 39E-I): Endosoma C-shaped, apex with a pair of small ear like secondary processes laterally and medially develpoed with an elongated flat process ………………...….…………..….…..….*P. cheongtaensis*
11. Body uniformly orange (Fig. 34B). Male genitalia (Fig. 35F-H): Endosoma J-shaped, sclerotized elongated process from apex slightly curved inward, membranous outgrowth with few spinules basally, secondary gonopore located apically. Female

genitalia (Fig. 35I): Sclerotized rings small, oval, somewhat straight posteriorly and pointed anteriorly, membranous folding furnished with dense spinules laterally on dorsal labiate plate …………………...…………………………………..*P. flavescens*

- Body other than orange coloration …………………….…………………………12

12. Hemelytron deeply red ……….……….……………………………………………….13

- Corium fuscous, brownish red …………………………………………….………...14

13. Head, pronotum, scutum, mesoscutellum castaneous; femora with apical 2/3 red and with few spots at anterior margin (Fig. 34A). Male genitalia (Fig. 35A-D): Endosoma J-shaped, margin of apex provided with spinules, and a short apical outgrowth. Female genitalia (Fig. 35E): Sclerotized ring small, oval with pointed anteriorly, membranous folding on dorsal labiate plate medially invaginated ..…*P. cinnabarinus*

- Head with pale vertex; pronotum, mesoscutum, scutellum and the base of hemelytron blackish, and shiny (dark red specimen, male) or orange red except callus dark (faintly red, female) (Fig. 37I-J); hind femora with black spots at entire anterior margin ………………………………………………………………..*P. koreanus*

14. Anterior margin of pronotum or callus with a large black spot; vertex and base of cuneus pale; corium and femora red (dark red specimens), or posterior part of pronotum, apex of scutellum, base of corium pale with larger posterior part dirty dark tinged with red, and femora pale (pale specimens) (Fig. 34H-K), femora provided with two rows of spots proximally, which distally merged into irregular spots ………………………………………………………………………......*P. ulmi*

- Pronotum reddish brown, or pale orange, or same as color as hemelytron ...……...15

15. Body pale, dorsum pale tinged with orange yellow or pale brown, head yellow to dark brown; apex of clavus fuscous, hind femora arranged with distinct large and small

spots at distal half, membrane brownish (Fig. 37D-E)……………....…………*P. kimi*

- Head ocher, fore head provided with dark markings, clypeus black brown ……………………………….………………………………..….*P. sanguinarius*

16. Genital segment with tuft of stiff hairs laterally. Male genitalia (Fig. 32A-D): Endosoma J-shaped, apex extended to elongated process, which base provided with membranous folding furnished with spinules. Female genitalia (Fig. 32E): Sclerotized rings broad and somewhat subrectangular, dorsal labiate plate somewhat sclerotized, membranous folding between sclerotized rings …………………….…..*P. tonnaichanus*

- Genital segment without a tuft of stiff hairs ……………………………………..17

17. All femora black, apically tinged with red except for pale apex of fore femur; Male genitalia (Fig. 33A-D): Endosoma J- shaped, subapically extended membranous folding provided with numerous spinules. Female genitalia (Fig. 33E): Sclerotized ring elongated, width narrow, membranous folding located centrally …..*P. castanea*e

- Femora castaneous, or apically pale (in all), or base of femora black and apex red …………………………………………………………………………………18

18. Labium reaching apex of mesocoxa; base of femora black, 1/2 or 3/4 from apex reddish provided with black spots. Male genitalia (Fig. 32F-H): Endosoma C-shaped, elongated process provided with cluster of spinules sub-apically. Female genitalia (Fig. 32I): Sclerotized rings elongated oval, posterior portion of dorsal labiate plate with inverted V-shaped membranous folding ………….……….….*P. suwonanus*

- Labium reaching metacoxae or at least exceeding mesocoxae ……….……………19

19. Body of small size about 2.9-3.0 mm; spots on metatibiae castaneous (Fig. 31G-H). Male genitalia (Fig. 33G-J): Endosoma nearly S-shaped, apical margin completely surrounded by spinules, and elongated process slender, base projecting from

secondary gonopore which is positioned near apex. Female genitalia (Fig. 33K): Sclerotized rings small, ovate, somewhat pointed anteriorly ………………....*P. ernsti*

- Body medium sized, spots on tibia brown or dark brown at the base of black spines ……………………………………………………………………………….....20

20. Coxae dark brown, trochanters pale ……….……………..……………….*P. kerzhneri*

- Coxae black, trochanters dark brown to blackish. Male genitalia (Fig. 36F-I): Endosoma J-shaped, apically ending as leaf like structure. Female genitalia (Fig. 36J): Sclerotized rings are strongly asymmetrical .....…………………….……..…*P. loginovae*

21. All antennal segments black. Male genitalia (Fig. 28A-D): Endosoma S-shaped, apical region membranous with numerous clusters of spinules, and outgrowing process is short and slender. Female genitalia (Fig. 28E): Sclerotized rings distinct, membranous folding at posterior portion of dorsal labiate plate vase shaped …………………………………………………………………………....*P. michaili*

- Antennal segments either with base or apex or both black ……………………..…..22

22. Male blackish, female brownish; head, pronotum, and scutellum black, in female provided with pale medial stripe extended from fore head to pronotum, enlarged as a spot at each medial region, scutellum with 3 pale spots and apex of scutellum pale; metafemora pale with chain of spots joining each other, tibia with large castaneous spots at base of pale spines. Male genitalia (Fig. 39A-C): Endosoma roughly s-shaped, extending outgrowth process appears as a horny spine together with other large spines arising from apex. Female genitalia (Fig. 39D): Sclerotized ring small, oval, broad posteriorly and narrow anteriorly, posterior portion of dorsal labiate plate with membranous folding supported lateral sclerotized ring ….…..........…...*P. bagjonicus*

- Head, pronotum and scutellum without spots, femur castaneous or black ………….23

23. Largest Korean species 4.8-5.5, vertex and inner margin of eyes pale, head and pronotum black, hemelytron and legs fuscous (Fig. 31C-D). Female genitalia (Fig. 33F): Sclerotized rings elongate oval, with apex extending like a protuberance and reaching spinules on dorsal lateral plates laterally ……………..…...*P. samdzijonicus*

- Size smaller, vertex pale or black, if pale only at central margin, femora black or castaneous and tibiae pale …………………..……………………………………...24

24. Ostiolar region grayish or pale ………………………………………………...25

- Ostiolar region black …………………………………………………………..26

25. Cuneus castaneous red with pale base, tibiae pale tinged with red and provided with small castaneous spots (Fig. 25D). Male genitalia (Fig. 27E-G): Endosoma S-shaped, laterally furnished with spinules subapically, and elongated outgrowth process slender and slightly curved opposite of spinules ………..………..………..……......*P. betuleti*

- Cuneus black (or castaneous), apically tinged with dark red, tibiae pale with large castaneous red spots. Male genitalia (Fig. 26C-F): Endosoma C-shaped, simple apex without spinules, apical process short and slender. Female genitalia (Fig. 26G): dorsal labiate plate with series of spinules laterally; posterior portion of dorsal labiate plate with numerous folds of membranes; sclerotized rings elongated, tapered anteriorly ………………………………………………..…………………………....*P. ater*

26. Fore and meso femora apically pale, tibiae with small brown spots. Male genitalia (Fig. 26A-B): Endosoma S-shaped, membranous folding arises from apex of secondary gonopore furnished with several spinules subapically ...……….*P. aethiops*

- Femora entirely black and shiny, tibiae with large castaneous black spots. Male genitalia (Fig. 27A-D): Endosoma C-shaped, membranous folding arising from apex of secondary gonopore, furnished with densely distributed spinules laterally and sparsely distributed few spinules medially …………………...……………..*P*. *atratus*

Subgenus *Apocremnus* Fieber, 1858 버들우리장님노린재아속

The genus *Apocremnus* Fieber was downgraded to subgenus *Psallus* by Reuter (1895, 1878) and comprises with fifteen described species (Kerzhner and Josifov, 1999; and Yasunaga & Vinokurov, 2000).

Species of this subgenus are mostly distinguished by darker body coloration, pale or dark appendages; C- or S-shaped endosoma bearing a membranous structure arise from either mesial or apex of the secondary gonopore and furnished with minute spinules (Fig. 26, 27). For detail description see Wagner, 1975a.

***Psallus* (*A.*) *aethiops* (Zetterstedt, 1838) 버들우리장님노린재**

Figures: 26A-B

Phytocoris aethiops Zetterstedt, 1838: 274.

Psallus (*A.*) *aethiops* (Zetterstedt, 1838)

Phytocoris aethiops Zetterstedt, 1838: 274 (n. sp.)

Capsus intermedius R.F. Sahlberg, 1848: 116, (syn. Reuter, 1878: 176)

Psallus aethiops flavicolor Lindberg, 1921: 50 (n. var.)

Psallus aethiops: Kulik, 1965: 62 (list); Kerzhner, 1973: 91 (list); 1988a: 845 (key, fig.); Schwartz and Kelton, 1990: 945 (dist.); Wheeler and Henry, 1992: 180 (dist., host); Schuh, 1995: 399 (cat.); Kerzhner and Josifov, 1999: 400 (cat.); Anufriev et al., 2001: 124 (Eng. transl.); Kwon et al., 2001: 177 (cat.); Duwal et al., 2012: 607 (diag., key, MG).

Diagnosis. Recognized by black dorsum except the margin of vertex pale; black entire antennal segments I and II and all femora, except the apices of femora pale; pale or pale brown tibiae with brown base and dark brown spots at the base of black spine; endosoma and paramere as in figures 25A-B.

Description. *Male*. Body elongate oval. COLORATION: Dorsum entirely black and shining. Venter black and shining. Antennal segments black except middle region of segment II dark brown. Labium entirely black. Coxae black, trochanters dark brown; all femora black except the apex of pro- and mesofemora pale; tibiae pale with dark bases and apices with rows of spots at base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple brown setae and with sericeous setae; head, pronotum, mesoscutum and scutellum slightly shagreened. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 26A-B): **Endosoma**: Shape J-like; apex clear and wide with spinules membrane subapically above the secondary gonopore; a elongated apical processes arise at the blunt apex tapers from base to apex; secondary gonopore positioned subapically (Fig. 26B). **Left paramere**: As in Figure 26A.

Female. Not observed.

Specimens examined. For reference:- **Russia**: 1♂, S. Yakutia, 18 km NE of Kolyma river, 577 m alt., 13.VII.1995, on *Salix* sp. (Salicaceae), T. Yasunaga, determined by T. Yasunaga, 2000 (NAAS).

Distribution. Canada, China, Europe, Korea, Russia, USA.

Host. *Salix* sp. (Salicaceae).

Remarks. Kerzhner (1988a) documented the host plant of this species as willow and also the specimen observed in this study was collected by Yasunaga, on *Salix* sp. (Saliaceae).

***Psallus* (*A.*) *ater* Josifov, 1983 나도우리장님노린재**

Figures: 25A-B, 26C-G

Psallus (*Apocremnus*) *ater* Josifov, 1983: 198 (n. sp., desc., figs.); 1992: 116 (list); Schuh, 1995: 401 (cat.); Kerzhner and Josifov, 1999: 401 (cat.); Kwon et al., 2001: 177 (cat.); Duwal et al., 2012: 608) (diag., key, MG).

Diagnosis. Recognized by usually black head and pronotum, castaneous black (or black) mesoscutum, scutellum, hemelytron and femora; pale tibiae with large castaneous red spots; enodsoma, parameres and phallotheca as in figures 26C-F.

Description. *Male*. Body elongate oval. COLORATION (Fig. 25A-B): Head, pronotum, mesoscutum and scutellum black except the posterior margin of vertex, mesoscutum laterally pale; hemelytron black or blackish, clavus blackish red or entirely black, endocorium basally or entirely black, exocorium brownish, cuneus castaneous; and membrane blackish brown. Venter dark brown or black with pale pro- and epimeron. Antennae, segment I black, segment II dark brown or brown except the extreme base and apex, and segment III and IV pale. Labium black and shining. Coxae black; trochanters brown; metafemora reddish black or black; tibiae pale or dirty yellow with large castaneous or brown spots at base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple black setae and with sericeous setae; dorsum shagreened. STRUCTURE: **Head**: Length nearly equal to the length of antennal segment III; interocular space wide, equal to the length of segment IV; labium slightly surpassing apex of metacoxae. GENITALIA (Fig. 26C-F): **Endosoma**: Shape J-like with blunt apex and slender elongated processes extending through apex; secondary gonopore positioned at about 1/3 from the apex (Fig. 26C). **Left paramere**: Body broad, anterior process short and slender and posterior process flat (26E).

Right paramere: Body elongate, with short protuberance apically (26D).

Female. GENITALIA (Fig. 26G): Brusa copulatrix large in size; dorsal labiate plate with series of spinules laterally and with numerous membranous folds anteriorly; sclerotized rings elongated, tapered anteriorly.

Specimens examined. **North Korea**: **Hwanghae-do**: 2♂, Bakyeon, 20 km N. Gaeseong (in label: Bagjon, 20 km N Kaesong), 21-23.V.1975, M. Josifov, determined by M. Josifov (TLIA) (paratype specimens). **South Korea**: **Gangwon-do**: 3♂, Donghae-si, Mt. Duta, 16.V.2001, light trap (NAAS); 1♀, 27.IV.2010, *Quercus* sp. (Fagaceae), S.H. Lee (nymph emerge). **Gyeonggi-do**: 1♂, Anyang-si, Gwanak Arboretum, 6.V.2009, R.K. Duwal (SNU); 2♂, Paju-si, Musan-eup, Gunnae-myeon, 21.V.2008, on *Acer ginnala* Maxim. (Aceraceae), S. Jung (SNU); 2♂, Gwangju-si, Mt. Taehwa, 2-20.V.2008, Malaise trap, J.O. Lim (SNU); 2♂, Yangpyeong-gun, Mt. Yongmun, 24.VI.2009, light trap, R.K. Duwal and S. Jung (SNU); 9♂, 4♀, same collection data as above except for date, 24.VI.2010; **Jeollanam-do**: 5♂, 1♀, Jangseong-gun, Mt. Bangjang, 24.VI.2010, light trap, R.K. Duwal (SNU).

Distribution. China, Korea.

Host. *Crataegus* sp., *Prunus* sp. (Rosaceae) [Josifov, 1983].

Remarks. Josifov (1983) documented the host plant as *Crataegus* sp., *Prunus* sp. (Rosaceae), whereas in Korea it was observed on a branch of *Quercus,* then reared in the laboratory during the late winter of 2010. The emerged nymph was given an animal diet, either lepidopteran or coleopteran larvae. It was very active undergoing rapid growth, and within a week the adult emerged and lived for more than a week. The adult was also observed feeding on decayed plant and animal matter.

***Psallus* (*A.*) *atratus* Josifov, 1983 너도우리장님노린재**

Figures: 25C, 27A-D

Psallus (*Apocremnus*) *atratus* Josifov, 1983: 197 (n. sp., desc., figs.); 1992a: 116 (list); Kerzhner, 1988b: 845(key, fig.); Schuh, 1995 (cat.): 401; Kerzhner and Josifov, 1999: 401 (cat.); Anufriev et al., 2001: 124 (eng transl.); Kwon et al., 2001: 178 (cat.); Duwal et al., 2012: 611 (diag., key, MG).

Diagnosis. Recognized by black dorsum, antennal segment I and distal (1/2 or 1/3) part of segment II (Fig. 25C); black and shiny femora, pale tibia with large castaneous black spots; membranous structure at the apex of endosoma laterally furnished with densely distributed spinules sparse towards the middle (Fig. 27A); parameres and phallotheca as in figures 27B-D.

Description. *Male*. Body medium sized, elongated. COLORATION (Fig. 25C): Generally black, shiny; dorsum entirely black with dark brown exocorium; hemelytron, membrane grayish black. Venter shining black. Antennal segment I, base and apex of segment II black, and segment III and IV brown. Labium dark brown. All coxae and femora black, ventrally with shining black aggregated spots; metatibiae reddish with black spots at the base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple black setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: Projecting anteriorly; labium surpassing apex of metacoxae. GENITALIA (Fig. 27A-D): **Endosoma**: Shape more or less J-like, primary endosomal process with enlarged blunt apex, and furnished with few short secondary processes, elongated process arise from apex short, slender and tapering towards the apex; secondary gonopore followed with membranous structure ornamented with small and large spicules (Fig. 27A). **Phallotheca**: Simple, tapered towards the apex and finger like apex (Fig. 27D). **Left paramere**: Body relatively short, anterior process elongated and slender, posterior process short and broad (more or less triangular) (Fig. 27B). **Right paramere**: Body elongate, elongated leaf like, and apex with finger like process (Fig. 27D).

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, 1♀, rearing branch from Yangpyeong-gun, 20.IV.2009, *Prunus* sp. (Rosaceae), R. K. Duwal (SNU) [♂ in alcohol].

Distribution. Korea, Russia.

Host. *Crataegus* sp., *Pyrus ussuriensis* Maxim. var. (Rosaceae) [Josifov, 1983; Kerzhner, 1988b, respt.], *Prunus* sp.

Remarks. This species was reported by Josifov (1983) on *Crataegus* sp. (Rosaceae). Likewise two individuals in this study were observed on a branch of *Prunus* sp. (Rosaceae). The branch was collected during early spring for observation when the temperature was still cold in Korea. The emerged nymphs developed to adults and lived for about 10-15 days before dying.

***Psallus* (*A.*) *betuleti* (Fallen, 1826) 박달우리장님노린재**

Figures: 25D, 27E-G

Cimex cruentus Müller, 1776: 108 (n. sp.)

Phytocoris betuleti Fallén 1826: 15 (n. sp.)

Psallus betuleti: Zaitzeva, 1968: 866 (desc., fig.); Wheeler and Henry, 1992: 185 (dist., host); Schwartz and Kelton, 1990: 946 (diag., desc.); Schuh, 1995: 401 (cat.); Kerzhner and Josifov, 1999: 401 (cat.); Anufriev et al., 2001: 125 (eng. transl.); Kwon et al., 2001: 178 (cat.); Rieger, and Rabitsch, 2006: 163 (diag., dist., figs.); Duwal et al., 2012: 612 (diag., key, MG).

Diagnosis. Recognized by black dorsum, antennal segment I and II; black hemelytron tinged with red, castaneous red cuneus with pale base (Fig. 25D); pale tibiae tinged with red and provided with small castaneous spots; apex of endosoma laterally furnished with a row of spinules (Fig. 27G), parameres and phallotheca as in figures 27E-F.

Description. *Male*. Body elongated, nearly parallel sided. COLORATION (Fig. 25D): Generally dorsum shiny, reddish black; head, pronotum, mesoscutum, scutellum and black; hemelytron, clavus black, corium black tinged with red, cuneus deep red, membrane grayish brown. Venter shining dark brown. Antennal segment I black and segment II-IV blackish brown. Labium, segment I-III shining dark brown. All coxae dark brown; all femora blackish brown tinged with red and with red apices; meta-tibiae reddish brown, with obscure dark spots. SURFACE AND VESTITURE: Dorsum furnished with simple black setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium, reaching apex of metacoxae. GENITALIA (Fig. 27E-G): **Endosoma**: Shape more or less S-like, with serrated margin subapically followed by secondary gonopore, apex followed with elongated secondary process; secondary gonopore located subapically (Fig. 27G). **Phallotheca**: Broad and nearly parallel (Fig. 27E). **Left paramere**: Body large, anterior process slender and slightly curved downwards, posterior process broad, short, with thumb like apex (Fig. 27F).

Specimens examined. For reference:- **Russia**: **S. Yakutia**: 1♂, Lengra, Mt. Stanovoj, 17-18.VII.1995, on *Alnus* sp. (Betulaceae), T. Yasunaga, determined by T. Yasunaga, 2008 (SNU).

Distribution. Canada, China, Europe, Korea, Russia.

Host. *Betula* spp., *Alnus* spp. (Betulaceae) [Henry and Wheeler, 1979; Kerzhner, 1978, respt.], *Epilobium* spp. (Onagraceae), *Rhododendron* (Ericaceae) [Schwartz and Kelton, 1990].

Remarks. This species is reported from various host plants; *Betula* spp. (Betulaceae)

(Henry and Wheeler, 1979), *Alnus* spp. (Betulaceae) (Kerzhner, 1978), *Epilobium* (Onagraceae), and *Rhododendron* (Ericaceae) (Schwartz and Kelton, 1990). Also, Yasunaga collected it on *Alnus* sp. (Betulaceae).

***Psallus* (*A.*) *michaili* Kerzhner et Schuh, 1995 검정우리장님노린재**

Figures: 25E, 28A-E

Psallus Apocremnus niger Josifov, 1992b: 113 (n. sp., desc. figs.); 1992a: 116 (list)

Psallus michaili: Kerzhner and Schuh, 1995: 4 (n. name); Schuh, 1995: 409 (cat.); Kerzhner and Josifov, 1999: 402 (cat.); Anufriev et al., 2001 (eng. transl.); Kwon et al., 2001: 178 (cat.); Duwal et al., 2012: 613 (diag., key, MG).

Diagnosis. Recognized by completely black body, dorsum, antennae and femora (Fig. 25E); dirty yellow tibiae with large black (or castaneous) spots; membranous apical region of endosoma with numerous clusters of spinules (Fig. 28A), and parameres and phallotheca as in figures 28B-D.

Description. *Male*. Body elongated. COLORATION (Fig. 25E): Generally shiny black; head, pronotum, mesoscutum and scutellum and entire hemelytron black, except membrane brown. Venter shining black. All antennal segments black. Labium shining castaneous black. All coxae and trochanters pale yellow; meta-femora shining black; meta-tibiae dirty yellow to dark brown, with black or castaneous. SURFACE AND VESTITURE: Dorsum furnished with simple black setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 28A-D): **Endosoma**: Shape more or less J-like, with broad membranous apex, furnished with numerous bundles of spicules, apical secondary process short and slender; secondary gonopore located medially

(Fig. 28A). **Phallotheca**: Simple, somewhat triangular with pointed apex. **Left paramere**: Body small, anterior slender process uniform in position to the body, posterior process triangular with thumb like apex (Fig. 28B). **Right paramere**: Body elongate, leaf like, tapering towards the apex (Fig. 28D).

Female. GENITALIA (Fig. 28E): Brusa copulatrix large, seminal depository wide, dorsal labiate plate with a few spinules laterally, posterior portion of dorsal labiate plate with vase shaped membranous folding, sclerotized rings distinctly elongated and broad.

Specimens examined. **South Korea**: **Gyeonggi-do**: 2♂, 2♀, Panmunjom, 21.V.2008, *Quercus* sp. (Fagaceae), S. Jung (SNU).

Distribution. Korea.

Host. *Acer ginnala* (Aceraceae), [Josifov, 1992], and Fagaceae.

Remarks. Josifov (1992) documented the host plant of this species as *Acer ginnala* (Aceraceae) in North Korea, whereas in South Korea it is collected on oak trees (Fagaceae).

Subgenus *Calopsallus* Yasunaga, 2000

The subgenus *Callopsallus* is introduced by Yasunaga & Vinokurov (2000) with description of a new species, *Psallus* (*Callopsallus*) *roseoguttatus* from Japan and three reported East Asian species, *P*. *clarus* Kerzhner, 1988, *P*. *tesongsanicus* Josifov, 1983, and *P*. *guttatus* Zheng et Li, 1900 are placed under same subgenus due to their similarity in morphological texture and structure of endosoma.

Members of this subgenus are similar in general appearance to the subgenus *Psallus*. However, these bears specific characteristics like, head, pronotum, mesoscutum and scutellum with numerous, small, dark spots; frons with several rows of punctures laterally; pygophore with paired bundles of stiff setae; endosoma broad with very complex apex bearing clusters of spinules; bursa copulatrix with small, oval sclerotized rings, centrally with semi-sclerotized and membranous structures (Fig. 28I, 30E, J). For detail description see Yasunaga & Vinokurov, 2000.

***Psallus* (*C.*) *clarus* Kerzhner, 1988 갈참우리장님노린재**

Figures: 29C-D, 30A-E

Psallus (*Psallus*) *clarus:* Kerzhner, 1988a: (n. sp., figs.); 1988b: 845 (key); Schuh, 1995: 403 (cat.); Kerzhner and Josifov, 1999: 412 (cat.); Anufriev et al., 2001: 123 (eng. transl.); Kwon et al., 2001: 182 (cat.).

Psallus (*Callopsallus*) *clarus*: Yasunaga and Vinokurov, 2000: 662 (disc.); Duwal et al., 2012: 615 (diag., key, MG).

Diagnosis. Recognized by pale dorsum with red speckles except on mesoscutum and scutellum, scattered brown spots on head, pronotum, mesoscutum and scutellum; pale antennae with brown basal ring on segment I; pale femora with irregularly arranged spots ventrally and dorsally without spots (Fig. 29C-D); C-shaped endosoma with blunt apex and provided with spinules on inner later margin and short secondary apical process (Fig. 30A); parameres and phallotheca as in figures 30B-D.

Description. *Male*. Body medium sized, elongated. COLORATION (Fig. 29C-D): Generally pale with red speckles; head pale with brown spots; pronotum with few red or orange speckles together with brown spots; mesoscutum and scutellum with brown spots; hemelytron, clavus and corium uniformly distributed with red speckles, cuneus pale and provided with few speckles at the base, membrane pale brown. Venter white (dark specimens with dark brown thoracic region). All antennal segments pale with brown basal ring on segment I. Labium pale with dark brown apex. All coxae and trochanters white; meta-femora pale with irregular large and small spots ventrally; metatibia pale with small dark brown spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 30A-D): **Endosoma**: Shape C-like, primary endosomal process broad and flat with very short apical secondary processes, attached with a spiculus membrane; secondary gonopore located subapically (Fig. 30A). **Phallotheca**: Simple, base broad, from middle distinctly tapers towards apex (Fig. 30D). **Left paramere**: Body large, anterior process elongated slender, posterior process thumb like (Fig. 30C). **Right paramere**: Body elongate, leaf like, apex with finger like process (Fig. 30B).

Female. GENITALIA (Fig. 30E): Brusa copulatrix large, lateral oviducts posteriorly supported by bowl shaped membranous folding, dorsal labiate plate with clusters of spinules laterally, sclerotized rings very small, more or less rounded.

Specimens examined. **South Korea**: **Chungcheonbuk-do**: 1♀, Cheongju-si, 17.V.1997, I.H. Lee (SNU). **Chungcheongnam-do**: 2♂, Cheonan-si, Ipjang-myeon, Heukam-ri, 13.V.2006, S.W. Park (SNU). **Gyeonggi-do**: 1♀, Icheon-si, 21.V.2008 S. Jung (SNU); 1♀, Namyangju-si, Jinjeop-eup, Palya-ri, 26.V.2006, J.W. Seong (SNU); 1♂, Namyangju-si, Onam-eup, Yangji-ri, 24.V.2006, T.M. Han; 12♂, 3♀, Osan-si, Sucheong-dong, 20.V.1998, light trap, H.K. Lee (SNU); 1♂, Osan-si, 24.V.2000, light trap, NAAS (SNU); 1♂, Suwon-si, 10-11.V.1997, light trap (NAAS); 1♀, Seoul, Gwanak-gu, Silim-dong, SNU (CALS), 9.V.2006, light trap, J. W. Seong (SNU); 1♂, 1♀, Suwon-si, SNU Arboretum, 20.V.2009, on *Kalopanax septemlobus* (Thunb. ex Murray) (Araliaceae), R.K. Duwal (SNU); 1♀, Yangpyeong-gun, Mt. Yongmun, 24.VI.2010, light trap, R.K. Duwal and S. Jung. **Jeollanam-do**: 57♀, Jangseong-gun, Mt. Bangjang, 24.VI.2010, light trap, R.K. Duwal.

Distribution. China, Korea, Russia.

Host. *Quercus dentata* Thunb. (Fagaceae) [Kerzhner, 1988b], *Kalopanax septemlobus* (Thunb. ex Murray) (Araliaceae) in Korea.

Remarks. Kerzhner (1988a) documented the host plant of this species as *Quercus dentata* (Fagaceae). The breeding host is unknown in Korea however, they were observed on *Kalopanax septemlobus* (Thunb. ex Murray) (Araliaceae) in northern region of South Korea.

***Psallus* (*C.*) *rogeoguttatus* Yasunaga and Vinokurov, 2000**

Figures: 29A-B, 28F-I

Psallus (*Calopsallus*) *roseoguttatus* Yasunaga and Vinokurov, 2000: 662 (n. sp., desc., figs.); Yasunaga, 2001b: 172 (diag., fig.); Duwal et al., 2012: 617 (diag., key, MG).

Diagnosis. Recognized by pale, shining dorsum with red or orange speckles; pale antennae and legs, pale or yellowish femora apically tinged with red, ventrally with densely distributed large and small fused spots, dorsally with few spots subapically (Fig. 29A-B); broad apex of endosoma with numerous spinules and with toothed spines at inner basal margin of apical process (Fig. 28F); left paramere and phallotheca as in figures 28G-H.

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 29A-B): Generally pale with widely distributed red (or orange) spots,; head and pronotum with mixed pale brown patches and brown spots, mesoscutum and scutellum with red spots, hemelytron, clavus, corium and cuneus with red spots, membrane pale brown or brown. Venter white or orange with numerous red spots. Antennal segments pale except extreme basal ring on segment I. Labium pale with dark brown apex. All coxae and trochanters pale; meta-femora pale, ventrally distributed with small and large brown spots, and dorsally with few apical spots; tibiae pale, with small brown spots. SURFACE AND VESTITURE: Dorsum furnished with simple brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 28F-H): **Endosoma**: Shape more or less C-like, primary endosomal process apically broad and furnished with several rows of spicules, apical secondary process somewhat curved and with spicules at base; secondary gonopore located subapically beneath secondary apical process (Fig. 28F). **Phallotheca**: Simple, broad basally and subapically tapers (Fig. 28H). **Left paramere**: Body small, anterior process slender and somewhat curved, posterior process thumb like (Fig. 28G). *Female*. GENITALIA (Fig. 28I): Brusa copulatrix large, anterior portion of dorsal labiate plates wide and furnished with spinules nearby margin, lateral oviducts positioned within roughly in heart shaped membranous fold supported by an additional leaf like membranous folding baso-laterally, sclerotized rings comparatively small, and oval.

Specimens examined. **South Korea**: **Gangwon-do**: 2♀, Donghae-si, Mt. Duta, 16.V.2001, light trap (NAAS). For reference:- **Japan**: 2♂, Shikoku, Kochi Pref., Sameura, 21.V.2000, M. Takai, determined by T. Yasunaga, 2008 (SNU).

Distribution. Japan, Korea.

Host. *Quercus serrata* (Fagaceae) [Yasunaga and Vinokurov, 2000].

Remarks. *Psallus roseoguttatus* is very closely similar to *P*. *clarus* but in careful observation, they can be discriminate by arrangements of brown spots on dorsum and spots on femora.

Yasunaga and Vinokurov (2000) confirmed the breeding host as *Quercus serrata* (Fagaceae), but in Korea hosts are unknown as all specimens were collected at light (NAAS).

***Psallus* (*C.*) *tesongsanicus* Josifov, 1983 대성산우리장님노린재**

Figures: 29E-F, 30F-J

Psallus (*Psallus*) *tesongsanicus* Josifov, 1983: 207 (n. sp., desc., figs.); 1992a: 116 (list); Schuh, 1995: 416 (cat.); Kerzhner and Josifov, 1999: 418 (cat.); Kwon et al., 2001: 183 (cat.).

Psallus (*Callopsallus*) *tesongsanicus*: Yasunaga and Vinokurov, 2000: 662 (disc.); Duwal et al., 2012 (diag., key, MG).

Diagnosis. Recognized by pale dorsum with red speckles, brown spots on head, anterior region of pronotum and scutellum; pale femora ventrally with numerous small spots at distal half and dorsally with few spots subapically (Fig. 29E-F); broad apex of endosoma with spinose margin and short apical process (Fig. 30G); parameres and phallotheca as in figure 30F, H-I.

Description. *Male*. Body elongated. COLORATION (Fig. 29E-F): Generally pale or orange yellow with red speckles; head with both brown spots and red speckles; pronotum with uniformly distributed red speckles and brown spots only on anterior pronotum; mesoscutum only with red speckles and scutellum only with red speckles (sometimes with few brown spots); hemelytron, clavus, corium, and cuneus pale (or tinged with orange color) and distributed with speckles; and membrane pale brown. Venter pale with densely distributed red spots. Antennae entirely pale. Labium yellowish, segment III and IV brown. All coxae and trochanters white; meta-femora pale with dense irregularly scattered spots; hind-tibia pale, with small dark brown spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 30F-I): **Endosoma**: Shape C-like, primary endosomal process broad and apically with numerous membranous structures furnished with spicules; secondary gonopore located subapically (Fig. 30G). **Phallotheca**: Simple, margin not uniform and apically tapered (Fig. 30F). **Left paramere**: Body large, anterior and posterior process slender (Fig. 30I). **Right paramere**: Body elongate, lateral margins not uniform and apically developed protuberance (Fig. 30H).

Female. GENITALIA (Fig. 30J): Brusa copulatrix large, dorsal labiate plate invaginate at middle and furnished with a few spinules laterally, sclerotized rings ovate but posterior margin straight; lateral oviduct supported by membranous folding arising from the dorsal labiate plate.

Specimens examined. **North Korea**: **Pyeongnnam-do**: 2♂, Pyeongyang, Mt. Yongak (in label: Bei Phiongjang, Rjonggang, Mt. Rjongak), 31.V.1987, M. Josifov, determined by M. Josifov (SNU). **South Korea**: **Gyeonggi-do**: 1♀, Yangpyeong-gun, Mt. Yongmun, 11.IV.2009, light trap, R.K. Duwal and S. Jung (SNU).

Distribution. Korea.

Host. *Quercus dentata* Thunb. (Fagaceae) [Josifov, 1983].

Remarks. Josifov (1983) reported this species on *Quercus dentata* (Fagaceae) in North Korea.

Subgenus *Hylopsallus* Wagner, 1952 해동우리장님노린재아속

The subgenus *Hyalopsallus* is a Holarctic group consists of fifteen documented species (Kerzhner & Josifov, 1999; Yasunaga & Vinokurov, 2000; Duwal et al. 2012).

Members of this subgenus are usually with dark body color, pale antennae and dark base on segment I, endosoma C-shaped, short and widened with cluster of spinules at the base of apical process. For detail description see Wagner, 1952.

***Psallus* (*H*.) *suwonanus* Duwal et al., 2012**

Figures: 29G-H, 32F-I

Psallus (*H*.) *suwonanus* Duwal et al., 2012: 620 (n. sp, desc., key, MG).

Diagnosis. Recognized by the blackish or dark brown endocorium, castaneous or deep red exocorium and cuneus; apex of femora (2/3 or 1/2) red with rows of large black spots; short extension of elongated secondary processes of endosoma furnished with bunch of spinules at subapical region; anteriorly angulated right paramere and tapered left paramere from base to apex.

Description. Male. Body elongate oval. COLORATION (Fig. 29G-H): Head, pronotum, mesoscutum and scutellum black; hemelytron black or blackish red, endocorium black or dark brown, exocorium castaneous or deep red, cuneus castaneous or deep red; membrane brown, with grey apical margin. Venter, thoracic region black, abdomen black or dark brown except last abdominal segment castaneous. Antennal segments pale except the extreme base of segment I dark. Labium, segment I, basal half of segment II, apical half of segment IV blackish brown, remaining parts pale. Coxae black, trochanters castaneous; metafemora at basal 1/3 or 1/2 black, larger apical part red with rows of large black spots; tibiae pale with rows of large castaneous spots at base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple black setae and with sericeous setae; head, pronotum, mesoscutum and scutellum slightly shagreened. STRUCTURE: **Head**: Length short comparative to body size; interocular space wide; labium slightly surpassing or reaching apex of mesocoxae. GENITALIA (Fig. 32F-H): **Endosoma**: shape C-like; a few long and short secondary processes; elongated processes extending through apex, furnished with a bunch of spinules; secondary gonopore positioned at about 1/4 from the apex (Fig. 32G). **Left paramere**: Body short, anterior process more or less angulated, posterior process short and flat (Fig. 32H). **Right paramere**: Body elongate, tapered from base to apex, apex with short finger like process (Fig. 32F).

Female. Not significantly different from male in color and vestiture. GENITALIA (Fig. 32I): Brusa copulatrix of moderate size, dorsal labiate plate furnished with spinules laterally; sclerotized rings large, somewhat irregular; folded membranes arise from anterior and posterior portions of dorsal labiate plate supporting lateral oviducts.

Specimens examined. **South Korea**: **Gyeonggi-do**: 14♂, 30♀, Suwon-si, SNU Arboretum, 20.V.2009, on *Rhamnus davurica* Pallas (Rhamnaceae), R.K. Duwal (AMNH_PBI 00383439- 383451; 00383452-383570) (SNU); 1♀, same data, *Pyrus ussuriensis* (Rosaceae), R.K. Duwal (SNU) (Holo- and Paratype specimens).

Distribution. Korea.

Host. *Rhamnus davurica* Pallas (Rhamnaceae).

Remarks. The primary host plant is *Rhamnus davurica* Pallas (Rhamnaceae), a few individuals were also collected from *Pyrus ussuriensis* var. (Rosaceae) which was planted next to *Rhamnus*. These are emerged from the middle to the end of May. The tree was seriously damaged but as they were collected together with large number of plant hoppers whose secretion made the tree very sticky, it is difficult to assume whether this species is a predator or a pest.

***Psallus* (*H.*) *tonnaichanus* Muramoto, 1973 해동우리장님노린재**

Figures: 31A-B, 32A-E

Psallus tonnaichanus Muramoto, 1973: 2897 (n. sp)

Psallus (*Phylidea*) *dryos* Kerzhner 1979: 47 (n. sp., desc., figs.)

Psallus tonnaichanus dolerus Kerzhner 1988a: 74 (n. comb.)

Psallus tonnaichanus dolerus Josifov, 1992b: 117 (fig.)

Psallus (*Hylopsallus*) *tonnaichanus* Yasunaga and Vinokurov, 2000: 656 (key, dist.); Yasunaga, 2001b: (diag., fig.); Anufriev et al., 2001: 125 (eng. transl.); Kwon et al., 2001: 179 (cat.); Duwal et al., 2012: 622 (diag., key, MG).

Diagnosis. Recognized by reddish dark brown or black dorsum; black head and pronotum; pale antennae except the extreme base of segment I dark; dark brown hemelytron, red cuneus (Fig. 31); dark brown femora with pale apex and ventrally arranged with two rows of spots, pale tibiae with large dark brown spots at the base of black spine; tuft of stiff hairs laterally on genital capsule; endosoma, parameres and phallotheca as in figures 32A-D.

Description. *Male*. Body small, oval. COLORATION (Fig. 31A-B): Generally black tinged with red (but some specimens were found reddish); head, pronotum, mesoscutum and scutellum black, or brown or dark brown; hemelytron, clavus dark brown or brown, endocorium dark brown or brown, exocorium reddish brown or deep red, membrane brown. Venter dark brown or black. Antennal segments pale except extreme base of segment I dark. Labium, segment I, base of segment II, apices of segment III and IV shining dark brown. All coxae and trochanters black; metafemora dark brown or black with pale apices, and two rows of aggregated shining black, small spots ventrally; meta-tibiae pale, with large dark brown spots at the base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple brown setae and with uniformly distributed sericeous setae. STRUCTURE: **Head**: Convex; labium exceeding apex of metacoxae. **Abdomen**: Pygophore with a pair of tuft stiff hairs at either lateral side. GENITALIA (Fig. 32A-D): **Endosoma**: Shape J-like, primary endosomal process flat and broad; elongated, short secondary process extended apically, the base of secondary process with a bunch of spicules; secondary gonopore located somewhat medially (Fig. 32A). **Phallotheca**: Simple, angulated subapically, apex triangular (Fig. 32D). **Left paramere**: Body small, anterior elongated process curved, posterior thumb like broad process curved upward (32B). **Right paramere**: Body elongate, leaf like with pointed apex (Fig. 32C).

Female. GENITALIA (Fig. 32E): Brusa copulatrix of moderate size, dorsal labiate plate somewhat sclerotized, membranous folding centrally located between sclerotized rings, sclerotized rings broad and elongate, somewhat oval elongate. Vestibular sclerites as in figure 12.

Specimens examined. **South Korea**: **Gangwon-do**: 1♂, Hongcheon-gun, 26.VI.2003, J.W. Seong (SNU). **Gyeonggi-do**: 1♂, Yangpyeong-gun, Mt. Yongmun, 11.VI.2009, light trap, R.K. Duwal and S. Jung (SNU); 2♀, same data except for host, *Quercus* sp. (Fagaceae) (SNU); 5♀, same data except for date, 24.VI.2009; 1♂, Yongin-si, Mt. Taehwa, 2-20.VI. 2008, Malaise trap, J.O. Lim (SNU). **Jeju-do**: 4♂, Jeju-si, Ungto-fall; 12-15.V.2008, T. Yasunaga, R.K. Duwal and S. Jung (SNU). For reference:- **Japan**: **Hokkaido**: 2♂, Mt. Chise-nupuri, 500-600 m alt., Niseko, 9.VII.1994, T. Yasunaga, determined by T. Yasunaga, 2008 (SNU).

Distribution. China, Japan, Korea, Russia.

Host. *Quercus* spp. (Fagaceae) [Kerzhner, 1988a, Yasunaga and Vinokurov, 2000].

Remarks. Kerzhner (1988a) reported this species on *Quercus* sp. (Fagaceae), which was confirmed as a breeding host by Yasunaga and Vinokurov (2000). However, the later author also observed it on flowers of *Hydrangea* sp. (Hydrangeaceae), *Syringa reticulate* (Blume) (Oleaceae).

Subgenus *Mesopsallus* Wagner, 1970 삼지연우리장님노린재아속

The subgenus *Mesopsallus* comprises four species (Kerzhner & Josifov, 1999; and Rizzotti, 2000), of which two species, *P*. *samdzijonicus* and *P*. *holomelas* are reported in East Asia.

Members of this genus are comparatively large elongated sized, with simple and slender endosoma (different than *Psallus* type). For detail description see Wagner, 1970.

Psallus (*M*.) *samdzijonicus* Josifov, 1983 삼지연우리장님노린재

Figures: 31C-D, 33F

Psallus (*Mesopsallus*) *samdzijonicus* Josifov, 1983: 200 (n. sp., desc., figs.); 1992a: 116 (list); Schuh, 1995: 415 (cat.); Kerzhner and Josifov, 1999: 405 (cat.); Kwon et al., 2001 (cat.); Duwal et al., 2012: 623 (diag., key, MG).

Diagnosis. Recognized by larger sized, black body, black dorsum with pale margins on vertex, inner margin of eyes; black antennal segment I and II; blackish brown femora with pale apices (Fig. 31C-D).

Description. *Male*. Body large, elongated, laterally nearly parallel. COLORATION (Fig. 31C-D): Generally black; head black except vertex and inner margins of eyes pale; pronotum, mesoscutum and scutellum black; hemelytron black or dark brownish black, membrane dark brown. Venter blackish brown. Antennal segment I and II black, and segment III and IV pale. Labium dark brown. All coxae blackish brown with pale apices; all femora blackish brown with shining brown spots; meta-tibiae dark brown with brown spines. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: Projecting anteriorly; reaching apex of metacoxae. GENITALIA (For figure see Josifov, 1983: 200 (13-18): **Endosoma**: Shape more or less S-like, simple and slender apex; secondary gonopore located subapically. **Phallotheca**: Simple, basally broad, and tapers towards apex. **Left paramere**: Body large, both processes slender and slightly curved. **Right paramere**: Body short, not uniform, apex with finger like protuberance.

Female. Similar in shape and texture as male except antennal segment II-IV pale. GENITALIA (Fig. 33F): Brusa copulatrix of moderate size, seminal depository wide, centrally occupied by wide folding of membrane, sclerotized rings elongate oval, anterior apex extending like a protuberance reaching lateral spinules.

Specimens examined. **North Korea**: **Yanggang-do**: 1♂, 1♀, Samjiyeon (in label: Jongkang-do, Samdzijon), 13-19.VII.1974, on *Sorbus amurensis* Koehne (Rosaceae), M. Josifov, determined by M. Josifov (TLIA) (Paratype specimens).

Distribution. Korea.

Host. *Sorbus amurensis* Koehne (Rosaceae) [Josifov, 1983].

Remarks. Josifov (1983) reported this species on *Sorbus amurensis* (Rosaceae) in North Korea.

Subgenus *Phylidea* Reuter, 1899 밤우리장님노린재아속

Subgenus *Phylidea* is widely distributed in Holarctic region and comprises of about twenty nine described species (Kerzhner & Josifov, 1999; Yasunaga & Josifov, 2000; and Duwal et al., 2012).

Members of this subgenus are defined by variously colored body (bright or dark), smooth or speckled dorsum, broad and short endosoma with series of spinules located subapically or apically. For detail description see Seidenstücker, 1962.

***Psallus* (*Ph.*) *castaneae* Josifov, 1983 밤우리장님노린재**

Figures: 31E-F, 33A-E

Psallus (*Phylidea*) *castaneae* Josifov, 1983: 202 (n. sp.); 1992a: 116 (list); Schuh, 1995: 402 (cat.); Kerzhner and Josifov, 1999: 405 (cat.); Yasunaga and Vinokurov, 2000: 656 (key, fig.); Yasunaga, 2001a: 173 (diag., fig.); Kwon et al., 2001 (cat.): 180; Duwal et al., 2012: 624 (diag., key, MG).

Diagnosis. Recognized by dark brown to black dorsum; pale antennae except base of segment I dark; pale tibiae with castaneous spots at the base of black spine (Fig. 31E-F); subapically extended membranous structure of endosoma provided with numerous spinules (Fig. 33A); parameres as in figures 5H-G.

Description. *Male*. Body small, oval. COLORATION (Fig. 31E-F): Generally dark brown to black body; head, pronotum, mesoscutum and scutellum black; hemelytron, clavus and endocorium black, exocorium castaneous black, membrane black. Venter shining black. Antennal segments pale except base of segment I dark. Labium, segment I, basal half of segment II, and apex of segment IV dark. All coxae shining black; trochanters dark brown; all femora black except the apex of fore femora pale, the meta-femora with shining black aggregated spots on basal half; meta-tibia pale with reddish base, and large castaneous spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; reaching apex of metacoxae. GENITALIA (Fig. 33A-D): **Endosoma**: Shape C-like, primary endosomal process with a few long and short secondary processes, apex of primary process extended to apical process, a membranous extension subapically with numerous spicules; secondary gonopore located subapically (Fig. 33A). **Phallotheca**: Simple, angulated, apex triangular (Fig. 33D). **Left paramere**: Body large, anterior process slender and elongated, posterior process short and blunt (Fig. 33C). **Right paramere**: Body elongate, margins not uniform, and leaf like (Fig. 33B).

Female. GENITALIA (Fig. 33E): Brusa copulatrix moderate size, membranous fold of dorsal labiate plate protrude medially as an inverted U-shaped curve, with central membranous folding wide, extended from anterior to posterior portion of dorsal labiate plate, sclerotized ring elongate, with narrow width.

Specimens examined. **South Korea**: **Chungcheongnam-do**: 1♂, Yesan-gun, Deoksan-myeon, Okgye, 4.VI.2007, light trap, J.W. Seong (SNU). **Gangwon-do**: 2♂, 5♀, Donghae-si, Mt. Duta, 16.V.2001, light trap (NAAS); 1♂, Wonju-si, Munmak, 1.VI.2009, R.K. Duwal and S. Jung; **Gyeonggi-do**: 1♀, Anyang-si, Gwanak Arboretum, 1.VI.2006, light trap, J.W. Seong (SNU); 1♂, Suwon, NAAS, 5-8.VI.1997, light trap (SNU); 2♂, Suwon-si, SNU Arboretum, 20.V.2009, R.K. Duwal (SNU); 1♀, Suwon, 25.VI.2009, light trap, R.K. Duwal and S. Jung (SNU); 1♂, 2♀, Yangpyeong-gun, Mt. Yongmun, 11.VI.2009, light trap, R.K. Duwal and S. Jung (SNU); 2♂, 3♀, same data except for date, 24.VI.2009 (SNU). **Gyeongsangnam-do**: 2♀, Sancheong-gun, Sicheon-myeon, 5-6.VI.1997, S.B. Ann (SNU). **Jeollanam-do**: 2♂, Gwangyang-si, Choosan-ri, 16-19.VI.2008, R.K. Duwal and S. Jung (SNU); 1♀, Suncheon-si, Seungju-eup, Mt. Jogye, 24.VI.1997, S.B. Ann (SNU); 20♂, 21♀, Jangseong-gun, Mt. Bangjang, 24.VI.2010, light trap, R.K. Duwal. For reference:- **Japan**: **Shikoku**: 1♂, Kochi Pref., Ashizuri, 22.V.1999, M. Takai, determined by T. Yasunaga, 2008 (SNU).

Distribution. China, Japan, Korea.

Host. *Castanea* sp. (Fagaceae) [Josifov, 1983], *Quercus serrata* (Yasunaga and Vinokurov, 2000).

Remarks. This species is associated with the fagaceous plants, *Castanea* (Josifov, 1983) and *Quercus serrata* (Yasunaga and Vinokurov, 2000). However, the host is unknown in Korea as most of the specimens were collected in light.

***Psallus* (*Ph*.) *cinnabarinus* Kerzhner, 1972**

Figures: 34A, 35A-E

Psallus (*Phylidea*) *cinnabarinus* Kerzhner, 1979: 44 (n. sp., desc., figs.); Kerzhner, 1988b: 847 (Key, figs.); Schuh, 1995: 403(cat.); Kerzhner and Josifov, 1999: 405 (cat.); Yasunaga and Vinokurov, 2000: 656 (key, fig.); Yasunaga, 2001a: 174 (diag., fig.); Anufriev et al., 2001: 126 (eng. transl.); Duwal et al., 2012: 627 (diag., key, MG).

Diagnosis. Recognized by deep red dorsum; somewhat darker head and pronotum, pale antennae, pro- and meso- legs, reddish metafemora, pale tibiae with castaneous red spots at the base of black spine (Fig. 34A); widely spinulus apex of endosoma with short apical outgrowth (Fig. 34A); parameres and phallotheca as in figures 35B-D.

Description. *Male*. Body small, oval. COLORATION (Fig. 34A): Generally deep shining red; head reddish brown; pronotum reddish black; mesoscutum and scutellum deep red or somewhat tinged black; hemelytron, clavus, corium and cuneus deep red, membrane dark brown. Venter deep red. All antennal segments pale. Labium pale yellow with brown apex. All coxae and trochanters pale; fore- and meso femora orange yellow or pale, meta-femora reddish, with few large spots on anterior and posterior margin ventrally; tibiae pale with castaneous spots at the base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 35A-D): **Endosoma**: Shape more or less J-like, primary endosomal process with broad apex and widely serrated apical margin reaches base of apical process; secondary gonopore wide and subapical (Fig. 35A). **Phallotheca**: Simple, broad base attenuated towards apex (Fig. 35D). **Left paramere**: Body small, anterior process short, apex looks like broken (Fig. 35B). **Right paramere**: Body elongate leaf like (Fig. 35C).

Female. GENITALIA (Fig. 35E): Brusa copulatrix large, with wide seminal depository, membranous folding divided into two halves medially at dorsal labiate plate, and furnished with scattered spinules laterally, sclerotized ring small oval with pointed anteriorly.

Specimens examined. **South Korea**: **Gangwon-do**: 2♂, Hongcheon-gun, 25-26.VI.2003, light trap, J.W. Seong (SNU). **Gyeonggi-do**: 1♂, Gapyeong-gun, Mt. Yumyeong, 14.VI.1997, J.B. Ann; 3♂, Yangpyeong-gun, Mt. Yongmun, 11.V.2009, light trap, R.K. Duwal and S. Jung (1♂ in alcohol) (SNU). For reference:- **Japan**: **Hokkaido**: 1♂, Kasuga near Mt. Inoh Asahikawa C., 19.VII.1998, T. Yasunaga; 1♀, 4-ban riv., Tobetsu, 10.VII.1991, H. Hiranuma, determined by T. Yasunaga, 2008 (SNU).

Distribution. Japan, Korea, Russia.

Host. *Ulmus propinqua*, *U. japonica* (Ulmaceae) [Kerzhner, 1978; Yasunaga and Vinokurov, 2000].

Remarks. Associated with the elm trees (Ulmaceae), *Ulmus propinqua* (Kerzhner, 1978) and *U. japonica* (Yasunaga and Vinokurov, 2000). However, in Korea the host is unknown as all individuals were collected in light.

***Psallus* (*Ph.*) *flavescens* Kerzhner, 1988**

Figures: 34B, 35F-I

Psallus (*Phylidea*) *flavescens*: Kerzhner, 1988a: 60 (n. sp., fig.); 1988b: 847 (key, fig.); Kerzhner, Schuh, 1995: 405 (cat.); Kerzhner and Josifov, 1999: 406 (cat.); Yasunaga and Vinokurov, 2000: 656 (key, dist.); Yasunaga, 2001a: 174 (fig.); Anufriev et al., 2001: 126 (eng. transl.); Duwal et al., 2012: 627 (diag., key, MG).

Diagnosis. Recognized by orange colored dorsum; pale base of cuneus, entire antennae and legs; two rows of dark brown spots at the base of metafemora irregularly scattered towards subapical region; pale tibiae with brown spots (Fig. 34B); endosoma and parameres as in figures 35F-H.

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 34B): Generally shining orange color; dorsum completely orange tinged with brown on head and pronotum, and exocorium and base and apex of cuneus pale. Venter pale yellow. All antennal segments pale except the extreme base brown. Labium pale with segment I, base of segment II and apex brown. All coxae and trochanters pale; all femora pale yellow, meta femora with two rows of dark brown spots that scattered irregularly subapically; meta-tibiae pale, with brown spots. SURFACE AND VESTITURE: Dorsum furnished with simple pale setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 35F-H): **Endosoma**: Shape more or less C-like, primary endosomal with wide apex, base of the apex with sclerotized secondary process and membranous process; secondary gonopore located apically (Fig. 35F). **Phallotheca**: Simple, more than basal half broad and tapered towards apex (Fig. 35H). **Left paramere**: Body large, anterior process elongated (Fig. 35G).

Female. GENITALIA (Fig. 35I): Brusa copulatrix of moderate size, seminal depositories wide, membranous folding furnished with dense spinules laterally on dorsal labiate plate, sclerotized rings small, oval but base somewhat straight and wide, and apex pointed.

Specimens examined. **South Korea**: **Gangwon-do**: 2♂, 4♀, Hongcheon-gun, 25-26.VI.2003, light trap, J.W. Seong and S. Jung (SNU).

Distribution. China, Japan, Korea, Russia.

Host. *Tilia japonica* (Tiliaceae) [Yasunaga and Vinokurov, 2000].

Remarks. In the Korean Peninsula the host plant is unknown, as all specimens were collected in light.

***Psallus* (*Ph*.) *ernsti* Duwal et al., 2012**

Figures: 31G-H, 33 G-K

Psallus (*Ph*.) *ernsti* Duwal et al, 2012: 627 (n. sp., desc., key, MG)

Diagnosis. Recognized by small size, castaneous black body, castaneous spots on the tibiae, membranous, and flat apex of endosoma, with a row of spinules apically.

Description. Male. Body small, oval. COLORATION (Fig. 31G-H): Generally reddish to reddish black, shiny; head, pronotum, mesoscutum and scutellum black; hemelytron, clavus black or base and apex black, corium blackish or castaneous black, membrane black. Venter unicolorously black. Antennal segment I pale with reddish tinged and extreme base dark, segment II pale, and segment III and IV brown. Labium, segment I-III castaneous, and segment IV pale except extreme base. All coxae and trochanters castaneous; hind femora black, with reddish apex, aggregation of black spots at the anterior margin ventrally; hind tibia pale, with castaneous spots at the base of black spines. SURFACE AND VESTITURE:

Dorsum furnished with simple black setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: Projecting anteriorly; labium short, reaching apex of mesocoxae. GENITALIA (Fig. 33G-J): **Endosoma**: Shape more or less S-like, primary endosomal process with a few long and short secondary processes, elongated process extended across secondary gonopore slightly curved inward; secondary gonopore located subapically beneath a row of spinules (Fig. 33H). **Phallotheca**: Simple, not angulated, apex pointed (Fig. 33I). **Left paramere**: Body relatively short, anterior process short, posterior process short, apex blunt and hanging on shoulder at base (Fig. 33J). **Right paramere**: Body elongate, more or less parallel sided, apex with finger like process (Fig. 33G).

Female. Not significantly different from male in color and vestiture, only the abdomen slightly wider. GENITALIA (Fig. 33K): Brusa copulatrix comparatively small, dorsal labiate plate furnished with spinules laterally; sclerotized rings small, ovate with somewhat narrow apex; the membranous folding on posterior of dorsal labiate plate supporting lateral oviducts at centre.

Specimens examined. **North Korea**: **Pyeongannam-do**: 1♂, Pyeongyang, Mt. Daeseong (in label: Bei Phjongjan, Mt. Tesong), 7.VI.1987, M. Josifov (TLIA). **North Korea**: 1♂, same data except for date, 29.V.1975, M. Josifov (TLIA); 2♀, same data except date, 1.VI.1987, M. Josifov (TLIA); 2♂, same data except date, 7.VI.1987, M. Josifov (TLIA); 2♀, Pyeongyang, Mt. Yongak (in label: Phjongjang, Rjonggang, Mt. Rjongak), 31.V.1987, M. Josifov (TLIA, SNU). **Hwanghae-do**: 1♂, Bakyeon, 20 km N. Gaeseong (in label: Bagjon, 20 km N Kaesong), 29.V.1987, M. Josifov, determined by M. Josifov (SNU) (Holo- and Paratype specimens).

Distribution. Korea.

Host. Unknown.

Remarks. The host plant is unknown for this species.

Psallus (*Ph.*) *kerzhneri* Josifov, 1992 참우리장님노린재

Figures: 34C, 36A

Psallus (*Phylidea*) *kerzhneri*: Josifov, 1992b: 115 (n. sp., desc., figs.); 1992a: 116 (list) Schuh, 1995: 408 (cat.); Kerzhner and Josifov, 1999: 406 (cat.); Kwon et al., 2001: 180 (cat.); Duwal et al., 2012: 628 (diag., key).

Diagnosis. Recognized by reddish body and dorsum, with black head and reddish black pronotum; reddish brown femora with pale apex and ventrally with irregular black spots; pale tibia with dark brown spots at the base of black spine (Fig. 34C).

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 34C): Generally shining reddish black body; head black with pale vertex; pronotum, mesoscutum and scutellum black, somewhat tinged with red; hemelytron, wide basal part of clavus black, base of corium red, remaining parts black, cuneus castaneous; membrane black. Venter shining, dark brown tinged with red. All antennal segments pale except extreme base of segment I dark brown. Labium reddish brown with dark apices of segment I and IV, and base of segment II dark. All coxae shining dark brown and tinged with red; trochanters pale (sometimes tinged with red); all femora dark brown tinged with red except pale apex and ventrally with irregular black spots; meta-tibia pale with large brown spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and with uniformly distributed sericeous setae. STRUCTURE: **Head**: Projecting anteriorly; labium not exceeding apex of metacoxae. GENITALIA (For figures see Josifov, 1992: 116 (55-59)): **Endosoma**: Shape C-like, primary endosomal process with a few long and short secondary processes, apical secondary process short and curved and spinulus membrane at the apex of secondary gonopore; secondary gonopore located subapically. **Phallotheca**: Simple, angulated subapically, apex pointed. **Left paramere**: Body large, anterior process very slender. **Right paramere**: Body elongate, leaf like, margin not uniform.

Female. GENITALIA (Fig. 36A). Bursa copulatrix simple; sclerotized rings asymmetrical, large, elongated and laterally furnished with minute spinules.

Specimens examined. **North Korea**: **Hwanghae-do**: 2♀, Bakyeon, 20 km N. Gaeseong (in label: Bagjon, 20 km N Kaesong), 29.V.1987, M. Josifov, determined by M. Josifov (TLIA) (Paratype specimens).

Distribution. Korea.

Host. *Quercus dentata* Thunb. (Fagaceae) [Josifov, 1992].

Remarks. The species is not observed in South Korea, so biology is unknown.

***Psallus* (*Ph.*) *loginovae* Kerzhner, 1988**

Figures: 34D-E, 36F-J

Psallus (*Phylidea*) *loginovae* Kerzhner, 1988a: 59 (n. sp., fig.); 1988b: 847 (key); Schuh, 1995: 408 (cat.); Kerzhner and Josifov, 1999:406 (cat.); Anufriev et al., 2001: 125 (eng. transl.); Duwal et al., 2012: 628 (diag., key, MG).

Diagnosis. Recognized by black head and pronotum, reddish or brownish hemelytron (in teneral ones pale brown); pale antennae except the extreme base of segment I dark; dirty yellow distal region of metafemora tinged with red, pale tibiae tinged with red at base and provided with castaneous or dark brown spots at the base of black spine (Fig. 34D-E); broad subapical region of endosoma tapered apically and continued to process (Fig. 36F);

parameres and phallotheca as in figures 36G-I.

Description. *Male*. Body small, elongated oval. COLORATION (Fig. 34D-E): Generally reddish or brownish black (teneral ones entirely pale brown); head black with posterior margin of vertex pale; pronotum entirely black; mesoscutum black except lateral margins pale; scutellum black or brown or reddish brown; hemelytron, clavus dark brown or brown, base of endocorium brown and towards the posterior black or dark, exocorium castaneous, cuneus deep red tinged with black, membrane black. Venter dark brown, or black, or reddish brown. All antennal segments pale with dark base. Labium reddish brown, segment I, base of segment II and apex of segment IV dark. All coxae and trochanters black or dark brown; meta-femora black with pale apices and tinged with red; meta-tibia pale, with castaneous or dark brown spots at the base of black spine. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium exceeding apex of metacoxae. GENITALIA (Fig. 36F-I): **Endosoma**: Shape more or less J-like, primary endosomal process tapers subapically and continued with secondary apical process, and with a long and short processes; secondary gonopore located medially (Fig. 36F). **Phallotheca**: Simple, angulated, nearly triangular (Fig. 36G). **Left paramere**: anterior process slender and curved, posterior process left like (Fig. 36I). **Right paramere**: Body elongate, margins not uniform, apex extend as protuberance (Fig. 36H).

Female. GENITALIA (Fig. 36J): Brusa copulatrix moderate sized, dorsal labiate plate furnished with few scattered spinules, sclerotized rings are strongly asymmetrical.

Specimens examined. **South Korea**: **Chungcheongbuk-do**: 18♂, 17♀, Danyan-gun, Mt. Sobaek (National Park), 25-26.V.2009, *Acer* sp. (Aceraceae), R.K. Duwal and S. Jung (SNU). **Gangwon-do**: 1♂, Wonju-si, Munmak, 1.VI.2009, on *Acer ginnala* Maxim.

(Aceraceae), R.K. Duwal and S. Jung (SNU). **Gyeonggi-do**: 3♂, 5♀, Panmunjom, 20.V.2008, S. Jung (SNU).

Distribution. Korea, Russia.

Host. *Acer ginnala* Maxim. (Aceraceae).

Remarks. Kerzhner (1988a) documented the host plant of this species as *Acer ginnala* (Aceraceae), which is confirmed as breeding host in this study, as large numbers of nymphs were observed together. These species appears at the end of May to early June in Korea. When collecting, we found that it was associated with a large number of plant hoppers, whose secretions made the tree completely sticky.

***Psallus* (*Ph.*) *ulmi* Kerzhner et Josifov, 1966 느릅우리장님노린재**

Figure: 34H-K

Psallus (*Phylidea*) *ulmi*: Kerzhner and Josifov, 1966: 627 (n. sp., desc., figs.); Kerzhner, 1988b: 847 (key, fig.); Schuh, 1995: 416 (cat.); Kerzhner and Josifov, 1999: 408 (cat.); Yasunaga and Vinokurov, 2000: 657 (key, dist., fig.); Yasunaga, 2001a: (diag., fig.); Anufriev et al., 2001: 126 (eng. transl.); Kwon et al., 2001: 180 (cat.); Duwal et al., 2012: 628 (diag., key).

Diagnosis. Recognized by red (or brown) dorsum with black calli, pale base of cuneus; pale antennae, tinged with red on segment I and IV; color of femora resembles the dorsum (i.e. red femora in specimen with red dorsum and brown femora in specimen with brown dorsum), pale tibiae with red small spots (Fig. 34H-K).

Description. *Male*. Body small, elongated oval. COLORATION (Fig. 34H-K): General coloration deep red, red or brown; head reddish or brownish with pale vertex; pronotum deep red or brown with black calli, mesoscutum and scutellum red or brown; hemelytron uniformly red (in red specimens), or base brown and darker towards the apex (in brown specimens), cuneus deep red with pale base, membrane brown. Venter resembles the dorsum color. All antennal segments pale with dark ring on the base of segment I and segment IV tinged with red. Meta-femora resemble the body color, with pale apex; meta-tibia pale with small red spots. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium, reaching apex of metacoxae. GENITALIA (For figures see Kerzhner and Josifov, 1966: 628 (1-6)): **Endosoma**: Shape C-like, primary endosomal process with blunt apex; secondary gonopore apically positioned. **Left paramere**: Body small and simple, posterior process nearly triangular. **Right paramere**: Body elongate, more or less parallel, apex with finger like protuberance.

Specimens examined. For reference:- **Russia**: 1♂, Burjatskaja, ASSR, Schara-gol am Flus Tschikoj, 1.VII.1928 (Lukjanovitsch) (AMNH_PBI 00239157) (ZISP); same data as above, 1♀ (AMNH_PBI 00239162) (ZISP); 2♂, Amurgebiet, Blagovestschensk, 26.VI.1956, Kerzhner, determined by Kerzhner and Josifov (AMNH_PBI 00239108, 00239109) (ZISP); 2 ♀, same data as above (AMNH_PBI 00238967, 00238968) (ZISP). **Mongolia**: 1♂, Ulan-Bator, 40 km Ostl. von, 3.VIII.1928 (A. Ivanov) (AMNH_PBI 00239146) (ZISP); 1♀, same data as above, (AMNH_PBI 00238994) (ZISP) (Paratype specimens).

Distribution. China, Japan, Korea, Mongolia, Russia.

Host. *Ulmus pumila* L., *U. japonica* Rehder (Ulmaceae) [Kerzhner and Josifov, 1966; Yasunaga and Vinokurov, 2000 respt.].

Remarks. This species is associated with elm (Ulmaceae) (Yasunaga and Vinokurov, 2000) but in South Korea, I am unable to collect any specimen.

Subgenus *Pityopsallus* Wagner, 1952 김우리장님노린재아속

The subgenus *Pityopsallus* is a Holarctic group, comprises seventeen reported species (Kerzhner & Josifov, 1999; and Yasunaga & Vinokurov, 2000). East Asian *Pityopsallus* was broadly revised by Vinokurov (1998) with nine species and confirmed as conifer inhabitant.

Members of this subgenus are recognized by dark dorsum, pale or brownish antennae, segment II as long as width of pronotum, labium surpassing apex of meta-coxae (except in vittatus), pygophore with keel, apical process of endosoma elongated bearing teeth like spines laterally. For detail description see Wagner, 1952.

Psallus (*Pt.*) *kimi* Josifov, 1983 김우리장님노린재

Figures: 37D-E

Psallus (*Pityopsallus*) *lapponicus kimi* Josifov, 1983:210 (n. sp., desc. figs.); 1992a: 116 (list)

Psallus (*Pityopsallus*) *salicicola* Schwartz and Kelton, 1990: 941 (n. sp., desc., figs.)

Psallus Pityopsallus kimi: Vinokurov 1998: 285 (n. syn.); Schuh, 1999: 408 (cat.); Kerzhner and Josifov, 1999: 409 (cat.); Kwon et al., 2001: 181 (cat.); Duwal et al., 2012: 629 (diag., key).

Diagnosis. Recognized by brown (male) and yellowish brown(female) dorsum with pale whitish cuneus; dirty yellow or pale brown antennae with darker segment IV (Fig. 37D-E).

Description. *Male*. Body medium sized, elongated, laterally parallel. COLORATION (Fig. 37D-E): Generally dorsum entirely brownish, with posterior margin of vertex, lateral margins of pronotum and mesoscutellum pale (in dark specimens), or entirely orange yellow (in pale specimens); hemelytron brown or dark, cuneus pale, membrane brown. Venter resembles dorsum color. Antennal segment I and II dirty yellow, segment III and IV darker. Labium brown with dark apex. All coxae and trochanters yellowish; meta-femora yellowish or brownish, with dark brown fused spots distally; meta-tibia yellowish or brownish. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (For figures see Josifov, 1983: 207 (75-81) and Vinokurov, 1998: 286 (1-4)): **Endosoma**: Shape more or less S-like, apical secondary process with serrated margin and secondary gonopore apically positioned. **Left paramere**: Body broad, anterior and posterior process slender and curved. **Right paramere**: Body elongate, lateral margins parallel, and apically developed a protuberance.

Specimens examined. For reference: **Russia**: 1♂, S. Yakutia, Chulmakan Rv. 577m alt., 18 km NE of Chulman, 13.VII.1995, on *Salix*, T. Yasunaga, determined by F. Konstantinov, 2010 (AMNH_PBI 00240680) (ZISP); 1♀, S. Yakutia, Nakhot 900 m, 17 km SE of Chulman, Mts. Stanovoj, 11.VII.1995, on conifer, T. Yasunaga, determined by F. Konstantinov, 2010 (AMNH_PBI 00240683) (ZISP).

Distribution. Canada, Korea, Russia, USA.

Host. *Salix* spp. (Salicaceae) [Josifov, 1983].

Remarks. This species is reported on *Salix* spp. (Salicaceae) by Josifov (1983) in North Korea whereas Yasunaga collected it on conifer trees around the Far East Russia.

Psallus kimi and its sister species *P. lapponicus*, are easily confused, the former has been synonymised with later species. Vinokurov (1998) declared *kimi* and *lapponicus* to be distinct species based on the length of labium, in *P. lapponicus*, it reaches or surpasses middle of the abdomen while in *P. kimi* it reaches up to or slightly surpasses the metacoxae.

***Psallus* (*Pt.*) *luridus* Reuter, 1878 어리김우리장님노린재**

Figures: 37A, 38A-D

Psallus luridus Reuter, 1878: 133 (n. sp.)

Psallus Pityopsallus luridus: Kerzhner, 1978: 44 (list); 1988a: 848 (key, fig.); Schuh, 1995: 408 (cat.); Kerzhner and Josifov, 1999: 409 (cat.); Anufriev et al., 2001: 127 (eng. transl.); Kwon et al., 2001: 181 (cat.); Duwal et al., 2012: 629 (diag., key, MG) .

Diagnosis. Recognized by brown dorsum, more darker head, pronotum, mesoscutum and scutellum; brown antennae and legs, distal half of metafemora with dark brown spots ventrally, and small brown spots on tibiae (Fig. 37A); nearly S-shaped endosoma with minute spicules on the basal half of apical process, a membrane at the apical region extend to middle and with serrated lateral margins (Fig. 38A); parameres and phallotheca as in figures 38B-D.

Description. *Male*. Body medium sized, elongated. COLORATION (Fig. 37A): Generally brown coloration; hemelytron and membrane brown. Venter uniformly brown. All antennal segments brown. Labium brown with darker apex. All coxae brown; trochanters whitish; meta-femora pale brown with dark brown spots sub-apically; meta-tibia pale brown with dark brown spots at the base of brown spine. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed shining setae. STRUCTURE: **Head**: Projecting anteriorly; labium exceeding apex of metacoxae. GENITALIA (Fig. 38A-D): **Endosoma**: Shape more or less S-like, primary endosomal process extended apically, secondary apical process with serrated margin, a membrane extend between apex to nearly middle of shaft; secondary gonopore apically positioned (Fig. 38A). **Phallotheca**: Simple, angulated, triangular as in figure 38C. **Left paramere**: Body broad, anterior and posterior process curved as in figure 38D. **Right paramere**: Body elongate, leaf like, margins not uniform as in figure 38B.

Specimens examined. **North Korea**: **Yanggang-do**: 1♂, Samjiyeon (in label: Jongkang-do, Samdzijon), 13-19.VII.1974, on *Larix* sp. (Pinaceae), M. Josifov, determined by M. Josifov (SNU); 1♀, Boseok-ri (in label: Bosok-ri), 1000 m, 20.VII.1974, on *Larix* sp. (Pinaceae), M. Josifov, determined by M. Josifov (SNU).

Distribution. China, Europe, Korea, Russia.

Host. *Larix* sp. (Pinaceae) [Kerzhner, 1978].

Remarks. This species is associated with *Larix* sp. (Pinaceae) (Kerzhner, 1978).

***Psallus* (*Pt.*) *vittatus* (Fieber, 1861) 줄깁우리장님노린재**

Figures: 37B-C, 38E-I

Agalliastes vittatus Fieber, 1861: 312, Kerzhner, 1996: 278 (n. sp.)

Sthenarus roseri decolor Gredler, 1874: 557 (syn. by Reuter, 1878: 113)

Psallus vittatus: Reuter, 1909: 75 (host); Kerzhner, 1988b: 847 (key, fig.); Schuh, 1995: 418 (cat.); Kerzhner and Josifov, 1999: 410 (cat.); Yasunaga, 2001a: 176 (diag., fig.); Anufriev et al., 2001: 127 (eng. transl.); Kwon et al., 2001: 181 (cat.); Duwal et al., 2012: 629 (diag., key, MG).

Diagnosis. Recognized by dark brown (or black) dorsum, with head, pronotum and scutellum black; brown femora with pale apex, provided with rows of spots, and obscure spots on tibia (Fig. 37B-C); nearly s-shaped endosoma furnished with toothed spinules apically (Fig. 38E); parameres and phallotheca as in figures 38G-H.

Description. *Male*. Body medium sized, elongated. COLORATION (Fig. 37B-C):

Generally brown to blackish brown coloration; head, pronotum, mesoscutum and scutellum black (or blackish dark brown); hemelytron, clavus and corium brown or dark brown, cuneus somewhat paler, membrane pale brown. Venter dark brown. All antennal segments brownish except segment I pale. Labium brown with dark apex. All coxae and trochanters brown; meta-femora brown with pale apex and ventrally with rows of black spots; meta-tibia pale brown, with dark brown spots at the base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple black and pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium short, reaching (or slightly exceeding) apex of metacoxae. GENITALIA (Fig. 38E-H): **Endosoma**: Shape more or less S-like, primary endosomal process extended to apical secondary process, marginal spicules medially loacted; secondary gonopore apically positioned (Fig. 38E). **Phallotheca**: Simple, margins slightly curved (Fig. 38H). **Left paramere**: Body large, anterior process relatively elongated and slender than posterior short process (Fig. 38F). **Right paramere**: Body elongate, somewhat curved, leaf like with apical protuberance (Fig. 38G).

Female. GENITALIA (Fig. 38I): Brusa copulatrix small, structures are very delicate, membranous folding a socket like; sclerotized rings very delicate or obscure.

Specimens examined. **North Korea**: **Pyeongannam-do**: 3♂, Pyeongyang, Mt. Daeseong (in label: Bei Phjongjan, Mt. Taesong), 7.VI.1987, on *Larix* sp. (Pinaceae), M. Josifov, determined by M. Josifov (SNU). For reference:- **Russia**: **S**. **Yakutia**: 3♂, 1♀, 4 km E of Nagornyj, Mt. Stanovoj, 800 m alt., 15-16.VII.1995, (2♂ on *Larix* sp.; 1♂, 1♀ on *Larch* sp.) (Pinaceae), T. Yasunaga, determined by T. Yasunaga, 2008 (SNU).

Distribution. China, Europe, Korea, Russia.

Host. *Larix* sp. (Pinaceae) [Kerzhner, 1978].

Remarks. Kerzhner (1978) documented the host plant of this species as *Larix* sp.

(Pinaceae). Likewise specimens examined for this study were collected by Josifov and Yasunaga from larch, *Larix* sp.

Subgenus *Psallus* Fieber, 1858 우리장님노린재아속

The subgenus *Psallus* is a large Holarctic group comprises of around fifty six species (Kerzhner & Josifov, 1999; Yasunaga & Josifov, 2000; and Duwal et al., 2012).

Members of this subgenus are variously colored (bright, or dark, or pale), short and sclerotized endosoma, with few or numerous denticle like spines at the apex. For detail description see Wagner, 1952.

***Psallus* (*P.*) *amoenus* Josifov, 1983 발해우리장님노린재**

Figures: 34F-G, 36B-E

Psallus (*Psallus*) *amoenus* Josifov, 1983: 208 (n. sp., desc., figs.); 1992a: 116 (list); Kerzhner, 1988b: 844-845 (key, fig.); Schuh, 1995: 400 (cat.); Kerzhner and Josifov, 1999: 411 (cat.); Anufriev et al., 2001: 123 (eng. transl.); Kwon et al., 2001: 181 (cat.); Duwal et al., 2012: 630 (diag., key, MG).

Diagnosis. Recognized by pale or yellowish dorsum with red speckles and brown spots on anterior region of pronotum; pale antennae except brown basal ring on segment I; pale brown femora tinged with red, and with large dark brown spots ventrally and few subapical spots dorsally, pale tibiae with small brown spots (Fig. 34F-G); simple apex of endosoma (Josifov, 1983: 204); parameres as in figures 36B-D. For detail description see Josifov, 1983.

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 34F-G): Generally orange yellow tinged with red; dorsum completely orange red with red speckles and base of cuneus pale, membrane brown. Venter yellow with red speckles. All antennal segments pale with basal brown ring on segment I. Labium pale yellow with dark apex. All coxae and trochanters whitish; meta-femora pale tinged with red, ventrally with large dark brown spots and dorsally with few sub-apical spots; meta-tibiae with pale, with small dark brown spots at the base of black spines. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 36B-D, & Josifov, 1983: 204 (48-57)): **Endosoma**: Shape J-like, primary endosomal process with uniform breath from middle to apex, apical secondary process slender and slightly curved; secondary gonopore located subapically. **Phallotheca**: Simple, slender. **Left paramere**: Body large with very short posterior process. **Right paramere**: Body elongate, with flat apex.

Female. GENITALIA (Fig. 36E): Brusa copulatrix large sized, dorsal labiate plate furnished with numerous spinules, and rectangular membranous folding anteriorly, Sclerotized rings wide and asymmetrical.

Specimens examined. **North Korea**: **Pyeongyannam-do**: 1♂, 1♀, Pyeongyang, Mt. Daeseong (in label: Bei Phjongjan, Mt. Tesong), 21.5-1.6.1987, on *Quercus dentata* Thunb. (Fagaceae), M. Josifov, determined by M. Josifov (SNU).

Distribution. Korea, Russia.

Host. *Quercus dentate* Thunb. (Fagaceae) [Josifov, 1983].

Remarks. Josifov (1983) documented the host plant of this species as *Quercus dentata* Thunb. (Fagaceae).

***Psallus* (*P.*) *bagjonicus* Josifov, 1983 북한우리장님노린재**

Figures: 37F-G, 39A-D

Psallus (*Psallus*) *bagjonicus* Josifov, 1983: 205 (n. sp., desc., figs.); 1992a: 116 (list); Schuh, 1995: 401 (cat.); Kerzhner and Josifov, 1999: 412 (cat.); Yasunaga and Vinokurov, 2000: 659 (key, figs.); Yasunaga 2001a: 176 (diag., figs.); Kwon et al., 2001: 182 (cat.); Duwal et al., 2012: 630 (diag., key, MG).

Diagnosis. Recognized by blackish (male) and brownish (female) coloration; usually black head, pronotum and scutellum, (but in female) provided with pale medial stripe extended from head to pronotum, 3 pale spots on scutellum; pale brown metafemora with chain of spots joining vertically, pale tibiae with large castaneous spots at the base of pale spine (Fig. 37F-G); large horny spines at the apex of endosoma (Fig. 39A); left paramere and phallotheca as in figures 39B-C.

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 37F-G): Generally brownish black; head, pronotum, mesoscutum and scutellum black; hemelytron, base of clavus brown and apex black, corium black with the apex of exocorium deep red, cuneus deep red, membrane black. Venter dark brown, tinged with red. Antennal segment I and base of segment II dark and others pale brown. Labium shining dark brown except segment I castaneous. All coxae and trochanters brown; meta-femora dirty yellow with numerous large black spots attached together giving blackish or castaneous pattern; meta-tibia pale, with large castaneous spots at the base of pale spines. SURFACE AND VESTITURE: Dorsum furnished with simple brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (Fig. 39A-C): **Endosoma**: Shape C-like, primary endosomal process with hammer like apex furnished with small and large spines; secondary gonopore located apically (Fig. 39A). **Phallotheca**: Simple, broad base and narrow apex (Fig. 39B). **Left paramere**:

Body small, anterior process short and slender (Fig. 39C).

Female. Body somewhat flat than male, similar in texture as male except lateral side of mesoscutum and apex scutellum pale; hemelytron somewhat brownish. GENITALIA (Fig. 39D): Brusa copulatrix of moderate size, dorsal labiate plate with a few scattered spinules and posterior region with somewhat rectangular membrane curved medially; sclerotized rings small, oval with broad base and slightly narrow apex.

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♀, Gwangju-si, Mt. Taehwa, 2-20.V.2008, Malaise trap, J.O. Lim (SNU); 2♀, Osan-si, Sucheong-dong, 20.VI.1998, light trap, H.K. Lee (SNU); 1♀, Suwon-si, NAAS, 10-11.V.1997, light trap (NAAS). For reference:- **Japan**: 1♂, 2♀, ?? (in Japanese), 6.V.1996, T. Yasunaga, determined by T. Yasunaga (SNU).

Distribution. Japan, Korea.

Host. *Quercus aliena* Blume (Fagaceae) [Josifov, 1983], *Q. serrata* Murray., *Q. acutissima* Carruth. [Yasunaga and Vinokurov, 2000].

Remarks. This species is associated with oaks (Fagaceae), *Quercus aliena* Blume, (Josifov, 1983) in North Korea, and *Q. serrata* Murray. and *Q. acutissima* Carruth. (Yasunaga and Vinokurov, 2000) in Japan. However, the host is unknown in South Korea, as all specimens were collected in light and Malaise traps.

***Psallus* (*P.*) *cheongtaensis* Duwal et al., 2012**

Figures: 37H, 40E-I

Psallus (*P.*) *cheongtaensis* Duwal et al., 2012: 630 (n. sp., desc., key, MG).

Diagnosis. Recognized by the uniformly pale (somewhat pale yellowish) body, pale dorsum uniformly distributed with simple semierect dark setae, pale hind tibia with large brown spots at the base of black spines, a pair of protuberances on either lateral side of genital segment and a pair of ear like secondary processes laterally on endosoma at apex, and medially developed elongated flat process (Fig. 38I).

Description. Male. Body elongate oval. COLORATION (Fig. 36H): Body uniformly pale dorsally and ventrally (or somewhat pale yellowish dry specimen). Antennal segments pale except segments III and IV pale brown. Labium, segment I and II pale, segment III brown and segment IV dark brown distally. Legs pale; metafemora ventrally with a row of spot at anterior margin, few scattered fused spots at the base and numerous irregular spots on distal half region; tibiae pale with rows of large brown spots at base of black spines, membrane grayish. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed simple black semierect setae and sericeous setae. STRUCTURE: **Head**: Length short comparative to body size; interocular space wide; labium slightly surpassing apex of the mesocoxae. GENITALIA (Figs. 38E-I): **Endosoma**: Shape C-like; apex with a pair of ear like secondary processes arising from either lateral side, and medially developed elongated flat process; secondary gonopore large and positioned subapically (Fig. 38I). **Left paramere**: Body large, both anterior and posterior process flat (Fig. 38G). **Right paramere**: Body elongate, subapically furnished with notch like outgrowth and apex tapered to form a short finger like process (Fig. 38F).

Specimens examined. **South Korea**: **Gangwon-do**: 1♂, Hoengseong-gun, Dunnae-myeon, Mt. Cheongtae (Natural recreation forest), 20-21.VII.2000, H.G. Goh (NAAS) (Holotype specimen).

Distribution. Korea.

Host. Unknown.

Remarks. The biology is unknown.

***Psallus* (*P*.) *koreanus* Josifov, 1983 우리장님노린재**

Figure: 37I-J

Psallus (*Psallus*) *koreanus* Josifov, 1983: 209 (n. sp., desc., figs.)

Psallus koreanus: Kerzhner, 1988b: 847 (key); Josifov, 1992: 116 (list); Schuh, 1995: 408 (cat.); Kerzhner and Josifov, 1999: 415 (cat.); Anufriev et al., 2001: 126 (eng. transl.); Kwon et al., 2001: 182 (cat.); Duwal et al., 2012: 631 (diag., key).

Diagnosis. Recognized by deep red dorsum with pale vertex, shiny blackish pronotum, mesoscutum, scutellum and base of hemelytron (or uniformly brownish red), deep red cuneus; red metafemora with black spots on anterior margin (Fig. 37I-J).

Description. *Male*. Body medium sized, elongated oval. COLORATION (Fig. 37I-J): Generally reddish; head brown or dark brown with pale vertex; pronotum reddish black (if red, calli black in color); mesoscutum and scutellum red tinged with black; hemelytron, clavus and corium red somewhat tinged with black, membrane dark brown. Venter resembles the dorsum. All antennal segments pale. Labium brown with dark apex. Meta-femora red with few large black spots ventrally; Meta-tibia pale with castaneous spots. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and uniformly distributed sericeous setae. STRUCTURE: **Head**: convex; labium reaching apex of metacoxae. GENITALIA (For figures see Josifov, 1983: 205 (60-65): **Endosoma**: Shape C-like, primary endosomal process narrow at middle and expanded at apex, apical secondary process leaf like; secondary gonopore located subapically. **Phallotheca**: Simple. **Left paramere**: Body large, anterior process very slender. **Right paramere**: Body elongate, margins not uniform, apex developed as a protuberance.

Specimens examined. **PARATYPES**: **North Korea**: Hwanghae-do: 1♂, 1♀, Gaeseong, 20 km N. Bakyeon (in label: Bagjon, 20 km N Kaesong), 21-23.V.1975, M. Josifov, determined by M. Josifov (AMNH_PBI 00240712) (ZISP); 1♀, data same as above, (AMNH_PBI 00240714).

Distribution. Korea, Russia.

Host. *Crataegus* sp., *Prunus* sp., *Sorbus amurensis* (Rosaceae) [Josifov, 1983].

Remarks. This species was reported by Josifov (1983) on various rosaceous trees like, e.g., *Crataegus* sp., *Prunus* sp., and *Sorbus amurensis,* and also observed on *Picea* sp. (Pinaceae).

***Psallus* (*P.*) *sanguinarius* Josifov, 1999 진우리장님노린재**

Psallus (*Psallus*) *sanguinolentus* Josifov, 1983: 209 (junior primary homonym of *Psallus graminicola f. sanguinolenta* Stichel, 1956); 1992a: 116 (list); Schuh, 1995: 415 (cat.)

Psallus sanguinarius Kerzhner and Josifov, 1999: 417 (cat.); Kwon et al., 2001: 183 (cat.); Duwal et al., 2012: 631 (diag., key).

Diagnosis. Recognized by brownish red dorsum; ocher head, dark markings on fore-head, black brown clypeus, pale antennae.

Description. *Male*. Body elongated. COLORATION: Generally brownish tinged with red; head dirty yellow with dark marking; pronotum and mesoscutum brownish red; hemelytron brownish, tinged with red; cuneus deep red. SURFACE AND VESTITURE: Dorsum furnished with simple pale brown setae and with uniformly distributed sericeous setae. GENITALIA (For figures see Josifov, 1983: 206 (68-74): **Endosoma**: Shape more or less J-like, primary endosomal process medially narrow and apically broad with broad apical secondary process; secondary gonopore located subapically. **Phallotheca**: Simple, angulated. **Left paramere**: Body broad with curved anterior process. **Right paramere**: Body elongate, lateral margins not uniform. For detail description see Josifov, 1983.

Specimens examined. Not observed

Distribution. Korea.

Host. *Sorbus amurensis* Koehne (Rosaceae), *Picea* sp. (Pinaceae) [Josifov, 1983].

Remarks. Josifov (1983) reported this species on *Sorbus amurensis* (Rosaceae) and on *Picea* (Pinaceae) in North Korea. We were unable to observe any specimens for this study.

Genus *Rubrocuneocoris* Schuh, 1984 참나무장님노린재속

Rubrocuneocoris Schuh, 1984: 11 (key), 424 (n. gen.); 1995: 427 (cat.); Yasunaga, 2001b: 117 (n. sp., diag., fig.); 2001a: 179 (diag., figs.); Duwal et al., 2010a: 38 (diag.).

Type species: *Rubrocuneocoris acuminatus* Schuh, 1984; original designation.

Diagnosis. Recognized by small body; simple, brownish vestiture on the dorsum; two pairs of distinct red spots on embolium and cuneus; enlarged metafemora; medially coiled vesica with attenuated apical process.

Distribution. Japan, Korea, Nepal, Pacific Islands.

Remarks. This genus represented with six species from Eastern Palearctic, Pacific and Oriental regions. Josifov (1987; 1992) and Kerzhner (1988a) observed the following species from North Korea, were found in southern part.

***Rubrocuneocoris quercicola* Josifov, 1987 참나무장님노린재**

Figure: 40A-D

Rubrocuneocoris quercicola: Josifov, 1987: 121-122 (n. sp, desc., fig., host); 1992a: 116 (list); Kerzhner, 1988b: 856 (Key, fig.); Schuh, 1995: 427 (cat.); Kerzhner and Josifov, 1999: 420 (cat.); Anufriev et al., 2001: 135-136 (eng. transl.); Kwon et al., 2001: 181 (cat.).

Diagnosis. Recognized by small body; yellowish brown dorsum furnished with pale brown vestiture, pale yellow appendages, tinged with red on antennal segment I and ventral side of metafemora; two pairs of red spots on apices of embolium and cuneus (Fig. 40A); strongly coiled endosoma with serrated margins on apical process (Fig. 40B).

Description. *Male*. Body small, elongated. COLORATION (Fig. 40A): Generally brownish; head dark brown with pale vertex, tylus and ventral parts of head red; pronotum brown; mesoscutum and scutellum pale brown; hemelytron pale brown, with red lateral margins, apices of corium and cuneus with red spot, membrane grayish. Venter red. Antennae, base of segment I pale and apical large part red, segment II pale brown with slightly darker apex, segment III and IV darker. Labium, segment I and II pale, segment III and IV brown. All coxae and trochanters pale; meta-femora brown tinged with red; meta-tibia pale with small brown spots at the base of brown spine. SURFACE AND VESTITURE: Dorsum uniformly distributed with semierect pale brown setae. STRUCTURE: **Head**: Convex, projecting anteriorly; antennal segment II cylindrical, labium reaching apex of metacoxae. GENITALIA (Fig. 40B-D): **Endosoma**: Shape broad, twisted, with serrated margins subapically. **Left paramere**: Body large, thick posterior process thumb like. **Right paramere**: Elongated, hammer like.

Female. Unable to observe the specimens.

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, Yangpyeong-gun, Mt. Yongmun, on light trap, 24.VI.2009, R.K. Duwal and S. Jung. Jeollanam-do: 1♂, Gurye-gun, Gurye-eup, 9.VIII.1996, J.Y. Choi, det. by T. Yasunaga (NAAS).

Distribution. Korea, Russia.

Host. *Quercus aliena* Blume, *Q. dentata* Thunb. (Fagaceae) [Josifov, 1987; Kerzhner, 1988b, respt.].

Remarks. The biology is unknown in Korea, as the specimen was collected in light.

Genus *Tytthus* Fieber, 1864 중국장님노린재속

Tytthus Fieber, 1896: 82 (n. gen.); Schuh, 1974: 135 (diag., disc.); 1995: 247 (cat.); Kerzhner and Josifov, 1999: 441; Yasunaga, 2001b: 182 (diag.).

Type species: *Capsus geminus* Flor, 1860; Subsequent designation.

Diagnosis. Recognized by small, parallel sided body; often with pale spots on head; inverted vase shaped pronotum, entirely or partially black or dark brown; slender and narrow femora; narrow abdomen (male) with more or less triangular pygophore; simple endosoma curved like C-, or S-, or U-shape, with weaky developed or obscure secondary gonopore.

Distribution. Holarctic region, Oriental region.

Remarks. The genus *Tytthus* is recently transferred into tribe Phylini (Menard and Schuh, 2011) and comprises of about twenty species in world and six in Palearctic region (Schuh, 1995, Kerzhner, 1999). Members of this species are usually considered as predatory, feeding on eggs, and homopterans pest of rice and also some species are used as effective biological control agent of sugarcane (Wheeler, 2001).

***Tytthus chinensis* (Stal, 1859) 중국장님노린재**

Figures: 41A-K

Capsus chinensis Stal, 1859: 258 (n. sp.)

Tytthus chinensis Schuh, 1984: 187 (diag., figs.); 1995: 248 (cat.); Kerzhner and Josifov, 1999: 441 (cat.); Yasunaga, 2001b: 182 (diag., fig.)

Tytthus koreanus Josifov and Kerzhner, 1972: 171 (n. sp.); Schuh, 1995: 249 (cat.); Kerzhner and Josifov, 1999: 441(cat.); Kwon et al., 2001: 184 (cat.); Henry, 2012: 25 (diag., re-desc.).

Diagnosis. Recognized by small, pale dorsum, black head, pronotum, mesoscutum and scutellum with pale spots on inner lateral sides of head, anterior region of head, entirely black antennae with extreme base and apex of segment I pale, and structures of male genitalia (Fig. 5F-I).

Description. *Male*. Body small, parallel. COLORATION (Fig. 41A-F): Generally pale appearance; head black with pale spots on inner lateral sides of eyes; pronotum either entirely black, or anterior region pale variously, mesoscutum, and scutellum black; hemelytron entirely pale, and tinged with pale brown, membrane pale brown. Venter, sternum black, abdominal segments laterally castaneous. Antennae entirely black except base and apex of segment I pale. Labium pale with dark brown apex. All coxae and trochanters pale with extreme bases of coxae brown or grayish; all femora pale or faintly tinged with red; meta-tibia pale with black base and furnished with brown spines and spots absent. SURFACE AND VESTITURE: Dorsum furnished with uniformly distributed pale brown setae. STRUCTURE: **Head**: Projecting anteriorly, convex; head, pronotum, mesoscutum and scutellum shagreen; labium surpass apex of mesocoxae. GENITALIA (Fig. 41G-J): **Endosoma**: Shape C-like in opposite side, apex blunt and curved inward; secondary gonopore obscure. **Phallotheca**:

Narrow, tapers towards apex. **Left paramere**: Body small, anterior process wide, subapically splayed out and apex blunt and somewhat beak shaped. **Right paramere**: Tiny, oval, margin of apex curved.

Female. Similar in color and texture as male. Genitalia (Fig. 41K): Sclerotized rings asymmetrical, narrow, nearly triangular and thin rimmed.

Specimens examined. **South Korea**: **Chungcheongnam-do**: 1♀, Boryeong-si, Ocheon-myeon, Wonsando-ri, 5.VIII.2008, on light trap, R.K. Duwal (SNU). **Gyeongsangbuk-do**: 5♂, 17♀, Ulleungdo, 8.VIII.2010, on light trap, R.K. Duwal (SNU). **Cambodia**: 5♂, 7♀, Kampong Seila Dist., National Road, PK 135 Boeng Trach Village, Picnic Resort, 11-12.XI.2010, on light trap, R.K. Duwal, S.H. Lee, W.H. Lee and S. Kim.

Distribution. Cambodia, China, Japan, Korea, Russia, Oriental region, Taiwan.

Host. Unknown.

Remarks. Due to variable color pattern on head and pronotum, the oriental and palearctic specimens of genus *Tytthus* are identified as *T. chinensis* and *T. koreanus* respectively. But in recent revision of genus *Tytthus*, these are synonymized to single speices *T. chinensis* according to resemblance of male genital structures (Henry, 2012).

Since, *T. chinensis* are abundantly collected in light trap around the paddy field and it is assumed that these bugs probably reside on rice field.

Tribe Pilophorini Douglas and Scott, 1876 표주박장님노린재족

Members of this tribe are elongated, medium to robust sized; usually ant memetic, head concave behind; posterior margin of vertex usually carinate; pronotum broad and flat, sometimes constricted medially separating anterior and posterior pronotum or with highly modified tubercles; hemelytron always with scale setae, often aggregated into rows or scattered; parempodia fleshy, recurved and convergent apically; vesica simply U-, or C- or incomplete S-shaped without secondary gonopore; phallotheca parallel laterally and slightly bend apiclly; left paramere distinctly large and splayed out; right paramere large, broad apex with finger like small or elongated process; female genitalia with evaginated structure along the posterior margin, or often distinctly spinulus chitinized structures (very similar with K-structure in Ortholylinae).

The Pilophorini is strongly ant memic, and comprises of one hundred and seventy species in twelve genera described in the world (Schuh, 1995), and forty seven species in seven genera in Palearctic region (Kerzhner and Josifov, 1999). Carvalho, 1958 considered this as Cosmopolitan group except in Antractica. Some of the members are considered predatory however in absence of animal food they can consume plant material as other mirids do.

Key to Korean genera of tribe Pilophorini

1) Base of abdomen constricted; hemelytron sinuous laterally, and provided with two rows of scale setae on hemelytron either continuous or discontinuous; scutellum with two or three bunches of scale setae ……………………………………......*Pilophorus*

- Base of abdomen not constricted; hemelytron parallel or somewhat ovate laterally, and scale setae if present scattered in hemelytron; scutellum without scale setae ………………………………………..…………………………………..*Pherolepis*

Genus *Pherolepis* Kulik, 1968 어리표주박장님노린재속

Pherolepis Kulik, 1968: 140 (n. gen); Schuh, 1995: 457 (cat.); Kerzhner and Josifov, 1999:

279 (cat.); Yasunaga, 2001a: 148 (diag.); Anufriev et al., 2001: 114 (as *Hypseloecus*; eng. transl.); Kwon et al., 2001 (cat.).

Type species: *Pherolepis atrans* Kulik, 1968; original designation.

Diagnosis. Recognized by medium sized, ovate body; completely shining black; transversed wrinkles on head, pronotum and scutellum; covered with pale soft vestiture of the head and pronotum and their unequal arrangements; arrangements of scale setae on hemelytron; colorations of appendages; and variously modified male and female genital structures (Fig. 42).

Distribution. East Asia.

Remarks. The genus *Pherolepis* is small group with seven described species (Kerzhner and Josifov, 1999 and Zhang and Liu, 2009). Though Kerzhner (1970) synonymized this genus with *Hypseloecus*, Schuh (1989) reinstated into its original status according to structures of vestiture.

Key to species of Korean *Pherolepis*.

1) Dorsum furnished with extremely short setae; head, pronotum and base of hemelytron bare; scales on hemelytron aggregated forming a band, extending anteriorly beyond the apex of scutellum and posteriorly at the level of middle of commissure; length of antennal segment II greater than or equal to width of head …………..…..*P. fasciatus*

\- Pronotum with short setae; entire hemelytron except membranes covered with long pale setae and silvery setae; antennal segment II shorter than width of head ………2

2) Setae on pronotum very short; legs, antennal segment I and base of segment II dirty yellowish brown; scutellum mesally and basally with dense pubescence than on

lateral margins (Fig. 42A) ………..……..…………………………………*P. amplus*

- Setae on pronotum longer; legs, antennal segment I and base of segment II red; scutellum with uniformly distributed pubescence (Fig. 42B) ..………...*P. kiritshenkoi*

Pherolepis amplus **Kulik, 1968 어리표주박장님노린재**

Figures: 42A, 43A-F

Pherolepis amplus Kulik, 1968: 142 (n. sp., desc., figs.);

Hypseloecus amplus Kerzhner, 1970: 638 (n. comb.); 1988a: 836 (key)

Pherolepis amplus: Schuh 1995: 275 (cat.); Kerzhner and Josifov, 1999: 457 (cat.); Anufriev et al., 2001: 115 (eng. transl.); Kwon et al., 2001: 162 (cat.).

Diagnosis. Recognized by medium sized, somewhat flatted body; completely black coloration, brownish antennae and legs; pale soft vestiture on pronotum densely distributed in anterior region and posteriorly sparse, which seems the surface bare, and structure of endosoma (Fig. 42A).

Description. *Male*. Medium sized, elongated oval. COLORATION (Fig. 42A): Generally black body. Dorsum blackish brown or black. Head, pronotum, mesoscutum and scutellum shining black. Hemelytron either completely brown or black; cuneus tinged with red. Venter shininig black. Antennae brown with dark brown apices. Labium shining, dark brown. All coxa and trochanters pale; meta-femora dirty yellow; meta-tibia pale. SURFACE AND VESTITURE: Head and anterior region of pronotum with uniformly distributed soft appressed setae, which scattered on posterior region of pronotum. Hemelytron covered with densely distributed flattened appressed scale like setae and soft setae. STRUCTURE: **Head**: Head and anterior region of pronotum smooth; posterior region of pronotum and hemelytron completely shagreen; vertex wide; labium reaching apex of metacoxae. GENITALIA (Fig. 43A-D): **Endosoma**: C-like, spine on the shaft of the endosoma bears two outgrowths anteriorly and posteriorly. **Phallotheca**: Wide as in figure 43C. **Left paramere**: As in figure 43D. **Right paramere**: As in figure 43B.

Female. Similar to color and texture as males but abdomen more wider than in males. GENITALIA (Fig. 43E-F). Sclerotized rings asymmetrical, narrow anteriorly and wide posterior region; dorsal labiate plate chitinized with spinulus structures. Posterior wall with chitinized structures furnished with spinulus (Fig. 43F).

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, 2♀, Paju-si, Musan-eup, Gunnae-myeon, 21-25.VII.2008, S. Jung; 3♀, Osan-si, Sucheong-dong, Mulhyanggi Arboretum, 22.VIII.2011, on *Salix* (Salicaceae), R.K. Duwal.

Distribution. China, Korea, Russia.

Host. *Salix* sp. (Salicaceae).

Remarks. The individuals of *Pherolepis amplus* were collected from willow trees around the ponds in natural conservation area in Osan. Recent article of Zhang and Liu (2009) reported this species as predatory.

Pherolepis fasciatus (Kerzhner, 1970) 느릅표주박장님노린재

Hypseloecus fasciatus Kerzhner, 1970: 639 (n. sp., desc., figs.); 1988a: 837 (key)

Pherolepis fasciatus: Schuh, 1995 (cat.); Kerzhner and Josifov, 1999 (cat.); Yasunaga, 2001a: 147 (diag., fig.); Anufriev et al., 2001: 115 (eng. transl.); Kwon et al., 2001: 162 (cat.).

Diagnosis. Recognized by medium sized body; completely shining black dorsum; shining scale like setae aggregated at middle region of hemelytron across the clavus. For detail see Kerzhner, 1970.

Description. *Male*. Medium sized, elongated oval. COLORATION: Generally black body. Dorsum and Venter shining black. Antennae; segment I and basal half of segment II pale brown, apex and remaining segment darker. Legs usually pale brown with dark rings at the base of tibiae. SURFACE AND VESTITURE: Dorsum completely furnished with very short and soft setae; hemelytron at middle region covered with flattened scale setae extending at the region form apex of scutellum and sub-apex of the clavus. [For detail description and male genital structures see Kerzhner, 1970].

Distribution. Japan, Korea, Russia.

Host. *Ulmus japonica* (Ulmaceae) [Kerzhner, 1988b].

Remarks. Though this species is said to be reported from Korea (Northern region), in this study I am not able to observe the specimen from southern region.

Pherolepis kiritshenkoi **(Kerzhner, 1970)**

Figures: 42B, 43G-L

Hypseloecus kiritshenkoi Kerzhner, 1970: 638 (n. sp., desc., figs.); 1988a: 837 (key)

Pherolepis kiritshenkoi: Schuh, 1995: 458 (cat.); Kerzhner and Josifov, 1999: 280 (cat.); Yasunaga, 2001a: 148 (diag., fig.); Anufriev et al., 2001: 115 (eng. transl.).

Diagnosis. Recognized by comparatively small body; completely black coloration; pale soft vestiture uniformly distributed on pronotum; reddish appendages with dark apices of antennal segments and structure of endosoma (Fig. 43I).

Description. *Male*. Medium sized, elongated oval. COLORATION (Fig. 42B): Generally black body. Head, pronotum, mesoscutum and scutellum shining black.

Hemelytron dark brown or black. Venter shining black. Antennae brown; segment I and basal half of segment II tinged with red towards apex black, and segment III and IV darker. Labium brown, segment I and II tinged with red. All coxae and trochanters pale; all femora red except the bases and apices pale; anterior half of meta-tibia red and remaining distal region and extreme base pale. SURFACE AND VESTITURE: Head and pronotum uniformly distributed with soft setae; hemelytron densely covered with flattened appressed scale setae and soft pale setae. STRUCTURE: **Head**: Pronotum partly shagreen; hemelytron shagreen; vertex comparatively wide, nearly half the length of antennal segment II; labium reaching apex of metacoxae. GENITALIA (Fig. 43G-J): **Endosoma**: Spine on the shaft of the endosoma with a branch (Fig. 43I). **Phallotheca**: As in figure 43G. **Left paramere**: As in figure 43J. **Right paramere**: As in figure 43H.

Female. Similar in color and texture as male. GENITALIA (Fig. 43K-L). Sclerotized rings asymmetrical, narrow anteriorly and margins irregular; dorsal labiate plate with chitinized spinulus structures. Posterior wall with chitinized spinulus structures (Fig. 43L).

Specimens examined. **South Korea**: **Gyeonggi-do**: 2♂, 1♀, Paju-si, Musan-eup, Gunnae-myeon, 21-25.VII.2008, S. Jung;

Distribution. Korea, Russia.

Host. *Salix rorrida* (Salicaceae) [Kerzhner, 1970].

Remarks. The host plant and other information in Korea are unknown.

Genus *Pilophorus* Hahn, 1826 표주박장님노린재속

Pilophorus Hahn, 1826: 23 (n. gen.); Schuh, 1984: 49 (diag.); 1989: 10 (diag.); 1995: 458 (cat.); Kerzhner, 1988b: 786 (key); Kerzhner and Josifov, 1999: 280 (cat.); Yasunaga, 2001a: 148 (diag.); Anufriev et al., 2001: 115 (eng. transl.); Kwon et al., 2001: 162 (cat.); Duwal and

Yasunaga, 2008: 32 (note).

Type species. *Cimex clavatus* Linnaeus, 1767; designation under the plenary powers.

Diagnosis. Recognized by small to medium sized body; shining or dull dorsum with variously arranged scale setae on hemelytron, among the three bunches of scale setae on scutellum, lateral two bunches very distinct while apical one either distinct or obscure; the anterior row of scale setae always arise at the level of the apex of scutellum; posterior row of scale setae often variously arranged, either continuous or discontinuous, and the scales at the base of cuneus present or absent, if present veriously arranged, only at inner base as spot, or extended at inner1/3, or 1/2 or entire base; and various structure of spine on the shaft.

Distribution. Holarctic region, Southeast Asia.

Remarks. The members of *Pilophrous* are strongly ant memic, comprises of one hundred and seven described species in the world (Schuh, 1995; Duwal et al., 2008), and thirty one species in Palearctic region (Kerzhner and Josifov, 1999). These are considered as oligophagous (Schuh, 1974). Some species are found feeding on aphids as well as small arthropods like, mites, scales, psyllids, and various depteras, their eggs and nymph (Schuh, 1974; Wheeler, 2001).

Key to species of Korean *Pilophorus*.

1) Posterior band of silvery setae discontinuous ……………………………………...2
- Posterior band of silvery setae continuous …………………………………...……3
2) Band of silvery setae distinctly anterior than posterior band of setae on corium; band of setae at the base of cuneus extending on inner half region, all coxae pale except distally red procoxae (Fig. 42D) ……………….…………………………….*P. clavatus*

- Posterior band of silvery setae interrupted on endocorium; posterior-lateral sides of pronotum notched; cuneus without silvery setae (Fig. 45B) ……….……… *P. lucidus*

3) Scutellum with three patches of silvery setae on each corner, the one at the apex of scutellum thick; labium reaching apex of meta-coxae, all legs dark brown (Fig. 45C) ………………………………………………………………………… *P. miyamotoi*

- Scutellum with two, or three patches of silvery setae on each corner but the one at apex of scutellum thin, or obscure; labium either reaching meta-coxa or shorter, coxae usually pale ……………………………………………………………….4

4) Body small and slender, uniformly dark; base of shining cuneus without silvery setae; fore femora pale (Fig. 45F) …..…..……………………………...………..*P. typicus*

- Body dull; cuneus with complete or incomplete row of silvery setae ……………..…5

5) Base if cuneus with incomplete band of silvery setae ………………………………..6

- Base of cuneus with complete band of silvery setae …………………………………7

6) Band of silvery setae at the inner corner of the cuneus as a spot; labium reaching apex of metacoxa; legs dark brown (Fig. 45D) ……….……..…...………………...*P. niger*

- Band of silvery setae extended on inner corner (about 1/3 of cuneus); labium exceeding apex of procoxa; fore- and mesofemora pale (Fig. 42C) ……...…..*P. choi*

7) Antennal segment II clavate ……………………………………………………….8

- Antennal segment II not clavate ……………………………………………………10

8) All coxae pale except the apex of fore-coxa tinged red …………………..*P. setulosus*

- Coxae with brownish base or apices …………………………………………………9

9) Distal region of procoxa, basal region of meso- and metacoxa brownish; shaft of endosoma with short median spine which is furnished with small protuberance near to apex (Fig. 42E) …………….……………………………...………...…*P. erraticus*

- Metacoxa entirely pale; shaft of endosoma with a median spine; inner body of the left paramere around the posterior process provided with chitinous membranous fold (Fig. 45A) ..……...…………..…………...…………………………………*P. koreanus*

10) Antennal segment II, two or three times longer than segment III, apex of segment III darker; base of segment IV narrowly pale ………………………..*P. pseudoperplexus*

- Antennal segment II twice as long as segment III, half of the segment III and entire segment IV black ……………………………………………………….*P. okamotoi*

Pilophorus choii Josifov, 1978 최표주박장님노린재

Figures: 42C, 44A-E

Pilophorus choii Josifov, 1978: 285 (n. sp., desc., figs.); Kerzhner, 1988b: 838 (key); Schuh, 1995: 460 (cat.); 1990: 165 (fig.); Kerzhner and Josifov, 1999: 281 (cat.); Anufriev et al., 2001: 116 (eng. transl.); Kwon et al., 2001: 163 (cat.).

Diagnosis. Recognized by elongated, entirely black body and dorsum somewhat fed towards the posterior region of corium, and castaneous cuneus; short labium slightly surpass apex of procoxa; arrangements of scale setae on dorsum (Fig. 42C); and structure of endosoma (Fig. 44B).

Description. *Male*. Medium sized, elongated. COLORATION (Fig. 42C): Generally black body. Dorsum entirely black; cuneus castaneous. Venter black or castaneous black. Antennae black or castaneous black except the bases and apices of segment III and IV pale. Labium shining dark brown. Pro- and mesocoxae, and trochanters pale; metafemora and tibia castaneous except the extreme base of tibia pale. SURFACE AND VESTITURE: Dorsum furnished with scattered soft pale setae; hemelytron covered with flattened scale setae; rows or aggregation of scale setae on scutellum and hemelytron, scutellum with two bunch of scales on either later side and few scales on posterior corner; and corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; row of scale setae at the base of cuneus extended on inner 1/4 region. STRUCTURE: Antennal segment III subequal to the antennal segment IV and sum of two segments shorter than antennal segment I; labium surpass the apex of the procoxae; lateral margins of pronotum sinuous. GENITALIA (Fig. 44A-E): **Endosoma**: C-like, a median spine on the shaft of the endosoma short and a small (Fig. 44B). **Phallotheca**: L-shaped as in figure 44A. **Left paramere**: As in figure 44D-E. **Right paramere**: As in figure 44C.

Female. Not observed.

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, Yangpyeong-gun, Mt. Youngmun, 16.VII.2009, on light trap, R.K. Duwal and S. Jung.

Distribution. Korea, Russia.

Host. *Quercus* sp. (Fagaceae) [Josifov, 1978]; *Q. dentate* [Kerzhner, 1988b].

Remarks. The biology is unknown as the specimen was collecteded in light.

Pilophorus clavatus (Linnaeus, 1767) 대륙표주박장님노린재

Figures: 42D, 44F-L

Pilophorus clavatus: Carvalho, 1958: 144 (cat.); Kelton, 1959: 67 (figs.); Schuh and Schwartz, 1988a: 164 (desc., figs.); Wheeler and Henry, 1992: 195 (dist.); Schuh, 1995: 460 (cat.); Kerzhner, 1988b: 837 (key); Kerzhner and Josifov, 1999: 281 (cat.); Anufriev et al., 2001: 115 (eng. transl.); Kwon et al., 2001: 163 (cat.).

Diagnosis. Recognized by dark brown body; black head, pronotum, mesoscutum and scutellum, and brown hemelytron; discontinuous posterior row of scale setae, scale setae on clavus positioned somewhat anterior than in corium (Fig. 42D); and male genital structures (44F-J).

Description. *Male*. Medium sized, elongated. COLORATION (Fig. 42D): Generally castaneosus or dark brown body. Head, pronotum, mesoscutum and scutellum dull black. Hemelytron brown or dark brown. Venter shining black or castaneous. Antennae, segment I brown with pale extreme base, basal larger region of segment II brown tinged with red while towards the apex black or castaneous; extreme bases of segment III and IV pale and remaining dark. Labium shining, dark brown. All coxae pale except the extreme bases of meso and metacoxae dark; distal half of metafemora and entire tibia castaneous. SURFACE AND VESTITURE: Dorsum entirely furnished with pale soft setae; hemelytron covered with uniformly distributed flattened appressed scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with two bunch on either later side and few scales on posterior corner; and corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and discontinuous; the scales on the clavus positioned anteriorly than the rows on the corium; row of scale setae at the base of cuneus extended on inner 1/2 region. STRUCTURE: Dorsum usually partly or completely shagreen; length of antennal segment II nearly similar with the length of labium and metafemora; labium reaching apex of metacoxae. GENITALIA (Fig. 44F-J): **Endosoma**: C-like, a median spine on the shaft of the endosoma distinctly branch near by the base. **Phallotheca**: As in figure 44G. **Left paramere**: As in figure 44I-J. **Right paramere**: As in figure 44F.

Female. Similar in color and texture as male. GENITALIA (Fig. 44K-L). Sclerotized rings elongated oval with flat posterior region, thin rimmed; dorsal labiate plate with chitinized spinulus structures. Posterior wall as in figure 44L.

Specimens examined. **South Korea**: **Gyeonggi-do**: 3♀, Wonju-si, Munmak, 1.VI.2009, on *Salix*, R.K. Duwal and S. Jung; 1♂, same data as above, on light trap.

Distribution. Holarctic region.

Host. *Cornus* sp. (Cornaceae), *Quercus* sp. (Fagaceae) [Schuh and Schwartz, 1988a]; *Alnus* sp., *Betula* sp. (Betulaceae), *Populus* sp., and *Salix* sp. (Saliaceae) [Wheeler and Henry, 1992].

Remarks. The specimens of *Pilophorus clavatus* were collected on willow trees along the river side under the bridge.

Pilophorus erraticus Linnavuori, 1962 평양표주박장님노린재

Figures: 42E, 46A-F

Pilophorus erraticus Linnavuori, 1962: 170 (n. sp., desc.); Schuh, 1984: 59 (disc.)

Pilophorus alni Josifov, 1987: 117 (n. sp., desc., figs.)

Pilophorus erracticus: Kerzhner, 1988b: 838 (key); 1993: 100 (syn.); Schuh, 1995: 462 (cat.); Kerzhner and Josifov, 1999: 282 (cat.); Yasunaga, 2001a: 148 (diag., fig); Anufriev et al., 2001: 116 (eng. transl.); Kwon et al., 2001: 163 (cat.).

Diagnosis. Recognized by castaneous black body; brown hemelytron with shining dark apices of exocorium beneath the posterior row of scale setae; continuous rows of scale setae, somewhat curved metatibiae; and male genital structures (Fig. 46A-D).

Description. *Male*. Medium sized, elongated. COLORATION (Fig. 42E): Generally shining castaneous black body. Head, pronotum, mesoscutum and scutellum black and dull, except the scutellum shining. Hemelytron brown or dark brown with darker exocorium posteriorly. Venter shining castaneous black. Antennae; segment I, basal half of segment III and extreme base of segment IV pale; basal half of segment II reddish and distal half black. Labium shining, brown with darker apex. Base of procoxa, apex of mesocoxa and entire metacoxa, and all trochanters pale; metafemora brown; metatibia entirely red. SURFACE AND VESTITURE: Dorsum entirely furnished with pale soft setae; hemelytron covered with uniformly distributed flattened appressed scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with two bunch on either later side and few scales on posterior corner; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; a row of scale setae at the base of cuneus extended on inner 3/4 region. STRUCTURE: **Head**: Dorsum entirely shagreen, antennal segment III and IV subequal in length; labium reaching apex of metacoxae. GENITALIA (Fig. 46A-D): **Endosoma**: C-like, a short median spine with a small outgrowth at middle as in figure 46A. **Phallotheca**: As in figure 46C. **Left paramere**: As in figure 46D. **Right paramere**: As in figure 46B.

Female. Similar in color and texture as male. GENITALIA (Fig. 46E-F). Sclerotized rings elongated oval with wide posterior region; dorsal labiate plate with chitinized spinulus structures. Posterior wall as in figure 46F.

Specimens examined. **South Korea**: **Gyeonggi-do**: 8♂, 4♀, Paju-si, Musan-eup, Gunnae-myeon, 21-25.VII.2008, S. Jung; 1♀, Yangpyeong-gun, Mt. Yongmun, 16.VII.2009, on light trap, R.K. Duwal and S. Jung.

Distribution. Japan, Korea, Russia.

Host. *Alnus* sp. (Betulaceae) [Josifov, 1987, Kerzhner, 1988b].

Remarks. The biological information in Korea is unknown.

Pilophorus koreanus **Josifov, 1978 우리표주박장님노린재**

Figures: 45A, 46G-L

Pilophours koreanus Josifov, 1978: 283 (n. sp., desc., figs.); Schuh, 1995: 464 (cat.); Kerzhner, 1988b: Kerzhner and Josifov, 1999: 282 (cat.); Kwon et al., 2001: 163 (cat.).

Diagnosis. Recognized by dull brownish body; hemelytron darker with apices of corium beneath the posterior row of scale setae; blackish posterior pronotum; and structures of male genitalia (Fig. 46G-J).

Description. *Male*. Medium sized, elongated. COLORATION (Fig. 45A): Generally dark brown body. Head, anterior pronotum, mesoscutum and scutellum dark brown, and posterior pronotum black. Hemelytron brown or dark brown; exocorium posteriorly darker. Venter castaneous except basal few abdominal segments pale. Antennae; segment I, basal half of segment III and extreme base of segment IV pale, and segment II reddish brown with black apex. Labium shining, brown. Base of procoxa, apex of mesocoxa and entire metacoxa, and all trochanters pale; meta-femora dirty brown and tinged with red; base of meta-tibia red. SURFACE AND VESTITURE: SURFACE AND VESTITURE: Dorsum entirely furnished with pale soft setae; hemelytron covered with uniformly distributed flattened appressed scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with two bunch on either later side; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; row of scale setae at the base of cuneus extended entirely. STRUCTURE: **Head**: Head, pronotum, mesoscutum and scutellum shagreen; antennal segment III and IV subequal in length; labium reaching apex of mesocoxae. GENITALIA (Fig. 46G-J):

Endosoma: C-like, a median spine at the shaft of the endosoma with a thumb like branch. **Phallotheca**: As in figure 46I. **Left paramere**: As in figure 46J. **Right paramere**: As in figure 46H.

Female. Not different in color and texture but abdomen more wide than in males. GENITALIA (Fig. 46K-L). Sclerotized rings elongated, anterior region tapers to form a pointed end and posterior region oval and flat; dorsal labiate plate with chitinized spinulus structures. Posterior wall as in figure 46L.

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, 2♀, Paju-si, Musan-eup, Gunnae-myeon, 21-25.VII.2008, S. Jung; 2♂, 4♀, same data as above except date, 21-25.VII.2008, S. Jung.

Distribution. China, Korea.

Host. *Acer barbinerve* (Aceraceae), *Salix* sp., (Salicaceae), *Ulmus monshurica* (Ulmaceae) [Josifov, 1978].

Remarks. *Pilophorus koreanus* is very similar in color and texture to the *P*. *erraticus,* it can be separable from later one by comparatively small size, dull dorsum and brownish head and anterior pronotum.

***Pilophorus lucidus* Linnavuori, 1962 오리표주박장님노린재**

Figures: 45B, 47A-G

Pilophorus lucidus Linnavuori, 1962: 171 (n. sp., desc.); Schuh, 1984: 65 (disc.); 1990: 164 (fig.); 1995: 464 (cat.); Kerzhner, 1988b: 837 (key); Kerzhner and Josifov, 1999: 282 (cat.); Yasunaga, 2001a: 149 (diag., fig.); Anufriev et al., 2001: 115 (eng. transl.); Kwon et al., 2001: 164 (cat.).

Diagnosis. Recognized by shining dorsum; black head, pronotum, mesoscutum and scutellum and posterior region of hemelytron beneath the posterior row of scale setae; laterally notched posterior margin of pronotum; posterior row of scale setae discontinuous at exocorium, and the base of cuneus without any scale setae; and structure of male genitalia (Fig. 47A-E).

Description. *Male*. Medium sized, elongated. COLORATION (Fig. 45B): Generally castaneous or dark brown body. Head, pronotum, mesoscutum and scutellum shining black. Hemelytron brown anteriorly and black (or dark) posteriorly. Venter castaneous. Antennae; segment I pale tinged with red dorsally; segment II castaneous; basal half of segment III and extreme base of segment IV pale. Labium dirty brown except base and apex. Base of pro-coxa, apex of mesocoxa and entire metacoxa, and all trochanters pale; meta-femora and tibia castaneous with pale base on tibia. SURFACE AND VESTITURE: Dorsum entirely furnished with pale soft setae; hemelytron covered with uniformly distributed flattened appressed scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with two bunch on either later side and posterior corner; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and discontinuous at endocorium; cuneus without aggregation of scale setae. STRUCTURE: **Head**: Dorsum partly shagreen; postero-lateral sides of pronotum notched labium reaching apex of metacoxae. GENITALIA (Fig. 47A-E): **Endosoma**: C-like, a median spine at the shaft of the endosoma distinctly bifurcated from the middle. **Phallotheca**: As in figure 47C. **Left paramere**: As in figure 47D-E. **Right paramere**: As in figure 47B.

Female. Not different in color and texture but abdomen more wide than in males. GENITALIA (Fig. 47F-G). Sclerotized rings oval and thin rimmed; dorsal labiate plate with chitinized spinulus structures. Posterior wall as in figure 47G.

Specimens examined. **South Korea**: **Gyeonggi-do**: 2♂, Gwangju-si, Mt. Taehwa, 5-19.VII.2007, J.O. Lim; 2♂, Icheon-si, 1.VIII.2008, on Quercus (Fagaceae), R.K. Duwal and S. Jung; 1♂, 1♀, Paju-si, Musan-eup, Gunnae-myeon, 21-25.VII.2008, S. Jung; 1♀, Yangpyeong-gun, Mt. Yongmun, 11.VI.2009, R.K. Duwal.

Distribution. China, Japan, Korea, Russia.

Host. *Quercus* sp. (Fagaceae).

Remarks. Though few specimens were collected in *Quercus* sp., the breeding host is unknown in Korea.

Pilophorus miyamotoi Linnavuori, 1961 솔표주박장님노린재

Figures: 45C, 47H-I

Pilophorus miyamotoi Linnavuori, 1961: 165 (n. sp., desc.); Schuh, 1984: 65 (disc.); 1990: 164 (fig.); 1995: 465 (cat.); Kerzhner, 1988b: 837 (key); Kerzhner and Josifov, 1999: 282 (cat.); Yasunaga, 2001a: 149 (diag., fig.); Anufriev et al., 2001: 115 (eng. transl.); Kwon et al., 2001: 164 (cat.).

Diagnosis. Recognized by flattened body, wide head and pronotum; shining black head, pronotum, mesoscutum and scutellum; brown hemetytron with more darker clavus and apex of exocorium and cuneus; uniformly continues scale setae, and three distinct bunches of scale setae on each corner of scutellum.

Description. *Female*. Medium sized, elongated. COLORATION (Fig. 45C): Generally dark brown or black body. Head, pronotum, mesoscutum and scutellum shining black. Hemelytron dark brown, clavus and exocorium darker. Venter shining dark brown, or black.

Antennae dirty yellow except distal half of segment II castanesous. Labium shining, brown. Coxae dark with pale extreme apex of mesocoxa and distal half of metacoxa; all trochanters brown; meta-femora and tibia dark brown or castaneous. SURFACE AND VESTITURE: Dorsum entirely furnished with pale soft setae and simple black semierect setae; hemelytron covered with uniformly distributed flattened appressed scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with three bunch on each corner and; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; cuneus with aggregation of scale setae on inner 2/3 region. STRUCTURE: Head, pronotum, mesoscutum and scutellum partly shagreen; length of antennal segment II nearly equal to the width of the pronotum; antennal segment II distinctly clavate; vertex wide; labium reaching apex of mesocoxae. GENITALIA (Fig. 47H-I): Sclerotized ring elongated oval, thin rimmed; dorsal labiate plate chitinized and anteriorly spinulus. Posterior wall as in figure 47I.

Male. Not observed.

Specimens examined. **South Korea**: **Jeju-do**: 2♀, Seogwipo-si, Namwon-eup, Namwon-ri, Mt. Songaksan, 27-28.IX.2006, on *Salix*, J.W. Seong.

Distribution. Japan, Korea, Russia.

Host. *Pinus densiflora* (Pinaceae) [Kerzhner, 1988b]; Salix sp. (Saliaceae).

Remarks. The representative specimens were collected on willow (Saliaceae) in Korea, but the breeding host is unknown.

Pilophorus niger **Poppius, 1914 큰검정표주박장님노린재**

Figures: 45D, 48A-G

Pilophorus niger Poppius, 1914: 247 (n. sp.); Carvalho, 1958: 147 (cat.); Linnavuori, 1961:

167 (rec.); Schuh, 1984: 65 (diag., disc.); 1990: 165 (fig.); 1995: 465 (cat.); Kerzhner, 1988b: 838 (key); Kerzhner and Josifov, 1999: 283 (cat.); Yasunaga, 2001a: 149 (diag., fig.); Anufriev et al., 2001: 116 (eng. transl.); Kwon et al., 2001: 164 (cat.).

Diagnosis. Recognized by shining black body and dorum; dark castaneous black hemelytron with shining golden flat setae; two bunches of scale setae on either later sides of scutellum, continuous row of scale setae posteriorly, and a spot like scale setae at the inner base of the cuneus; and structures of male genitalia (Fig. 48A-E).

Description. *Male*. Medium sized, elongated. COLORATION (Fig. 45D): Generally black. Dorsum and ventral completely shining black. Antennae; segment I dirty brown; segment II castaneous with black apex; segment III and IV pale with dark apices. Labium shining black. All coxa black except apex of metacoxa pale; meta-femora and tibia entirely castaneous black. SURFACE AND VESTITURE: Dorsum entirely furnished with pale soft setae and simple black semierect setae; hemelytron covered with uniformly distributed golden flattened appressed scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with two bunch on either lateral side and; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; base of cuneus with aggregation of scale setae as a spot at inner corner. STRUCTURE: Head, pronotum, and scutellum partly shargreen; mesoscutellum smooth; labium reaching apex of mesocoxae. GENITALIA (Fig. 48A-E): **Endosoma**: C-like, a median spine on the shaft of the endosoma as in figure 48A. **Phallotheca**: As in figure 48D. **Left paramere**: As in figure 48B-C. **Right paramere**: As in figure 48E.

Female. Similar in color and texture as males. GENITALIA (Fig. 48F-G). Sclerotized rings elongated oval, anteriorly produce a small protuberance; dorsal labiate plate chitinized and anteriorly with spinulus structures. Posterior wall as in figure 48G.

Specimens examined. **South Korea**: **Gyeonggi-do**: 1♂, Suwon-si, SNU Arboretum, 25.VI.2009, on light trap, R.K. Duwal and S. Jung; 1♂, Yangpyeong-gun, Mt. Yongmun, on light trap, 24.VI.2009, R.K. Duwal and S. Jung; 1♂, same data as above, 16.VII.2009; 1♀, Paju-si, Musan-eup, Gunnae-myeon, 21-25.VII.2008, S. Jung.

Distribution. China, Japan, Korea, Mongolia, Russia.

Host. Unknown.

Remarks. The biology is unknown in Korea.

Pilophorus okamotoi **Miyamoto and Lee, 1966 참표주박장님노린재**

Pilophorus okamotoi Miyamotoi and Lee, 1966: 379 (n. sp., desc., figs.); Schuh, 1984: 66 (disc.); 1995: 465 (cat.); Kerzhner, 1988b: 838 (key); Kerzhner and Josifov, 1999: 283 (cat.); Yasunaga, 2001a: 149 (diag., fig.); Anufriev et al., 2001: 116 (eng. transl.); Kwon et al., 2001: 164 (cat.).

Diagnosis. Recognized by shining dark brown body, head, pronotum, mesoscutum and scutellum; dirty yellow hemelytron with dark apices of corium and clavus; continuous arrnagments of scale setae, and structures of male genitalia (Miyamoto and Lee, 1966: 379).

Description. *Male*. Medium sized, elongated. COLORATION: Generally dark brown body. Head, pronotum, mesoscutum and scutellum shining dark brown. Hemelytron dirty yellow with dark apices of corium and clavus. Venter shining dark brown. Antennae; segment I yellowish, segment II orange with apical 1/3 black, and basal half of segment III pale and remaining apical region, and entire segment IV dark. Labium brownish. Legs brownish, with all coxae and trochanters pale yellow. SURFACE AND VESTITURE: Rows or aggregation of scale setae on scutellum and hemelytron: scutellum with three bunch on either lateral side and; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; base of cuneus with aggregation of scale setae on inner 1/2 region. For detail description and male genital structures see Miyamoto and Lee, 1966: 379: (12-15).

Distribution. Japan, Korea, Russia.

Host. Unknown.

Remarks. This species is well described by Miyamoto and Lee (1966) from Jeju Island. But were not collected during survey and also unable to observe any type specimen.

Pilophorus pseudoperplexus **Josifov, 1987 별표주박장님노린재**

Pilophorus pseudoperplexus Josifov, 1987: 118 (n. sp., desc.); Kerzhner, 1988b: 838 (key)

Pilophorus oculatus Kerzhner, 1988a: 53 (n. sp., desc., figs.)

Pilophorus pseudoperplexus: Schuh, 1995: 466 (cat.); Kerzhner and Josifov, 1999: 283 (cat.); Yasunaga, 2001a: 150 (diag., fig.); Anufriev et al., 2001: 116 (eng. transl.); Kwon et al., 2001: 165 (cat.).

Diagnosis. Recognized by brown body and hemelytron with darker clavus and posterior region of hemelytron with a row of scale setae; scale setae across the entire length on the base of cuneus.

Description. *Male*. Medium sized, elongated. COLORATION: Generally dark brown body. Head and pronotum dull, black. Hemelytron brown, with darker clavus and whole posterior corium beneath the posterior row of scale setae. Venter dark brown. Antennae brown with dark base of segmet I and apices of segment II and III and larger part of segment IV except base. Legs uniformly brown. SURFACE AND VESTITURE: Rows or aggregation of scale setae on scutellum and hemelytron: scutellum with two bunch on either lateral side, and one on apex indistinct; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; base of cuneus with aggregation of scale setae on entire length. For detail descriptions and male genital structures see Josifov 1987: 118; or Kerzhner, 1988b: 838 with figure 210-218.

Distribution. Japan, Korea, Russia.

Host. *Acer* sp. (Aceraceae); *Fraxinus rhynchophylla* (Oleaceae); *Phellodendron amurense* (Rutaceae), *Quercus mongolica* (Fagaceae) [Kerzhner, 1988b]

Remarks. Though this species is described by Josifov (1987) from Northern region, in this study related specimen was not observed in Southern region, and biology is unknown.

Pilophorus setulosus **Horvath, 1905 털표주박장님노린재**

Figures: 45E, 48H-M

Pilophorus setulosus: Linnavuori, 1962: 169 (desc.); Schuh, 1984: 67 (diag., dist., figs.); 1995: 467 (cat.); Kerzhner, 1988b: 838 (key); Kerzhner and Josifov, 1999: 283 (cat.); Yasunaga, 2001a: 150; Anufriev et al., 2001: 116 (eng. transl.); Kwon et al., 2001: 165 (cat.).

Diagnosis. Recognized by dark coloration of body; brown hemelytron with dark clavus apex of exocorium; continuous arrangements of scale setae; and structures of male genitalia (Fig. 48H-K).

Description. *Male*. Medium sized, elongated oval. COLORATION (Fig. 45E):

Generally dark brown body. Head and pronotum dark brown and dull. Hemelytron brown; mesial region of clavus, and apex of endocorium pale; cuneus deep red. Venter dark brown. Antennae pale; basal half of segment I brown and apical margin with red ring, and segment III and IV tinged with red. Labium shining, brown with darker apex. Procoxa brown; meso- and metacoxa and all trochanters pale; meta-femora blackish brown and somewhat tinged red at margins, except extreme base; metatibia entirely pale. SURFACE AND VESTITURE: Dorsum entirely furnished with pale soft setae and simple black semierect setae; hemelytron covered with uniformly distributed golden flattened appressed scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with three bunch on each corner and; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; base of cuneus with aggregation of scale setae at inner 2/3 region. STRUCTURE: **Head**: Head and pronotum partly shagreen; labium reaching apex of mesocoxae. GENITALIA (Fig. 48H-K): **Endosoma**: C-like, a median spine at the shaft of the endosoma as in figure 48H. **Phallotheca**: As in figure 46K. **Left paramere**: As in figure 46I. **Right paramere**: As in figure 48J.

Female. Similar in color and texture as males. GENITALIA (Fig. 48L-M). Sclerotized rings elongated oval, posteriorly wider than anterior region; dorsal labiate plate chitinized. Posterior wall as in figure 48M.

Specimens examined. For reference:- **Japan**: Hokkaido: 2♂, 1♀, Moshiri-Shirakaba, Horokanai, 7.VI.1994, T. Tôdô leg., Det. T. Yasunaga, 2008.

Distribution. China, Japan, Korea, Russia.

Host. *Salix* sp. (Salicaceae) [Kerzhner, 1988b].

Remarks. This species is unable to collect during survey from Southern region.

***Pilophorus typicus* (Distant, 1909) 검정표주박장님노린재**

Figures: 45F, 49A-E

Thaumaturgus typicus Distant, 1909: 519 (n. sp.)

Pilophorus pullulus Poppius, 1914: 238 (n. sp.); Carvalho, 1958: 148 (cat.)

Pilophorus typicus: Linnavuori, 1962: 172 (diag., disc.); Schuh, 1984: 71 (diag., disc. figs.); 1990: 164 (key); 1995: 468 (cat.); Kerzhner, 1999: 284 (cat.); Yasunaga, 2001a: 150 (diag., fig.); Kwon et al., 2001: 165 (cat.).

Diagnosis. Recognized by small elongated body; completely shining black body; convex pronotum with subequal breath on anterior and posterior margin; arrangements of scale setae, and base of cuneus without scale setae; and structures of male gentalia (Fig. 49A-C).

Description. *Male*. small, elongated. COLORATION (Fig. 45F): Generally shining black body. Dorsum and Venter completely shining black. Antennae; segment I pale; segment II entirely black; and basal half of segment III pale and remaining distal half and segment IV darker. Labium castaneous. Procoxa and extreme base of mesocoxa pale; meta-femora castaneous black except pale base and apex; and tibia black except pale extreme base and distal region. SURFACE AND VESTITURE Dorsum entirely furnished with pale soft setae and simple black semierect setae; anterior region of hemelytron covered with uniformly distributed golden flattened appressed scale setae lined by posterior margin of aggregated scale setae; rows or aggregation of scale setae on scutellum and hemelytron: scutellum with two bunch on either later side and; corium with two rows of scale setae, one on anterior region at the level of posterior corner of the scutellum and other posteriorly on subapical region of clavus and continuous; base of cuneus without aggregation of scale setae. STRUCTURE: Head and pronotum partly shagreen; labium reaching apex of mesocoxae. GENITALIA (Fig. 49A-C): **Endosoma**: J-like, a median spine without branch as in figure 49A. **Left paramere**: As in figure 49B. **Right paramere**: As in figure 49C.

Female. Similar in color and texture as males. GENITALIA (Fig. 49D-E). Sclerotized rings assymetrical and oval; dorsal labiate plate chitinized. Posterior wall as in figure 49E.

Specimens examined. **South Korea**: **Chungcheongbuk-do**: 1♂, Cheongwon-gun, Nami-myeon, Sudae-ri, 7.VI.2008, S.W. Park; 1♂, Cheongwon-gun, Naesu-eup, Deokam-ri, 22.VI.2008, S.W. Park; 5♂, Cheongwon-gun, Oksan-myeon, Guksa 1 ri, 4.X.2008, S.W. Park; 2♂, 2♀, Naebuk-myeon, Jeokeum-ri, 27.IX.2008, S.W. Park. **Chuncheongnam-do**: 1♀, Cheonan-si, Susin-myeon, Baekja-ri, 5.X.2008, S.W. Park. **Gyeongsangbuk-do**: Mt. Palgong, 12.VIII.2008, R.K. Duwal and S. Jung. **Gyeongsangnam-do**: 2♂, 2♀, Geoje-si, Geoje Arboretum, 25-27.VIII.2008, R.K. Duwal and S. Jung; 1♀, Geoje-si, Is. Jisim, 28-29.VIII.2008, R.K. Duwal and S. Jung. **Jeollanam-do**: 2♂, Gwangyang-si, Choosan, 16-19. VI.2008, R.K. Duwal and S. Jung.

Distribution. China, Japan, Korea, Oriental Region, Taiwan.

Host. *Artemisia* sp. (Asteraceae).

Remarks. *Pilophorus typicus* is highly populated and most common species among the genus. They are usually aggregated with large number of ants, mostly in *Artemisia* plants. The occurring host plant usually bears aphids but it is hard to assume that they are predatory without any proof of observation.

Zoogeographic Discussion of phyline bugs in the East Asia.

Fig. 50, Table 2

There are several definations on Eastasian continents, however in this study China, Japan, Korea, Mongolia, the Far eastern Russia, and Taiwan are considered as Eastasia, which lies along the North Pacific Ocean (Fig. 50). East Asia is a large region that occupies about 28 precent of total area of Asian continents. Extended towards the northern hemisphere, it includes various geographic structures; low lands, foothills, mountains, basins, plateus, massifs, tablelands, deserts and steppes, etc. Due to such variation in geography, climates in East Asia are extremely diverse: southern humid subtropical climates with dry and warm weathers, middle temperate or humid continental climates usually with cool and humid summer and long, dry and severly cold winter, and the northern most subartic climates. Such a specific geography and climate reserve restriction in distribution of flora and fauna from south to north which comprises of: subtropical moist broadleaf forest, temperate broadleaf and mixed forests, temperate conifer forest, grasslands, and arctic and boreal vegetations. To the dates two hundred and seventy species in seventy genera of phyline bugs (Kerzhner, 1999; Chang-Shin Lin, 2000-2007; Duwal, 2010; 2011; Yasunaga and Vinokurov, 2000; Yasunaga, 2001; 2010; Zhang and Liu, 2010) are reported from East Asia.

The brief summarization of East Asian phyline fauna is listed in table 2. It concludes that 5 tribes of subfamily Phylinae; Auricillocorini, Hallodapini, Leucophoropterini, Phylini and Pilophorini exist in Eastasia. From the list it is clear that China, Japan and Far eastern Russia are densely diverisified rather than Mongolia and Taiwan. Also, regional distribution of fauna was observed in similar circumstances of temperature and vegetations. For example, some common genera are reported from the northern part of China, Mongolia and Far eastern

Russia such as; *Acroletus*, *Camptotylus, Campotylidea*, *Compzorus*, *Conostethus*, *Criocoris, Decota*, *Eumecotarsus, Eurycolpus, Excentricoris, Glaucopernum*, *Monochroica*, *Monocris, Nasocoris*, *Phaeochiton*, *Phaxia*, *Phoenicocoris*, *Plesiodema*, *Psallopsis*, *Sacculifer*, *Salicarus*, *Solenoxyphus*, *Sthenaropsis* and *Tuponia* which are not found in Japan, Korea, Taiwan and Southern China. Except the above mentioned genera, all other genera in Table 2 belong to Middle and Southern part of East Asia.

Tribe Auricillocorini usually distributed along eastern Indomalaya region, of which few species; *Cleotomiris chinensis*, *Cleotomiroides* sp., *Wygomiris mingorum*, *W. taipokau* are repoted in East Asia only from lowland of China.

There are no reports of tribe Hallodapini form Mongolia, whereas at least a representative species were reported from other continents of East Asia. Genus *Hallodapus* is the biggest group found in this tribe, large number of which is distributed in subtropical and temperate regions of China and Japan and few species are observed in Korea, Far eastern Russia and Taiwan.

Similary, there are no reports of tribe Leucophoropterini from Mongolia and very few (one or two) are recognized in Far eastern Russia and Korea. Leucophoropterini listed in table 2 are from Japan. And it is believed that tribe Leucophoropterini evolved from tropics and subtropics of Indomalyan region (Schuh, 1974, 1984).

The largest tribe in subfamily Phylinae, tribe phylini are distributed in all continents of East Asia, however, on generic or specific consideration their distribution pattern are regionally restricted, except few genera such as; *Campylomma*, *Compsidolon*, *Monosynamma*, *Orthonotus*, *Psallus*, *Plagiognathus*, *Europiella*, *Chlamydatus*, and *Rubrocuneocoris* are common. Genus *Psallus* is the largest group, which is restricted in Paleartic region, is widely distributed in temperate and cold temperate vegetations of East Asia, and was hardly observed in southernmost region of China and Taiwan with tropical or subtropical climates. Though three genera of phylines, *Atractotomoidea*, *Atractotomus* and *Moissonia* are reported form Japan and Korea, due to recent reports from tropics/subtropics and temperate regions of Nepal and Thailand (Duwal et al., 2010b; Yasunaga, 2010) these genera are assumed to be widely distributed in both oriental and palearctic regions.

Among the genera of tribe Pilophorini, genus *Pherolepis* is reported common to all continents of Eastasia except Taiwan. In contrast, genera such as, *Druthmarus*, *Hypseloecus*, *Spinolosus* and *Sthenaridea* are found in subtropical lowlands. And the broadly existing genus of the tribe Pilophorini, genus *Pilophorus* is common to Eastasia however, only few species of *Pilophorus*, *P. formosanus*, *P. latus*, and *P. typicus* are recognized in the southern lowlands of China and Taiwan.

Though, comprehensive studies has been done to report the phylines of Japan, Southern Korea, and Far eastern Russia still larger area are remained unsurvayed like, China, North Korea, Mongolia and Taiwan. Therefore, in this study it is realized that more exploration is inneed for detail discussion on the status of phylines form East Asia.

PART II. Molecular Phylogeny of Miridae (Hemiptera: Heteroptera)

(i) Higher group relationships within family Miridae (Heteroptera: Cimicomorpha)

ABSTRACT

A phylogenetic analyses for the family Miridae based on molecular datasets was conducted using one hundred and fifty nine taxa, including seven subfamilies and six outgroups. About 3,609 base pairs of DNA of following gene regions were tested: mitochondrial protein (COI) and ribosomal (16S), and nuclear protein (H2A, H3A) and ribosomal (18S, 28SD3) DNA. Data were analyzed using parsimony, partition maximum likelihood and partitioned Bayesian criteria. The result concluded that Miridae is a monophyletic group. Subfamilies like, Cylapinae, Deraeocorinae, Isometopinae, Mirinae and Phylinae are monophyletic, whereas Bryocorinae and Orthotylinae are paraphyletic. Dicyphini (of Bryocorinae) occurs as a sister group to all remaining mirid taxa.

Key words: Miridae, Phylogeny, Protein and Ribosomal DNA.

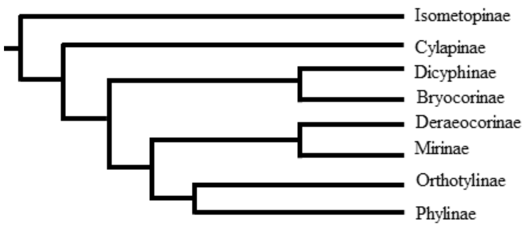
Introduction

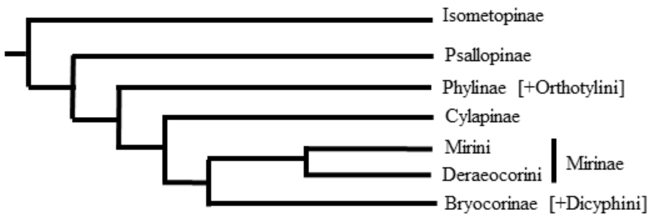
The tiny true bugs family Miridae Hahn, 1833 (Heteroptera: Cimicomorpha) are largest family of Heteroptera with about more than ten thousand species in fourteen hundred genera described to the date (Schuh, 1995; Kerzhner and Josifov, 1999). The mirid bugs show great morphological diversity with adaptation to any kind of extremities of environment. These bugs occupy wide host range including fungi (Cylapinae and Isometopinae), ferns (Bryocorini of Bryocorinae) and various angiosperms (eudicots + monocots) and are considerable pest of agroecosystem. However, members of Deraeocorinae and Pilophorini (Phylinae) are obligate predators feeding on animal food: eggs, larvae, and adults of small arthropods (e.g., aphids, coccids, white files, mites, etc) (Kerzhner and Josifov, 1999; Wheeler, 2001).

The mirid bugs are variously colored, 2-5 mm length, oval or oval elongated bodied creatures. Due to delicate body, it is difficult to handle, and for confirmation of the species need to examine their male genital structure, which is a key identifying character in Miridae. The nymph and female individuals are hardly identified, if males are not collected together. In such cases use of molecular markers can be the tool to see their correct placement.

Though former authors suggested important characters needed for phylogeny studies in mirids, (1) pretarsal structures (Reuter, 1912; 1923; 1941; 1968; Carvalho and Leston, 1952), (2) female and male genital structures (Slater, 1950; Kelton, 1959), and the first morphology based cladogram was published by Schuh (1974) which define that Isometopinae are the sister group of remaining subfamilies of Miridae and supports the sister group relations of Phylinae and Orthotylinae, and Mirinae and Deraeocorinae (Fig. 51A). Later on, in 1976 Schuh proposed another higher level relationship in family Miridae based on pretarsal structure as follows: Isometopinae, Psallopinae, Phylinae (Orthotylini+ Pilophorini+ Phylini), Cylapinae, Mirinae (Mirini+ Deraeocorini), Bryocorinae (Eccritotarsini+ Dicyphini+ Bryocorini) (Fig. 51B). Further, Schuh et al., (2009) considered significant number of sampling of Miridae on higher level relationship within the Cimicomorpha (Hemiptera: Heteroptera) based on morphological and molecular datasets (Fig. 51C). They proposed subfamily Phylinae as a sister group to the remaining subfamilies of Miridae. The Halticini (of Orthotylinae), Eccritorasini and Dicyphini (of Bryocorinae), Fulvini and Cylapini (of Cylapinae) are clustered causing paraphyly. The latest phylogenetic relationship was proposed by Jung and Lee (2012) based on molecular datasets. And the limited sampling shows monophyletic relationship between subfamilies of Miridae except for Bryocorinae which appears paraphyly, Dicyphini is sister with Orthotylinae and Bryocorini with Mirinae.

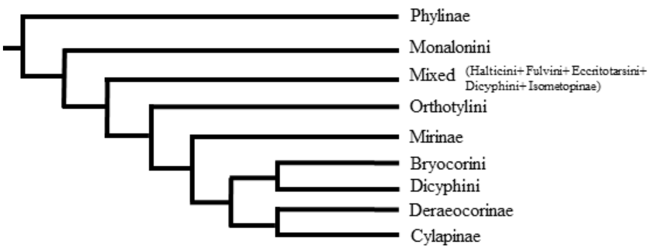
In this study, the combined datasets: Schuh et al. (2009), and Jung and Lee (2012), together with additional specific sampling on tribes were conducted to see the higher taxa relationship of Miridae.

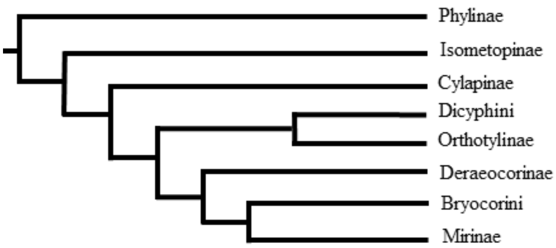




Schuh, 1974 (A)

Schuh, 1976 (B)





Schuh et al., 2009 (C)

Jung and Lee, 2012 (D)

Fig. 51. Higher-level relationship of family Miridae. A. Schuh, 1974. B. Schuh, 1976. C. Schuh et al., 2009. D. Jung and Lee, 2012.

Material and Methods

Taxon sampling

Among the one hundred and fifty nine species used for analyses, fifty-one individuals in forty-nine species were sampled for the first time in this study. The selected samples belong to six subfamilies and twelve tribes which are listed in table 3. The samples had been directly killed and preserved in 99% ethanol for to use in Molecular work. Taxa in this study are carefully examined and identified with the help of references (Distant, 1909; 1910a; 1910b 1911a; 1911b; Schuh, 1974; 1976; 1984; 1991; 1995; Kerzhner and Josifov, 1999; Yasunaga, 2001; 2010; Duwal et al., 2010a; Duwal et al., 2010b; Duwal and Yasunaga, 2011; Duwal et al., 2012). For most of the species male genitalia are observed for confirmation. The list of downloaded data from NCBI (Schuh et al, 2009 and Jung and Lee, 2012) are given in following table 4.

Specimen vouchering

The remains of the body after DNA extraction were either preserved in alcohol or mounted for dried specimen for further study. It was possible because though we use whole body for extraction, we just make few punctures instead of crushing the whole body. Therefore, the vouchers are deposited in Seoul National University, Insect Biosystematics Museum.

DNA extraction, primers, and PCR amplification

Total genomic DNA was extracted from each individual by using QIAamp Tissue Kit (Qiagen) according to the manufacturer’s protocol. Each specimen for the extraction was punctured on their stomach, added ATL buffer and proteinase K, and incubated the sample at 56°C. The remaining exoskeleton after the extraction was preserved dry or alcohol as a voucher specimen. The primer pairs used for the polymerase chain reactions are in following table 5.

Table. 5. Primers used for Miridae analyses.

Gene regions	Primer pairs	Sequences (5’→ 3’)	References
16S rRNA	16S-A	CGCCTGTTTAACAAAAACAT	Simon et al., 1994
	16S-B	CCGGTTGAACTCAGATCA	Kambhampati and Smith, 1995
18S rRNA	18S-1	CTGGTTGATCCTGCCAGTAGT	Hillis and Dixon, 1991
	18S-2	AGATACCGCCCTAGTTCTAACC	Hillis and Dixon, 1991
	18S-3	GGTTAGAACTAGGGCGGTATCT	Hillis and Dixon, 1991
	18S-4	GATCCTTCTGCAGGTTCACC	Hillis and Dixon, 1991
28S rRNA	28S-DD	GGGACCCGTCTTGAAACAC	Hillis and Dixon, 1991
	28S-FF	TTACACACTCCTTAGCGGAT	Hillis and Dixon, 1991
COI	LCO1490	GGTCAACAAATCATAAAGATATTGG	Folmer et al., 1994
	HCO2198	TAAACTTCAGGGTGACAAAAAATCA	Folmer et al., 1994
H2A	H2AF1	TGTCTGGYCGCGGCAARGG	Cryan and Urban, 2012
	H2AR1	ACGGCCTGGATGTTGGGCA	Cryan and Urban, 2012
H3A	H3AF	ATGGCTCGTACCAAGCAGACVGC	Cryan and Urban, 2012
	H3AR	ATATCCTTRGGCATRATRGTGAC	Cryan and Urban, 2012

For the amplification AccuPower® PCR Taq (Bioneer) was used with the 20μl reaction mixture containing 0.05 μg genomic DNA template, and 0.4 μM each Primer. The thermal program applied for four initial markers was 40 cycles of 90°C/30s, 40-52°C/30s and 72°C/60s followed by a final extension at 68°C/10min, however the annealing temperatures were adjusted accordingly COI: 40-48°C, 16S rRNA: 45-50°C, 18S rRNA: 48-50°, and 28S rRNA: 45-50°C. The other two primers were amplified under following reaction cycle: 94°C/3min, 30-35 cycles of 1min at 54-56°C and 72°/60s followed by 72°/10min. And the PCR products were sequenced at MACROGEN Inc., Republic of Korea. H2A and H3A regions were tested for the recently extracted samples and DNA samples deposited in the Laboratory of SNU (Jung and Lee, 2012).

Nucleotide sequence alignment, and Cladistics analyses

Sequences were assembled and edited using Lasergene SeqMan II (ver. 5.01, 2001; DNA star). Alignments of each marker was conducted by using MAFFT (Katoch et al., 2002; 2005) through the online server (http://mafft.cbrc.jp/alignment/server; ver. 6) in which Q-INS-I strategy was selected for rRNA genes (16S, 18S and 28S), that considered secondary structure of RNA genes and datasets <200 (Katoh et al., 2005), whereas, protein coding gene (COI, H2A and H3A) sequences are aligned using FFT-NS-I strategy. Then each of the sequence data was combined with the help of sequence matrix 1.7.8 (Vaidya et al., 2010).

Herein, three cladistics analytical methods were conducted: parsimony by using Paup ver. 4b10 (Swofford, 1998); maximum likelihood (ML) through RAxML -VI-HPC 7.3.1 (Stamatakis et al., 2005; Stamatakis, 2006); and Bayesian inference (BI) using MrBayes ver. 3.1.2 (Huelsenbeck and Ronquist, 2001; Ronquist and Huelenbek, 2003). The suitable model of nucleotide substitution was selected for Bayesian searches using the Modeltest 3.7 (Posada and Crandall, 1998) for each of the gene region.

For the maximum likelihood (ML) the preliminary datasets were submitted to the online portal CIPRES, where the ML analyses is conducted with RAxML-VI-HPC 7.3.1 in Windows. Datasets were partitioned by gene region to allow separate optimization per site substitution rates. The parameters set in the online version of CIPRES are used with execution of 500 non-parametric bootstrap replications.

Parsimony analyses was conducted in Paup ver. 4b10 using ten random sequences addition replicates and tree bisection-reconnection (TBR) branch swapping and nodal support was performed by using 1,000 non-parametric bootstrap replication with heuristic search.

The preliminary data for the Bayesian estimation (BI) was first performed with model test for each gene region, which was therefore selected as GTR + I + G model with their specific model scores. The BI analyses of the data sets ran for five million generations. Burn-in was set at 15% of the sampled number of trees. To ensure that the distribution had stabilized, Tracer ver. 1.4 (Rambaut and Drummond, 2003) was used to view the graphical representation of Markov chain Monte Carlo (MCMC) chain mixing. A 50% majority-rule consensus tree was constructed from the remaining trees to estimate posterior probabilities.

Results

Cladistic analyses

The three sets of trees based on MrBayes, RAxML, and parsimony analyses were compared. Topologies of MrBayes and RAxML were nearly congruent, though parsimony analyses shows some variations. The bootstrap scores for all three analyses of the respective clades in subfamily and tribes are summarized in Fig. 52. The blank space indicated by (-) is either support value lower than 50 or have different topology.

Most of the clades were supported in all analyses, except few were recovered in only subset of analyses. The unambiguously supported clades were characterized by high support values in all analyses (Fig. 52). The clades supported in all three analyses were Miridae, Isometopinae, Cylapinae, Deraeocorinae, Mirinae and Phylinae as monophyletic groups whereas Bryocorinae (Dicyphini + Monalonini, Bryocorinae) and Orthotylinae (Halticini+ Orthotylini, Coridromini) are non-monophyletic. The analyses supports Bryocorinae (Dicyphini+ Monalonini) as sister group to the all remaining mirids.

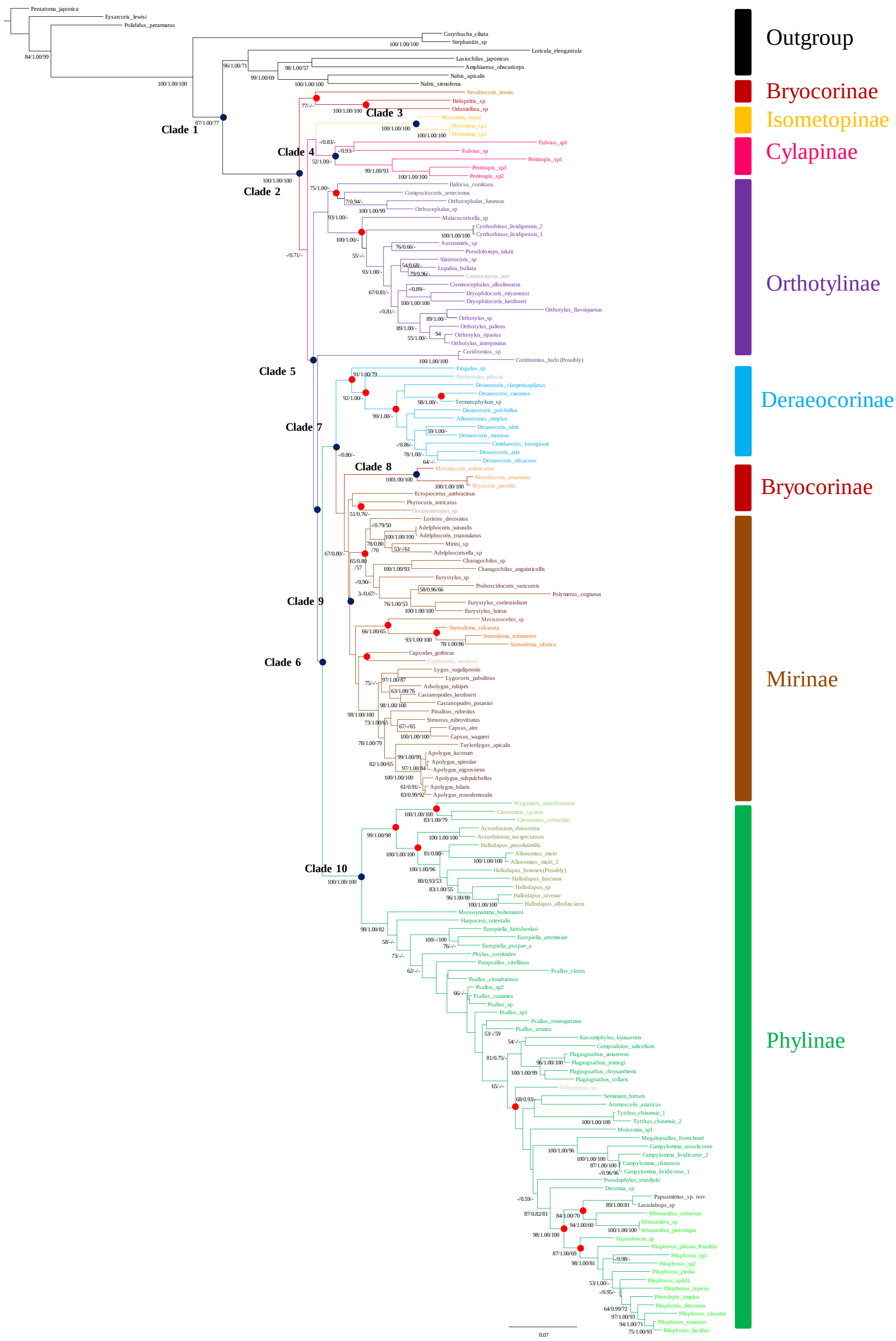


Fig. 52. Tree based on maximum likelihood The numbers below the branches represent bootstrap values of, Maximum likelihood, Bayesian estimation and parsimony (BI, ML and parsimony) greater than 50% and for value less than 50% or not recovered in data analyses is represented by (-).

Discussion

The concept of Phylogenetic relationship of Miridae is shown in Fig. 51 (Schuh, 1974; 1976; Schuh et al., 2009; Jung and Lee 2012). The first two hypothesis which were based on morphology (Fig. 51A-B) were in controversy after updated higher taxa relationship of Miridae by Schuh et al. (2009) (morphology+ molecular in Cimicomorphan relation), and Jung and Lee (2012) (molecular). In which they suggested that Phylinae is the sister group to all remaining groups of mirids.

During this study, in two analyses (ML, BI) topology and branch support shows relatively high degree of congruence (Fig. 52) but parsimony analyses have variation in topologies. Figure 52 summarized the total analyses. Subfamilies, Mirinae, Deraeocorinae, Isometopinae, Cylapinae and Phylinae are found monophyletic whereas, Bryocorinae and Orthotylinae are non-monophyletic in all three analyses. And this study suggested that Bryocorinae (Dicyphini+ Monalonini) as a sister group to the all remaining groups of mirids. The explanations on each of the clades are as follows:

Clade 1. Cimicomorpha and Miridae

The monophyly of Infraorder Cimicomorpha and Miridae was recovered in all analyses, which is consistent with the previous analyses (Schuh and styts, 1991; Wheeler et al., 1993; Schuh et al., 2009; Jung and Lee, 2012).

Clade 2. Bryocorinae (Dicyphini) sister to remaining mirids

In contrast to previous analyses in Cimicomophan relationship (Schuh et al., 2009), and results of Jung and Lee (2012), here Dicyphina+ Monaloniina (Bryocorinae: Dicyphini) were supported as a sister-group to all remaining mirids.

Clade 3. Subfamily Isometopinae

Isometopinae is a small group with four tribes Diphlebini, Gigantometopini Isometopini and Myiommini (Cassis and Schuh, 2012), and are considered feeding on fungus and decayed bodies (Wheeler, 2001). In this study, Isometopinae is supported as monophyletic, and are sister to Cylapinae which is partly consistent with the analyses of Schuh (1974). But, it is realized that for the accurate placement resampling should be done with additional taxa including other tribes.

Clade 4. Subfamily Cylapinae

Regarding to recent classification (Cassis and Schuh, 2012), subfamily Cylapinae consist of five tribes: Bothriomirini, Cylapini, Fulviini, Rhinomirini and Vaniini. Here, in this analyses tribe Fulviini with two genera in five species are representing the subfamily, which are supported as a monophyletic group. But I could not conclude this subfamily as a monophyletic group because, in the Cimicomorphan relationship of Schuh et al. (2009), species of tribe Cylapini were found clustered. Therefore, this group should be reconsidered with resampling including the member of as many tribes as possible.

Clade 5-6. Subfamily Orthotylinae

Subfamily Orthotylinae consist of six tribes (Tatarnic and Cassis, 2011): Austromirini, Ceratocapsini, Coridromiini, Halticini, Nichomachini and Orthotylini. During analyses, the branch of *Coridromius* in Orthotylinae is separated causing paraphyly. Therefore, as suggested by Tatarnic and Cassis (2011), *Coridromius* should be considered as a separate tribe, or subfamily. Though, the monophyly of Orthotylini is consistent with Schuh et al.

(2009), the recent recognition of tribes Austromirini and Ceratocapsini in classification (Schuh and Cassis, 2012) made the tribe Orthotylini paraphyletic.

Clade 7. Subfamily Deraeocorinae

Subfamily Deraeocorinae, in current classification consist of six tribes: Clivinemini, Deraeocorini, Hyaliodini, Saturniomirini, Surinamellini and Termatophylini. The monophyly of this subfamily is recognized. But the monophyly of the tribe Deraeocorini is uncertain due to tribe Termatophylini which is erected as a separate tribe based on first labial segment and anterolateral pronotal setae (Cassis, 1995). On the other hand genus *Fingulus* is separated from tribe Deraeocorini and sister to the Clivinemiini which is supported with high bootstrap value in this study. Therefore, I would like to suggest *Fingulus* as a separate group because unlike other Dereaocorini, it has long extension of head behind the eye (neck) (Stonedahl and Cassis, 1991).

Clade 8. Tribe Bryocorini

The members of tribe Bryocorini are restricted to feed on fern (wheeler, 2001).

The current analyses supported the monophyly of tribe Bryocorini (Schuh et al., 2009 and Jung and Lee 2012). Likewise, it support the sister relationship of Bryocorini+ Mirinae as in Jung and Lee (2012).

Clade 9. Subfamily Mirinae

Subfamily Mirinae is widely cosmopolitan group (Cassis and Schuh, 2012) and comprises of six tribes: Herdoniini, Hyalopeplini, Mecistoscelini, Mirini, Resthenini and Stenodemini. The monophyly of subfamily Mirinae is recognized. But tribes Mininae, Stenodemiini, Resthenini, Herdoniini and Mirini are clustered in this study.

Clade 10. Subfamily Phylinae

Subfamily Phylinae is another cosmopolitan group, which is considered with six tribes Auricillocorini, Hallodapini, Leucophoropterini, Phylini, Pilophorini and Pronotocrepini (Cassis and Schuh, 2012). Members in this group are defined by upturned collar (except in Hallodapini), rigid endosoma. In this study, the monophyly of Phylinae is highly supported. Here, subfamily Miridae is sister to the Phylinae. Within the subfamily, tribes Auricillorini, Hallodapini, Leucophoropterini and Pilophorini are monophyletic and are supported with high bootstrap value. The greater genetic affinity of genus *Teleorhinus* (of tribe Pronotocrepini) with tribe Phylini is observed. Auricillocorini is sister to all other tribes of Phylinae and the relationship shown in clade as follows: (Auricilloroini+ Hallodapini+ (Phylini+ Pronotocrepini+ Phylini) Leucophoropterini+ Pilophorini). The detail discussion on taxa of subfamily relationships is given in chapter II (ii).

Conclusion

The present analyses used protein and ribosomal molecular data, which are aligned using MAFFT, and parsimony, maximum likelihood and Bayesian analyses to generate hypotheses on subfamily relationships of Miridae. Present analyses show the relations Dicyphini + Isometopinae + Cylapinae + Orthotylinae + Coridromius + Deraeocorinae + Bryocorini + Mirinae + Phylinae, which is controversial to the previous analyses in sister relations.

Therefore, it is concluded that subfamily Phylinae which were considered living on mixed diet are most derived group.

(ii) Phylogeny of the subfamily Phylinae

Abstract

The recent study is the first comprehensive cladistics analyses of plant bugs subfamily Phylinae based on molecular data. Sampling included sixty eight taxa (57 phylines and 11 outgroup) in six tribes of Phylinae based on ~3,677 base pairs of mitochondrial protein (COI) and ribosomal (16S), and nuclear protein (H2A, H3A) and ribosomal (18S, 28SD3) DNA. Data were analyzed using parsimony, partition maximum likelihood and partitioned Bayesian criteria. Clades recovered in all analyses are as follows: outgroup taxa [Isometopinae, Cylapinae, Orthotylinae, Dicyphyni (Bryocorinae), Mirinae, Deraeocorinae, Bryocorini (Bryocorinae)], and ingroup taxa [Auricillocorini, Hallodapini, (Phylini + Pronotocrepini), (Leucophoropterini + Pilophorini)], and Auricillocorini as a sister group of remaining phylines. The results show monophyly of tribes Auricillocorini, Hallodapini, and non-monophyly of Phylini, and argue on the monophyly of tribes Leucophoropterini and Pilophorini.

Key words. Phylogeny, Phylinae, Protein and Ribosomal DNA.

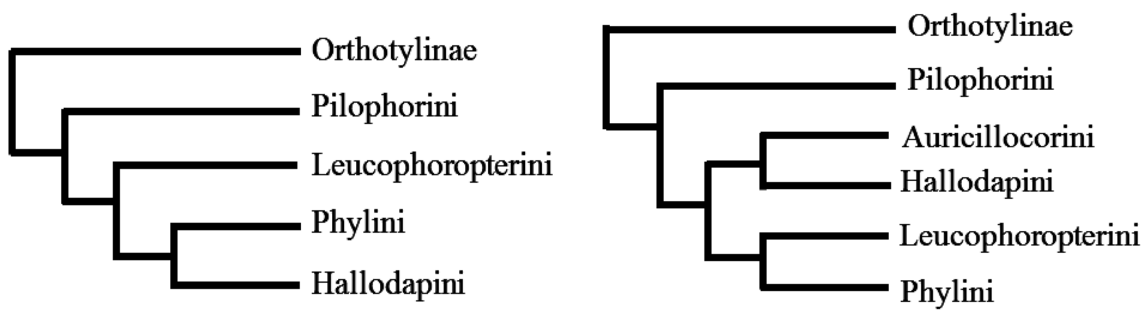
Introduction

Phylinae (Hemiptera: Miridae) the plant bugs are the diverse group in true bugs which is described with more than three hundred genera worldwide (Schuh, 1995; 2008; Schuh and

Slater, 1995; Kerzhner and Josifov, 1999; http://research.amnh.org/pbi). Phylines in family Miridae are very specific in their superficial morphology due to absence of collar (except Hallodapini and some genera of Auricillocorini); usually setiform parempodia (except in Pilophorini), and distinctly sclerotized endosoma of variously shaped (usually slender forms). These tiny bugs are defined as omnivores, since they can easily change their feeding habits to suit the surrounding circumstances and adapted as predatory and scavenge on small arthropods as well as feed on host producing serious injuries (Wheeler, 2001).

Despite of several definitions on Phylinae, and tribal level placements by Carvalho (1952) and Kelton (1959), the first comprehensive monograph of subfamily Phylinae was published by Schuh (1974) with redefinition of each tribe and their relationships with South African phyline fauna. Later on, the major morphology based phylogenetic relationships within tribes of Phylinae was published (Schuh, 1984) with revision of Indo-pacific region. In both studies Schuh (1974; 1984) believed that Orthotylinae was the base for evolution of Phylinae, and suggested that the tribe Pilophorini as a sister group to remaining tribes (Fig. 1A-B). The latest Phylogeny of the Phylinae (Schuh, 1984) based on morphology proposed the relationship of five tribes which is as follows: Pilophorini + Auricillocorini + Hallodapini + Leucophoropterini + Phylini (Fig. 53) and concluded that all tribes are monophyletic except the tribe Phylini is paraphyletic not because they are mixed with other tribes but due to complex arrangements of taxa. The recent studies by Schuh et al. (2009) in Cimicomorphan relationship, and Jung and Lee (2012) in molecular phylogeny of Miridae proposed the monophyly of subfamily Phylinae, but the sister relation within the subfamily could not be evaluated due to lack of representative tribes/ or limitation in sampling.

The prior concept of tribal relationships of Phylinae by Schuh (1974; 1984) provides several evidences such as disappearance and evolution of collar at different phase, derivation of setiform parempodia from the fleshy structures, and primary stabilization of myrmecomorphic forms evolved to nonmyrmecomorphic forms, and paraphyly of Phylini due to divergence in morphology and genitalic structure, which are considered as strong evidence of evaluation, but realized inneed of molecular reevaluation to see their compatibility. Moreover, in latest studies (Schuh et al., 2009; Jung and Lee, 2012) with limited sampling subfamily Phylinae is consideration as a sister to remaining subfamilies which is totally different than the relationship suggested by Schuh (1974; 1984), such controversy enhanced and added enthusiasm for this study. Therefore, a relatively large sample including all six recently defined tribes are considered to see their relationships as a final goal.



(A) Schuh, 1974 (B) Schuh, 1984

Fig. 53. Cladogram of subfamily Phylinae relationships. (A) Schuh, 1974, and (B) Schuh, 1984

Material and methods

Taxon sampling

In total 68 taxa were used in analyses, representing 57 ingroup species and 11 outgroup species (subfamilies of Miridae except Psallopinae). Among 68 samples, data for 31 samples were downloaded from NCBI (Schuh et al, 2009 and Jung and Lee, 2012) and remaining extracted during this study. Therefore in this study, representative taxa of all six currently occurring tribes of subfamily Phylinae; Auricillocorini, Hallodapini, Leucophoropterini, Phylini, Pilophorini, and Pronotocrepini are included. The six outgroup taxa two from each subfamily *Monalocoris amamianus* Yasunaga, 2000; and *Nesidiocoris tenuis* (Reuter, 1895) [Bryocorninae]; *Peritropis* sp.1; and *Fulvius* sp. [Cylapinae]; *Deraeocoris ulmi* Josifov, 1983 and *Fingulus* sp. [Deraeocorinae]; *Apolygus lucorum* (Meyer-Dur, 1843); *Stenodema calcarata* (Fallen, 1807) [Mirinae], and *Orthocephalus funestus* Jakovlev, 1881; and *Cyrtorhinus lividipennis* Reuter, 1885 [Orthotylinae]; and a species, *Myiomma kukai* Yasunaga and Hayashi, 2000 [Isometopinae] are selected. Table 6 provides details regarding taxa sampling and locality for recently sequenced samples and Gene bank accession number for downloaded data.

Specimen vouchering

The remains of the body after DNA extraction were either preserved in alcohol or mounted dried for further study. It was possible because though we use whole body for extraction, we just make few punctures instead of crushing the whole body. Therefore, the vouchers are deposited in Insect Biosystematics Museum, Seoul National University.

The whole body or stomach with legs were taken for extraction and followed QIAGEN DNeasy Blood and Tissue kit® protocols. Primer sequences used for PCR amplification of mitochondrial protein (COI) and ribosomal (16S), and nuclear protein (H2A and H3A) and ribosomal (18S and 28S) DNA regions are given in Table 7. PCR was performed using

Table 7. Primers used for Phylinae analyses.

Gene regions	**Primer pairs**	**Sequences (5'→ 3')**	**References**
16S rRNA	16S-A	CGCCTGTTTAACAAAAACAT	Simon et al., 1994
	16S-B	CCGGTTGAACTCAGATCA	Kambhampati and Smith, 1995
18S rRNA	18S-1	CTGGTTGATCCTGCCAGTAGT	Hillis and Dixon, 1991
	18S-2	AGATACCGCCCTAGTTCTAACC	Hillis and Dixon, 1991
	18S-3	GGTTAGAACTAGGGCGGTATCT	Hillis and Dixon, 1991
	18S-4	GATCCTTCTGCAGGTTCACC	Hillis and Dixon, 1991
28S rRNA	28S-DD	GGGACCCGTCTTGAAACAC	Hillis and Dixon, 1991
	28S-FF	TTACACACTCCTTAGCGGAT	Hillis and Dixon, 1991
COI	LCO1490	GGTCAACAAATCATAAAGATATTGG	Folmer et al., 1994
	HCO2198	TAAACTTCAGGGTGACAAAAAATCA	Folmer et al., 1994
H2A	H2AF1	TGTCTGGYCGCGGCAARGG	Cryan and Urban, 2012
	H2AR1	ACGGCCTGGATGTTGGGCA	Cryan and Urban, 2012
H3A	H3AF	ATGGCTCGTACCAAGCAGACVGC	Cryan and Urban, 2012
	H3AR	ATATCCTTRGGCATRATRGTGAC	Cryan and Urban, 2012

BiONEER AccuPower® Taq. The thermal program applied for COI, 16S, 18S and 28S markers was 40 cycles of 90°C/30s, 40-52°C/30s and 72°C/60s followed by a final extension at 68°C/10min, however the annealing temperatures were adjusted accordingly COI: 40-48°C, 16S rRNA: 45-50°C, 18S rRNA: 48-50°, and 28S rRNA 45-50°C. H3A, and H2A primers were amplified under following reaction cycle: 94°C/3min, 30-35 cycles of 1min at 50-56°C and 72°/60s followed by 72°/10min where the annealing temperature were adjusted as H2A: 50-54°C, and H3A: 54-56°C. And the PCR products were sequenced at MACROGEN Inc., Republic of Korea.

Nucleotide sequence alignment, and Cladistics analyses

Sequences were assembled and edited using Lasergene SeqMan II (ver. 5.01, 2001; DNA star). Alignments of each marker was conducted by using MAFFT (Katoch et al., 2002; 2005) through the online server (http://mafft.cbrc.jp/alignment/server; ver. 6) in which Q-INS-I strategy was selected for rRNA genes (16S, 18S and 28S), that considered secondary structure of RNA genes and datasets <200 (Katoh et al., 2005), whereas, protein coding gene (COI, H2A and H3A) sequences are aligned using FFT-NS-I strategy. Then each of the sequence data was combined with the help of sequence matrix 1.7.8 (Vaidya et al., 2010).

Herein, three cladistics analytical methods were conducted: parsimony by using Paup ver. 4b10 (Swofford, 1998); maximum likelihood (ML) through RAxML -VI-HPC 7.3.1 (Stamatakis et al., 2005; Stamatakis, 2006); and Bayesian inference (BI) using MrBayes ver. 3.1.2 (Huelsenbeck and Ronquist, 2001; Ronquist and Huelenbek, 2003). The suitable model of nucleotide substitution was selected for Bayesian searches using the Modeltest 3.7 (Posada and Crandall, 1998) for each of the gene region.

For the maximum likelihood (ML) the preliminary datasets were submitted to the online portal CIPRES, where the ML analyses is conducted with RAxML-VI-HPC 7.3.1 in

Windows. Datasets were partitioned by gene region to allow separate optimization per site substitution rates. The parameters set in the online version of CIPRES are used with execution of 500 non-parametric bootstrap replications.

Parsimony analyses was conducted in Paup ver. 4b10 using ten random sequences addition replicates and tree bisection-reconnection (TBR) branch swapping and nodal support was performed by using 1,000 non-parametric bootstrap replication with heuristic search.

The preliminary data for the Bayesian estimation (BI) was first performed with model test for each gene region, which was therefore selected as GTR + I + G model with their specific model scores. The BI analyses of the data sets ran for five million generations. Burn-in was set at 15% of the sampled number of trees. To ensure that the distribution had stabilized, Tracer ver. 1.4 (Rambaut and Drummond, 2003) was used to view the graphical representation of Markov chain Monte Carlo (MCMC) chain mixing. A 50% majority-rule consensus tree was constructed from the remaining trees to estimate posterior probabilities.

Results

Cladistic analyses

The three sets of trees based on MrBayes, RAxML, and parsimony analyses were compared. Topologies in MrBayes and RAxML were congruent except the *Psallus* complex which clade was found complex in both analyses, in other hand the parsimony topology was unmatched. The bootstrap scores for all three analyses of the respective clades in tribal and generic grouping are summarized in Fig. 54, and Table 8. The blank space indicated by (-) is either support value lower than 50 or have different topology.

Most of the clades were supported in all analyses, but, few were recovered in only a subset of analyses. The unambiguously supported clades were characterized by high supporting values in all analyses (Fig. 54; Table 8). The supported clades in all three analyses were Phylinae, Aurocillocorini, Hallodapini, (Phylini complex + Pronocrepini), (Pilophorini + Leucophoropterini), and most of the genera in datasets except *Psallus* complex. In all analyses it was found that, the Phylini was found non monophyletic dividing into several branches, and a species of Pronotocrepini (*Teleorhinus* sp.) lies within the members of tribe phylini; *Lasiolabops* sp. was clearly separated from the clade of tribe phylini but found together with *Sthenaridea* (Pilophorini); *Papuamimus* sp. within the clade of *Pilophorus* was highly supported; and genus *Pilophorus* was non monophyletic because of congeneric taxon *Pherolepis* which lies within the clade. In all three analyses it is confirmed that tribe Auricillocorini followed by Hallodapini are monophyletic, and Auricillocorini as a sister group to all remaining tribes of Phylinae in this study.

Discussion

Subfamily Phylinae are second largest group in family Miridae. The classification given by Schuh (1974, 1984) is the only phylogeny based classification in Phylinae which supports the monophyly of all five tribes and considered tribe phylini as paraphytelic group, however tribe Pronotocrepini is resurrected in recent studies (Cassis and Schuh, 2012).

In two analyses (BI and ML), topology and branch support shows relatively high degree of congruence but parsimony analyses occur with different topologies (Fig. 54, Table 8). Both Fig. 54 and Table 8 summarize a recovery or rejection of nodes in all three analyses. The monophyly of Auricillocorini and Hallodapini are recovered, tribe Phylini are often observed as complex group, *Teleorhinus* sp is found within Phylini, (Fig. 54, node 13), *Lasiolabops* clearly separated from the clade of Phyline (Fig. 54, node 18), and Pilophorini and Leucophoropterini are not separated in different clades, but were found that strongly

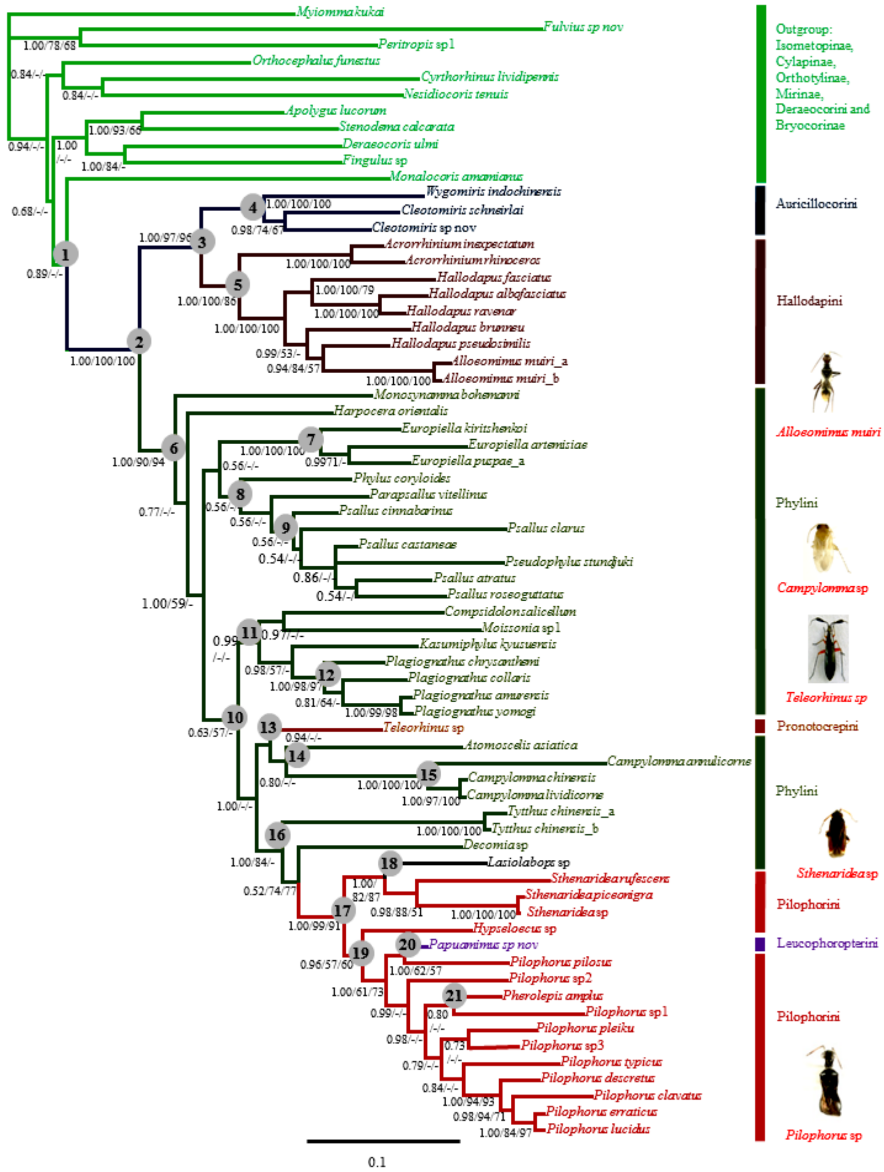


Fig. 54. Tree based on the Bayesian estimation. The numbers below the branches represent bootstrap values of Bayesian estimation, maximum likelihood, and parsimony (BI, ML and parsimony) greater than 50% and for value less than 50% or not recovered in data analyses is represented by (-).

Table 8. Clades recovered in the three analyses, Bayesian estimation (BI), maximum likelihood (ML) and parsimony. Values for parsimony and ML are bootstap values (BP); those for MrBayes analyses posterior probabilities. A (-) indicates that a particular clade is supported by bootstrap values in <50%, or not recovered in those analyses.

Clades	**Node on Fig. 54**	**MrBayes (BI)**	**RAxML (ML)**	**Paup (P)**
Bryocorini	1	89	_	_
Phylinae	2	100	100	100
Auricillocorini + Hallodapini	3	100	97	96
Auricillocorini	4	100	100	100
Cleotomiris		97	74	67
Hallodapini	5	100	100	86
Acrorrhinium + (*Hallodapus* +*Alloeomius*)		100	100	100
Hallodapus + *Alloeomius*		94	84	57
Phylini + Prononotocrepini	6	100	90	94
(*Europiella* + *Psallus* complex + *Phylus* + *Parapsallus*) + (*Compsidolon* + *Moissonia* + *Kasumiphylus* + *Plagiognathus* + *Campylomma*)		100	59	_
Europiella	7	100	100	100
Phylus + *Psallus* complex	8	56	_	_
Psallus Complex	9	56	_	_
(*Compsidolon* + *Moissonia* + *Kasumiphylus* + *Plagiognathus*) + (*Teleorhinus* + *Atomoscelis* + *Campylomma* + *Tytthus* + *Decomia*)	10	63	57	_
(*Compsidolon* + *Moissonia*) + (*Kasumiphylus* + *Plagiognathus*)	11	99	_	_
Kasumiphylus + *Plagiognathus*		98	57	_
Plagiognathus	12	100	98	97
Teleorhinus	13	94	_	_
Atomoscelis		80	_	_
Campylomma	15	100	100	100
Tytthus	16	100	84	77
Lasiolabops + Pilophorini + Leucophoroptereini	17	100	99	91
Lasiolabops + *Sthenaridea*	18	100	82	87
Sthenaridea		98	88	51
Hypseloecus	19	96	57	60
Papuamius +Pilophorini		100	61	73
Papuamius +*Pilophorus pilosus*	20	100	62	57
Pherolepis + *Pilophorus*	21	80	_	_

myrmecomorphic and non myrmecomorphic groups are clearly separated into two branches with high bootstrap score (Fig. 54, node 17). In all analyses tribe Auricillocorini is observed as a sister group to remaining tribes of subfamily Phylinae, which is different than the basal relationship proposed by Schuh (1984).

Comparision of results with prior analyses

Taking in consideration the latest morphology based phylogeny by Schuh (1984), as the hypothesis, and recent resurrection of Pronocrepini (Wyniger, 2010) and re-position of *Lasiolabops* into Phylini (Menard, 2011) are compared with current analyses for discussion.

Miridae and Phylinae: nodes 1-2

Most topologies of subfamilies included in family Miridae (applied as outgroup taxa) are congruent in BI and ML analyses, however the supporting value for higher branches in ML is less than 50 (Fig. 54, node 1). Two samples from each subfamilies; Bryocorinae, Deraeocorinae, Cylapinae, Orthotylinae and Mirinae and a species of Isometopinae were analyzed for to see the relationship with Phylinae, which showed that Bryocorini (Bryocorinae) has a sister relation with Phylinae that is controversial against the sister relation proposed by Schuh, (1974; 1984) in the morphology based analyses.

Monophyly of Phylinae is recovered in all three analyses which has high support, as suggested in prior studies by Schuh (1974, 1984), Schuh et al. (2009) and Jung and Lee (2012).

Basal relationships within Phylinae: node 3-5

Auricillocorini and Hallodapini (Fig. 54, node 3) are always recovered being in sister relation in all analyses which have high support as treated by Schuh (1984). Different from the morphology based analyses (Schuh, 1984), these groups occur at the base of subfamily Phylinae with bootstrap support value 96 to 100. The homoplasy shared between these two tribes are strongly elevated and swollen posterior lobe of pronotum, weakly or strongly flattened collar, laterally protruding evaporatory lobe, and flattened metafemora with parallel ventral surfaces (Schuh, 1984).

Auricillocorini are representing as a sister group to other tribes of Phylinae in present analyses and are supported with high bootstrap score (Fig. 54, node 3).

Monophyly of Auricillocorini: node 4

Tribe Auricillocorini recovered as monophyly which is well supported with high bootstrap value in current analyses (Fig. 54, Table 8). Among the five described genera (Schuh, 1984), we were able to sample two genera with three species from Cambodia which were nested in one clade with strong bootstrap scores. Such result shows the correlation with the characters proposed by Schuh (1984), i.e. broad and triangular cuneus with obsolete cuneal incisure, moderately fleshy parempodia convergent apically, and cuneal fracture perpendicular to corial margin (except in *Wygomiris*) and mesoscutum obscure.

Monophyly of Hallodapini: node 5

Monophyly of Hallodapini is observed with strong bootstrap support in present study (Fig. 54, node 5). Among two hundred and seventy described species in forty nine genera of Hallodapini, we were able to admit eight species in three monophyletic genera: *Acrorrhinium*

+ *Hallodapus* + *Alloeomimus* each of which were well supported with high scores (Fig. 54, Table 8, node 5). The correlated morphological characters suggested by Schuh (1984) are: prognathous head, prominent clypeus, broad and flattened collar and comparatively large genital capsule.

Phylini complex: nodes 6-16

Phylini, are found non-monophyletic in all analyses, however, major taxa show monophyletic relations within generic level (except *Psallus*, Fig. 54, node 9). The taxon sampling including twenty eight species in fifteen genera are limited in contest to nearly fifteen hundred existing species (Schuh, 1995; http://research.amnh.org/pbi) which show complex clusters. Such as topologies are congruent in BI and ML analyses although supporting value is weak in later one. *Lasiolabops* is clearly separated from Phylini clade in all three analyses. Likewise, *Teleorhinus* (Pronotocrepini) has close involvement with members of Phylini which is supported in BI and ML analyses.

Tribe Phylini is diverse group with various coloration, shape and size and genital structure. In morphology based Phylogenetic analyses, Schuh (1984) mentioned that this group is paraphyletic though species do not fall into other tribes, somewhat similar evidence observed in present analyses. Genera like *Monosynamma*, *Harpocera*, *Tytthus*, and *Decomia* though represented with single species each are represented by separate clade in BI and ML analyses (Fig. 54) which are obviously can be presumed as a monophyletic. Clades of *Europiella* spp. (Fig. 54, node 7), *Plagiognathus* spp. (Fig. 54, node 12), and *Campylomma* spp. (Fig. 54, node 15) are strongly supported with maximum bootstrap score in all three analyses. But the complexity of *Psallus* spp. (Fig. 54, node 9) being unsolved because of unusual different topologies, clustered clades (ML) and have low support values in all three analyses. *Monosynamma*, well supported with high bootstrap scores are appear as a sister group to other members of tribe Phylini (Fig. 54). These primitive willow inhabiting group are defined with following morphological character: fleshy parampodia moderately large size (unlike other phylines) but phyline type S- shaped endosoma with well-developed secondary gonopore, and female genitalia with wide and very elongated sclerotized rings.

The morphologically robust group, *Harpocera* is observed in a separate clade showing monophyly in BI and ML analyses in present study (Fig. 54) and is well supported in BI but have low value in ML. The uniqueness of this genus could be the stout antennae, segment II short and hatched shaped, usually short labium exceeding to procoxae, more or less distinct calli, and simple, weekly S-shaped endosoma.

Tytthus is representing in separate branch as monophyletic clade with well supported bootstrap score in BI and ML analyses (Fig.54, node 16). Recent placement of the genus *Tytthus* (Menard and Schuh, 2011) into Phylini is support in this study. Several correlated morphological characters proposed by Schuh (1984) and Henry (2012) are: flared humeral angels of lateral margins of pronotum, conspicuously elongated metafemora with parallel surfaces, setiform parempodia, tapered abdomen and small genital capsule, tubular endosoma with obscure secondary gonopore.

The genus *Decomia* is found as separate clade showing monophyly with well supported bootstrap score. The morphological evidences reported by Schuh (1984) are short and broad metafemora with strongly arched dorsal surface, large pulvilli, J-shaped tubular endosoma and well developed, horse shoe shaped secondary gonopore, and strongly flattened left paramere.

The genus *Europiella* established as a monophyletic clade with well supported bootstrap score (Fig. 54, node 7) in present analyses. Though it is not fair to make a certain decision with few representative sample (3 species) for large and dispersed Holarctic genus, but in our analyses those admitted species show monophyly. We further realized in need of mass sampling including complex species like *Euplagiognathus lividellus*, *Europiella albipennis*, and others.

Node 8 have very low supporting values in all analyses which bears clades with genera *Phylus*, *Parapsallus*, *Psallus*, and *Pseudophylus*, and are observed clustered in ML analyses. The clade with *Psallus* complex is very confusing (Fig. 54, node 9) which varies in all three analyses. The complexity of sub-generic identification of this diverse group should be reconsidered further with mass representative samples from all subgenera: *Apocremnus*, *Calopsallus*, *Hylopsallus*, *Mesopsallus*, *Phylidea*, *Pityopsallus*, *Subpsallus* and *Psallus* including both Palearctic and Nearctic fauna to resolve its problem. Unlikely, *Pseudophylus* which is morphologically very different from *Psallus* is found combined with *Psallus* in BI in present analyses.

Node 11 consists of genera like *Compsidolon*, *Moissonia*, *Kasumiphylus* and *Plagiognathus* in all three analyses but the supporting value is low in ML and parsimony analyses. *Plagiognathus* observed as a monophyletic clade supported with high scores in all analyses (Fig. 54, node 12). Complete or incomplete stripes of the metafemora, and genital structure could be the unique morphological characters.

Node 13 consist genera like *Teleorhinus*, the clade supported in BI and ML analyses (Fig. 54, node 13) but low support value in ML analyses. *Teleorhinus* is considered as morphologically complex genus, which is transferred from one tribe to another by several authors [i.e. Reuter (1910) placed it as genera incertae sedis, and Knight (1923) transferred to the Hallodapini]. But later recently it is placed within tribe Pronotocrepini (Wyniger, 2010), due to morphological characters like, distally inflated antennal segment II (but variously inflated structure of antennal segment II are found within members in Phylini e.g. *Atractotomus*, and *Malaysiamiris*, with completely enlarged or flattened, *Harpocera* with hatched shaped, etc.) and genital structure.

Atomoscelis, morphologically very similar to *Campylomma* or *Europiella* is obtained as separate clade but the supporting value is low in ML and parsimony analyses (Fig. 54, node 14). The evidential characters might be spots and smoky pattern of hemelytra, and male genital structures.

Genus *Campylomma* are well supported with bootstrap score in all three analyses (Fig.54, node 15). Corresponding morphological characters reported by Schuh (1984) are, dorsally furnished a row of tiny dark spicules on distal half of metafemora, and two sclerotized blades of endosoma arising distad of secondary gonopore.

Node 17

Node 17 formed another clade with well supported bootstrap score in all three analyses (Fig. 54, Table 8) which are divided into clades, *Lasiolabops* + *Sthenaridea*, Hypseloecus and (*Papuamimus* + *Pilophorus* + *Pherolepis).* Such clades in present analyses indicated that oriental *Lasiolabops* has affinity toward *Sthenaridea* whereas *Papuamimus* with *Pilophorus*, and also clades of myrmecomorphic and non-myrmecomorphic groups are clearly separated.

Node 18

Genus *Lasiolabops* is clearly separated from phylini and showed close affinity towards *Sthenaridea* which is well supported with bootstrap score in all three analyses (Fig. 54, node 18). The placement of *Lasiolabops* was transferred several time showing different morphological affinities. Carvalho (1958) considered it as Phylini, Schuh (1984) transferred it into Leucophoropterini and recently Menard and Schuh (2011) proposed this genus to be in Phylini. Therefore, it is realized that more sampling are required for making a clear decision on it.

Sthenaridea is recovered as monophyletic group with strong bootstrap support in all three analyses (Fig. 54, Table 8). The correlated characters proposed by Schuh (1984) are uniqueness of left paramere having enlarged posterior process, and simple tubular endosoma without secondary gonopore.

Nodes 19-21

Hypseloecus, is found monophyly with bootstrap value more than 50 (Fig. 54, node 19) in present analyses. Though this genus is not strongly myrmecomorphic in appearance but its genitalia is very similar to *Pherolepis* or *Pilophorus*.

The myrmecomerphic genus *Papuamimus,* is found with the clade of *Pilophorus* which have well supported bootstrap score (Fig 2, node 20) in present analyses. In contrast, this genus was previously defined within tribe Leucophoropterini by Schuh (1984) reporting the synapomorphic characters like: strongly sinuous lateral corial margins, reduced corium on anterior half region, slender and longer abdominal segment II, and abdominal two with striated areas laterally. Since, present analyses consist only a species of *Papuamius*, it is difficult of make a specific decision. Hence, additional samplings are suggested in future analyses.

Strongly myrmecomorphic group, genus *Pilophorus* is found paraphyletic due to presence of genera *Papuamimus* and *Pherolepis* within the clade (Fig. 54, node 20, 21). The Papuamimus is described above. In case of, genus *Pherolepis*, it has different appearance but their genital structure has strong affinity with *Pilophorus*. The characters suggested by Schuh (1984) for monophyly of Pilophorus are; weakly or strongly sinuous lateral corial margins, elevated and swollen posterior pronotal lobe, elongated face below eyes and eyes occupying less than 2/3 of height of head, curved antennal segment II, aggregated scale setae on hemelytron and metepimeron.

Therefore, present analyses argued the monophyly concept of the tribe Leucophoropterini, and Pilophorini but further insist to reconsider the placement with application of more sampling in analyses.

Conclusion

The present analyses used protein and ribosomal molecular data, which are aligned using MAFFT, and parsimony, maximum likelihood and Bayesian analyses to generate hypotheses on tribal relationships of Phylinae. The data presented have largely congruent with morphology based hypotheses that supports the monophyly of tribes Auricillocorini and Hallodapini, and non-monophyly of Phylini. Reverse to the hypothesis, Auricillocorini is highly supported at the basal position, appears as a sister group to all other tribes, whereas

Pilophorini as most derived group. Moreover, analyses suggest that *Teleorhinus* has close affinity to Phylini, whereas the monophyletic concept of Leucophoropterini and Pilophorini are not resolved. Therefore, it indicated that to improve the current analyses, additional taxa including as many genera as from different distribution region should be considered.

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Checklist of Phylinae in the Korean Peninsula

Subfamily Phylinae Douglas and Scott, 1865 애장님노린재아과 (8)

Hallodapini Van Duzee, 1916 꼬마장님노린재족 (10)

1) *Acrorrhinium inexpectatum* (Josifov, 1978) 산꼬마장님노린재 (12)

2) *Hallodapus centrimaculatus* (Poppius, 1914) 노랑무늬꼬마장님노린재 (15)

3) *H. linnavuori* Miyamoto, 1966 꼬마장님노린재 (16)

4) *H. pumilus* Horvath, 1901 대륙꼬마장님노린재 (18)

5) *Systellonotus malaisei* Lindberg, 1934 개미사돈장님노린재 (20)

Leucophoropterini Schuh, 1974 (21)

6) *Sejanus potanini* (Reuter, 1906) 고리버들장님노린재 (23)

Phylini Douglas and Scott, 1865 애장님노린재족 (24)

7) *Atomoscelis asiatica* (Josifov, 1979) 동방장님노린재 (28)

8) *Atractotomus morio* Sahlberg, 1883 사방장님노린재 (31)

9) *Atractotomoidea castanea* Yasunaga, 1999 (32)

10) *Campylomma annulicorne* (Signoret, 1865) 검은촉각장님노린재 (36)

11) *C. chinense* Schuh, 1984 (37)

12) *C. lividicorne* Reuter, 1912 독도장님노린재 (39)

13) *C. miyamotoi* Yasunaga, 2001 (40)

14) *Chlamydatus pulicarius* (Fallen, 1807) **큰사촌애장님노린재** (42)

15) *C. pullus* (Reuter, 1870) **사촌애장님노린재** (43)

16) *Compsidolon elaegnicola* Yasunaga, 2001 (45)

17) *C. salicellum* (Herrich-Schaeffer, 1841) **버들애장님노린재** (46)

18) *Euplagiognathus lividellus* (Kerzhner, 1979) (49)

19) *Europiella artemisiae* (Becker, 1864) (53)

20) *E. gilva* (Kulik, 1965) **고구려다리장님노린재** (56)

21) *E. kiritshenkoi* Kulik, 1975 (57)

22) *E. livida* (Reuter, 1906) **다리장님노린재** (59)

23) *E. miyamotoi* (Kerzhner, 1988) (60)

24) *Harpocera choii* Josifov, 1977 **최고려애장님노린재** (62)

25) *H. koreana* Josifov, 1977 **고려애장님노린재** (64)

26) *Kasumiphylus kyushuensis* (Linnavuori, 1961) **동해애장님노린재** (66)

27) *Macrotylus cruciatus* (Sahlberg, 1848) **이질풀큰애장님노린재** (68)

28) *M. mundulus* (Stal, 1858) **큰애장님노린재** (70)

29) *Moissonia befui* Yasunaga, 1999 (72)

30) *M. kalopani* Duwal and Lee, 2011 (73)

31) *M. yasunagai* Duwal and Lee, 2011 (75)

32) *Monosynamma bohemanni* (Fallen, 1826) (77)

33) *Orthonotus biccoloriceps* Kerzhner, 1988 **콘애장님노린재** (80)

34) *Orthophylus yongmuni* Duwal and Lee, 2011 (82)

35) *Parapsallus vitellinus* (Scholtz, 1847) **어리애장님노린재** (84)

36) *Phylus coryloides* Josifov et Kerzhner, 1972 **애장님노린재** (88)

37) *Phylus ingriscapsus* Kerzhner, 1988 **떡갈애장님노린재** (89)

38) *Pseudophylus stundjuki* (Kulik, 1973) (90)

39) *Plagiognathus amurensis* Reuter, 1883 **발해다리장님놀닌재** (94)

40) *Plagiognathus chrysanthemi* (Wolff, 1778) (97)

41) *Plagiognathus collaris* (Mastsumura, 1911) **쑥다리장님놀닌재** (98)

42) *Plagiognathus yomogi* Miyamoto, 1969 **닮은다리장님놀닌재** (100)

43) *Psallus* (*Apocremnus*) *aethiops* (zetterstedt, 1938) **버들우리장님노린재** (111)

44) *P.* (*A.*) *ater* Josifov, 1983 **나도우리장님노린재** (113)

45) *P.* (*A.*) *atratus* Josifov, 1983) **너도우리장님노린재** (115)

46) *P.* (*A.*) *betuleti* (Fallen, 1826) **박달우리장님노린재** (116)

47) *P*. (*A*.) *michaili* Kerzhner et Schuh, 1995 **검정우리장님노린재** (118)

48) *P*. (*Callopsallus*) *clarus* Kerzhner, 1988 **갈참우리장님노린재** (120)

49) *P*. (C.) *roseoguttatus* Yasunaga and Vinokurov, 2000 (122)

50) *P*. (*C*.) *tesongsanicus* Josifov, 1983) **대성산우리장님노린재** (124)

51) *P*. (*Hylopsallus*) *suwonanus* Duwal et al., 2012 (126)

52) *P*. (*H*.) *tonnaichanus* Muramoto, 1973 **해동우리장님노린재** (127)

53) *P*. (*Mesopsallus*) *samdzijonicus* Josifov, 1983) **삼지연우리장님노린재** (130)

54) *P*. (*Phylidea*) *castanea* Josifov, 1983 **밤우리장님노린재** (132)

55) *P*. (*Ph*.) *cinnabarinus* Kerzhner, 1972) (134)

56) *P*. (*Ph*.) *flavescens* Kerzhner, 1988 (136)

57) *P*. (*Ph*.) *ernsti* Duwal et al., 2012 (137)

58) *P*. (*Ph*.) *kerzhner* Josifov, 1992 **참우리장님노린재** (139)

59) *P*. (*Ph*.) *loginovae* Kerzhner, 1988 (140)

60) *P*. (*Ph*.) *ulmi* Kerzhner et Josifov, 1966 **느릅우리장님노린재** (142)

61) *P*. (*Pityopsallus*) *kimi* Josifov, 1983 **김우리장님노린재** (144)

62) *P*. (*Pt*.) *luridus* Reuter, 1878 **어리김우리장님노린재** (146)

63) *P*. (*Pt*.) *vittatus* (Fieber, 1861) **줄김우리장님노린재** (147)

64) *P*. (*Psallus*) *ameonus* Josifov, 1983 **발해우리장님노린재** (149)

65) *P*. (*P*.) *bagjonicus* Josifov, 1983 **북한우리장님노린재** (150)

66) *P*. (*P*.) *choengtaensis* Duwal et al., 2012 (152)

67) *P*. (*P*.) *koreanus* Josifov, 1983 **우리장님노린재** (154)

68) *P*. (*P*.) *sanguinarius* Josifov, 1999 **진우리장님노린재** (155)

69) *Rubrocuneocoris quercicola* Josifov, 1987 **참나무장님노린재** (157)

70) *Tytthus chinensis* (Stal, 1859) **중국장님노린재** (159)

Pilophorini Douglas and Scott, 1876 **표주박장님노린재족** (160)

71) *Pherolepis amplus* Kulik, 1968 **어리표주박장님노린재** (163)

72) *P*. *fasciatus* (Kerzhner, 1970) **느릅표주박장님노린재** (164)

73) *P*. *kiritshenkoi* (Kerzhner, 1970) (165)

74) *Pilophorus choii* Josifov, 1978 **최표주박장님노린재** (169)

75) *P*. *clavatus* (Linnaeus, 1767) **대륙표주박장님노린재** (170)

76) *P*. *erraticus* Linnavuori, 1962 **평양표주박장님노린재** (172)

77) *P*. *koreanus* Josifov, 1978 **우리표주박장님노린재** (174)

78) *P*. *lucidus* Linnavuori, 1962 **오리표주박장님노린재** (175)

79) *P. miyamotoi* Linnavuori, 1961 **솔표주박장님노린재** (177)

80) *P. niger* Poppius, 1914 **큰검정표주박장님노린재** (178)

81) *P. okamotoi* Miyamoto and Lee, 1966 **참표주박장님노린재** (180)

82) *P. pseudoperplexus* Josifov, 1987 **별표주박장님노린재** (181)

83) *P. setulosus* Horvath, 1905 **털표주박장님노린재** (182)

84) *P. typicus* (Distant, 1909) **검정표주박장님노린재** (184)

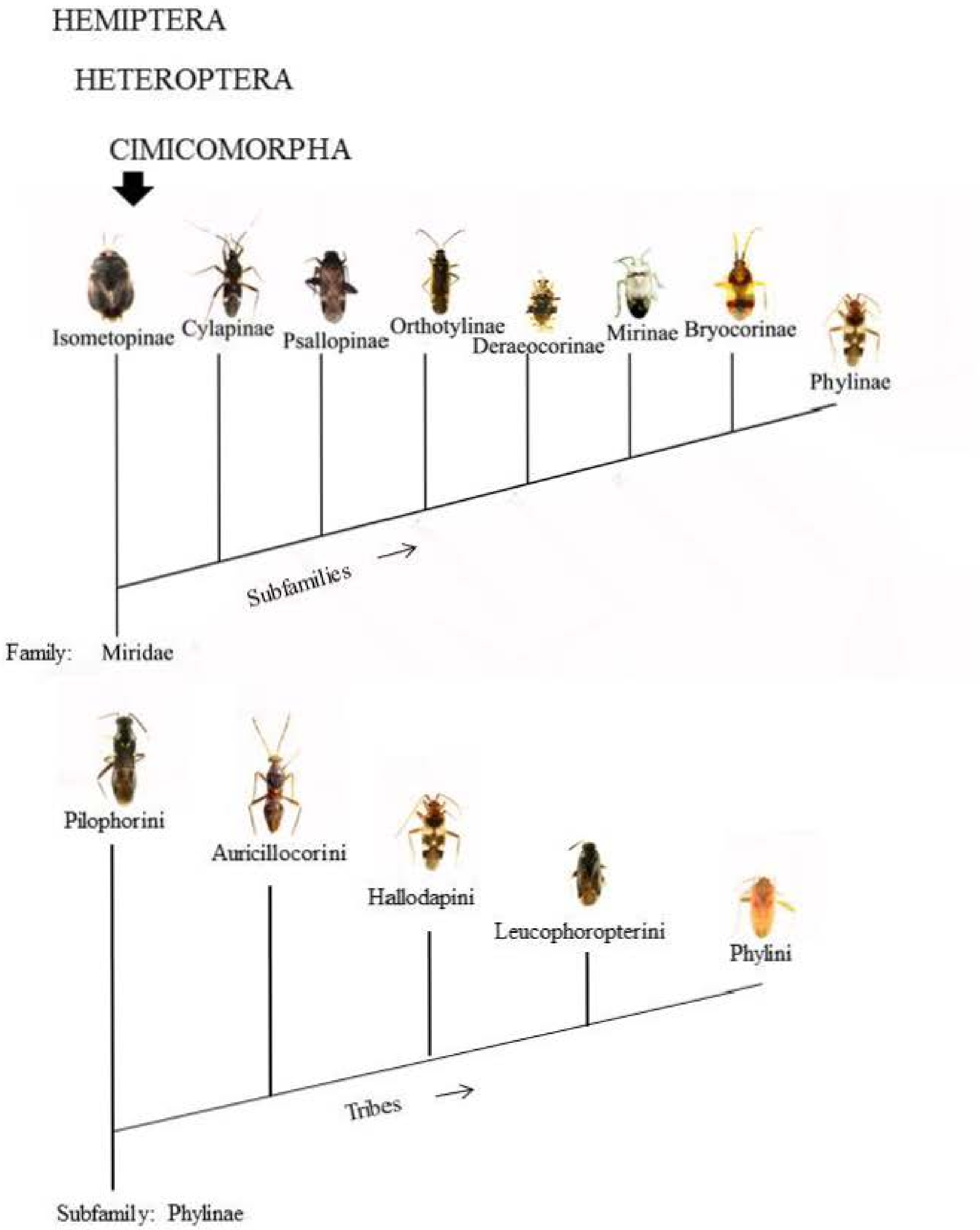

Fig. 1. Taxonomic position of the subfamily Phylinae (Douglas and Scott, 1865).

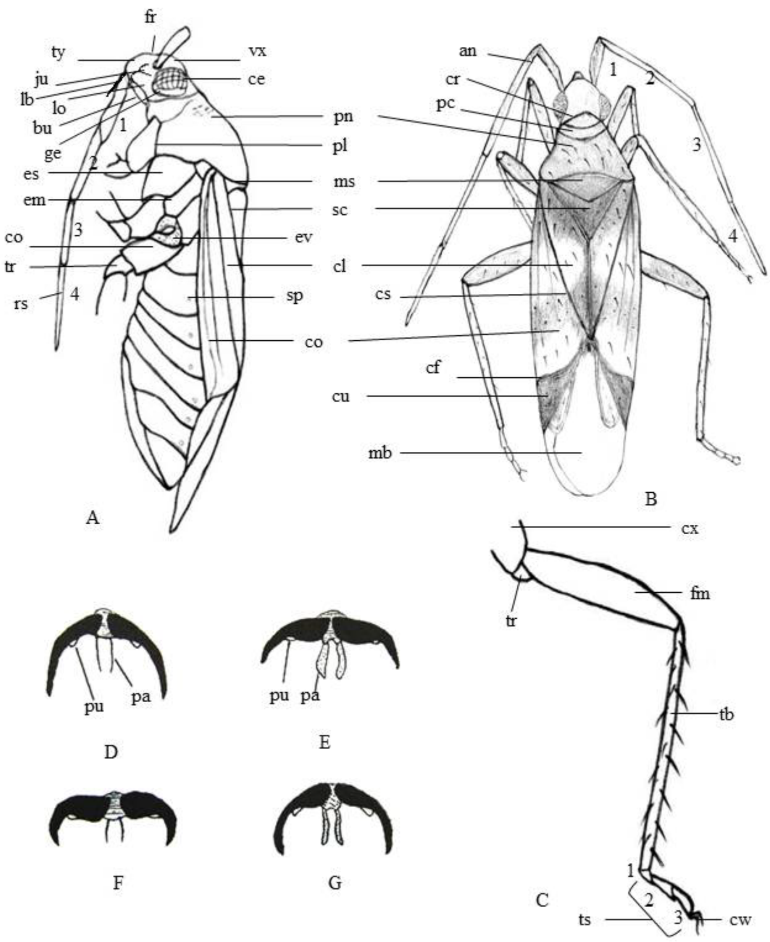

Fig. 2. General morphology of Phylinae. A-C. *Hallodapus albofasciatus*. D. *Atractotomus morio*. E. *Brachyarthrum limitatum*. F. *Psallus pullus*. G. *Moissonia punctata*. A. Lateral view. B. Dorsal view. C. Leg. D-G. Pretarsal structures (Figs of pretarsus:Yasunaga, 2001a).

Abbreviations: an: antenna, bu: buccula, ce: compound eye, cf: cuneal fracture, cl: clavus, co: corium, cr: carina, cs: claval suture, cu: cuneus, cw: claw, cx: coxa, em: embodium, em: epimeron, es: episternum, ev: evaporative area, fm: femur, fr: frons, ge: gena, ju: jugum, lb: labrum, lo: lorum (=maxillary plate), mb: membrane, mm: mesoscutum, pa: parempodia, pc: pronotal collar, pl: propleuron, pm: paramere, pn: pronotum, pu: pulvilli; rs: rostrum, sc: scutellum, sp: spiracle, tb: tibia, ts: tarsus, ty: tylus, vx: vertex.

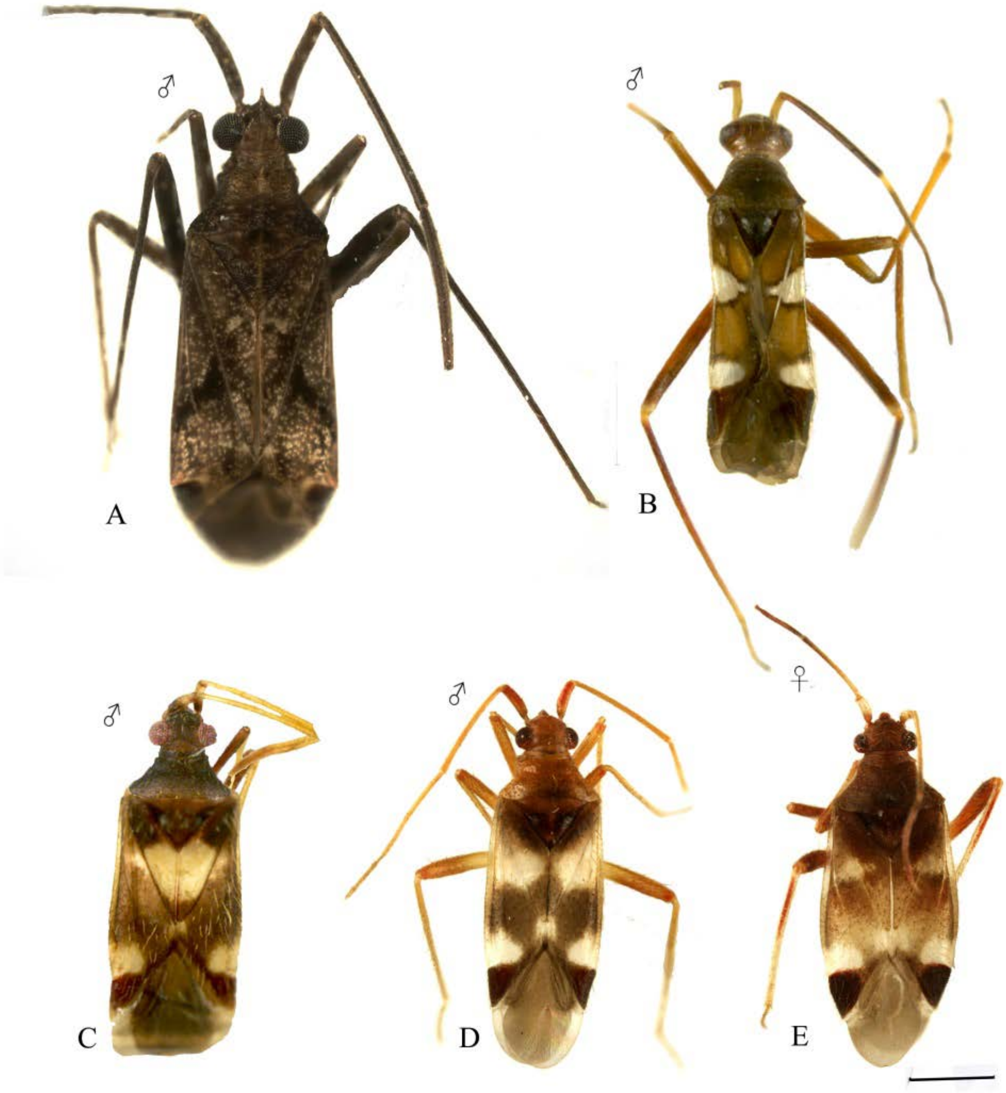

Fig. 3. Dorsal habitus of tribe Hallodapini. A. *Acrorrhinium inexpectatum*. B. *Systellonotus malaise*. C. *Hallodapus centrimaculatus*. D. *H. linnavuori*. E. *H. pumillus*. Scale bars: 0.5mm.

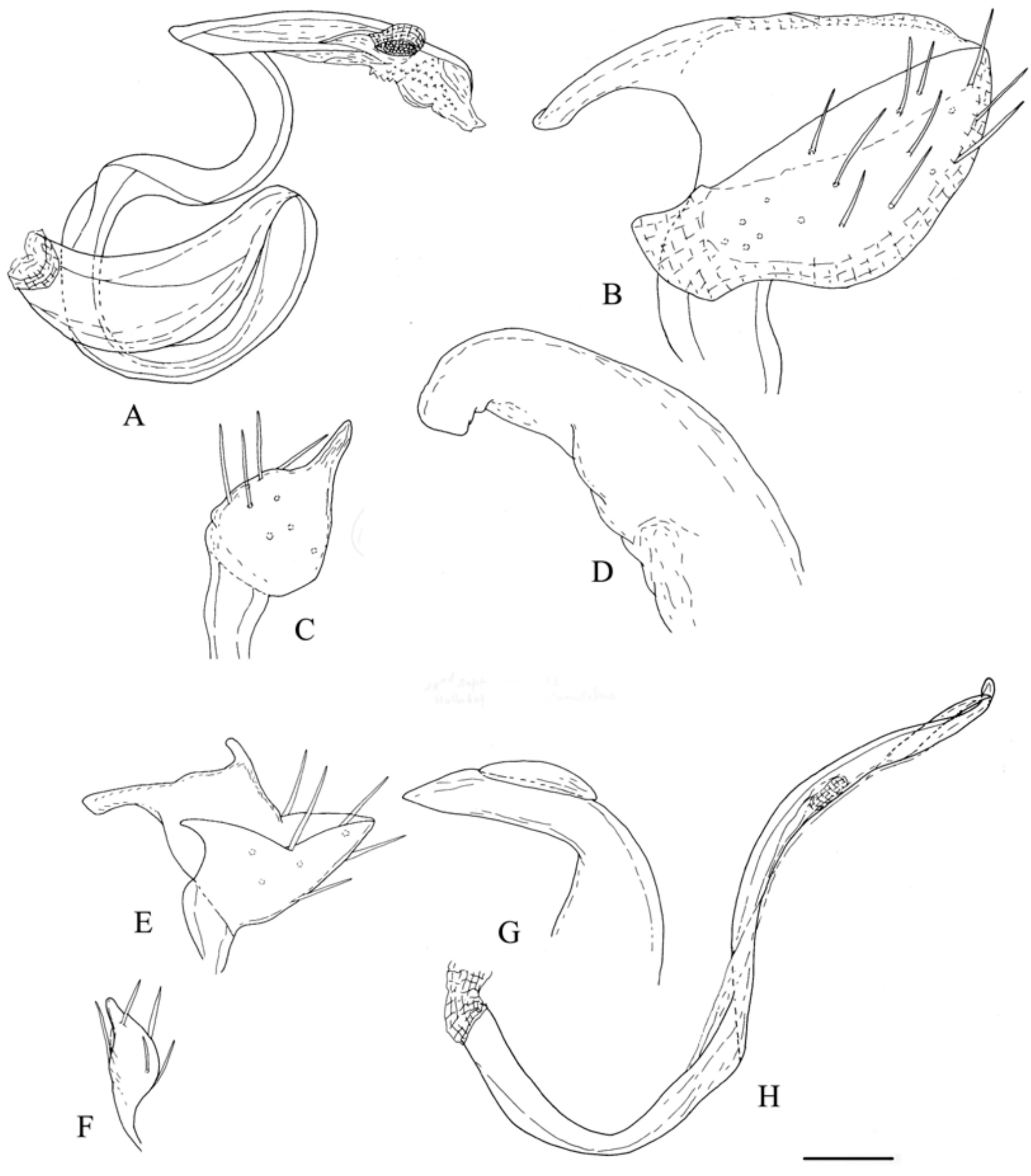

Fig. 4. Male genitalia of tribe Hallodapini. A-D. *Acrorrhinium inexpectatum*. E-H. *Hallodapus centrimaculatus*. A, H. Endosoma. B, E. Left paramere. C, F. Right paramere. D, G.Phallotheca. Scale bar: 0.1mm.

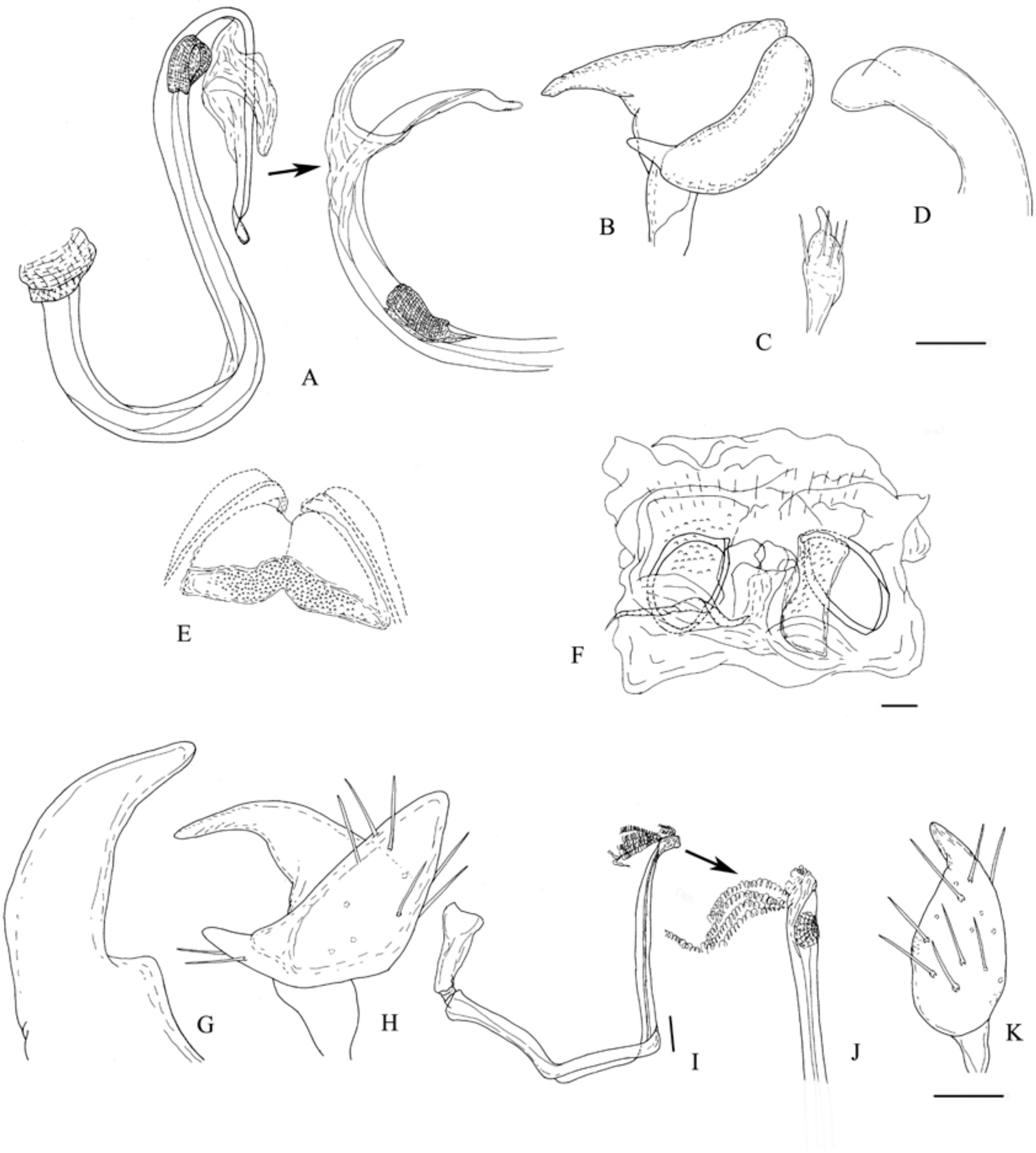

Fig. 5. Genital structures of tribe Hallodapini. A-D. *Hallodapus linnavuori*. E-F. *H. pumillus*. G-K. *Systellonotus malaise*. A-D, G-K. Male genitalia. E-F. Female genitalia. A, I-J. Endosoma. B, H. Left paramere. C, K. Right paramere. D, G. Phallotheca. E. Posteriora wall. F. Bursa copulatrix (Dorsal labiate plate). Scale bar: 0.1mm.

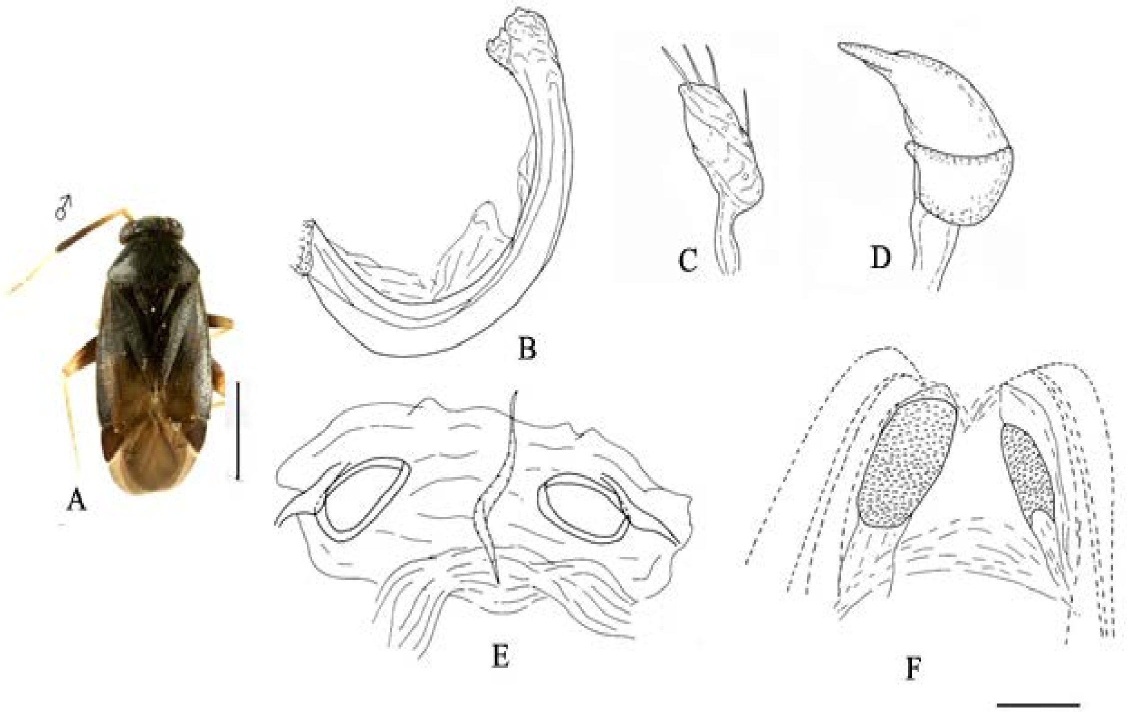

Fig. 6. Dorsal habitus and genital structures of *Sejanus potanini*. A-C. Male genitalia. D-E. Female genitalia. A. Endosoma. B. Right paramere. C. Left paramere. D. Bursa copulatrix. E. Posterior wall. Scale bar: dorsal: 0.5, genital structure: 0.1.

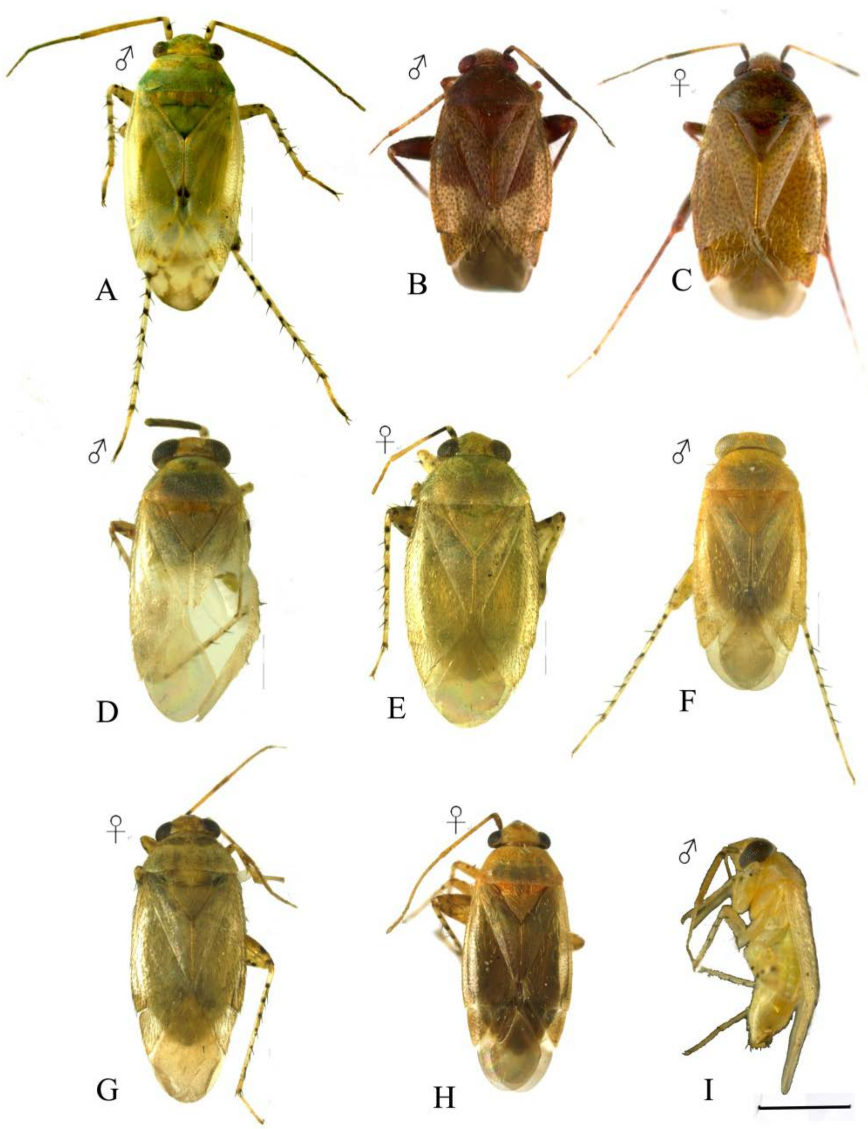

Fig. 7. Dorsal Habitus of tribe Phylini. Scale bar: A. *Atomoscelis asiatica*. B-C. *Atractotomoidea castanea*. D-E. *Campylomma annulicorne*. F. *C. lividicorne*. G. *C. miyamotoi*. H-I. *C. chinense*. 0.5mm.

Fig. 8. Genital structures of Phylini. A-E. *Atomoscelis asiatica*. F-J. *Atractotomoidea castanea*. A, F. Endosoma. B, H. Left paramere. C, I. Phallotheca. D, G. Right paramere. E, J. Bursa copulatrix. Scale Bar: 0.1mm.

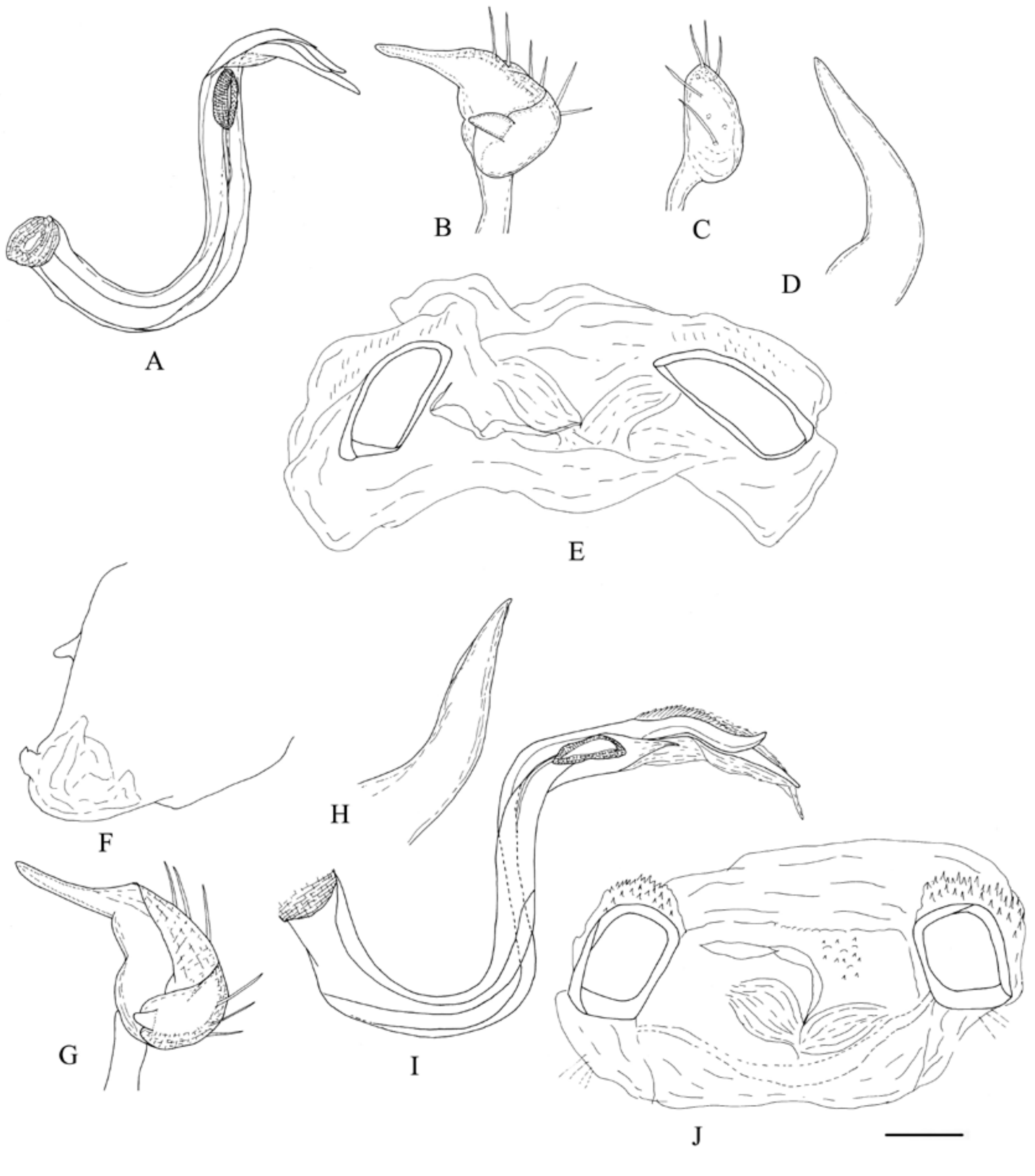

Fig. 9. Genital structures of Phylini. A-E. *Campylomma annulicorne*. F-J. *C. chinense*. A, I. Endosoma. B, G. Left paramere. C. Right paramere. D, H. Phallotheca. F. Pygohore. E, J. Bursa copulatrix. Scale bar: 0.1mm.

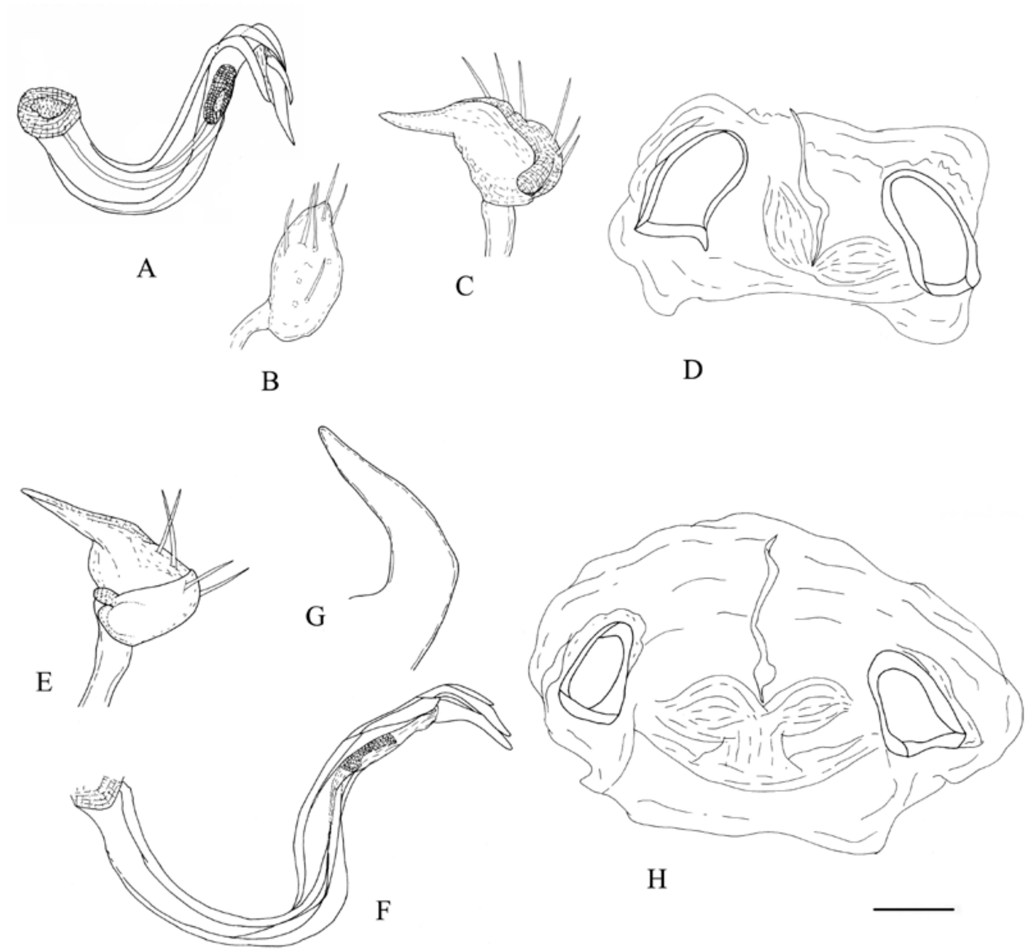

Fig. 10. Genital structures of Phylini. A-D. *Campylomma lividicorne*. E-H. *C. miyamotoi*. A, F. Endosoma. B. Right paramere. C, E. Left paramere. G. Phallotheca. D, H. Bursa copulatrix. Scale bar: 0.1mm.

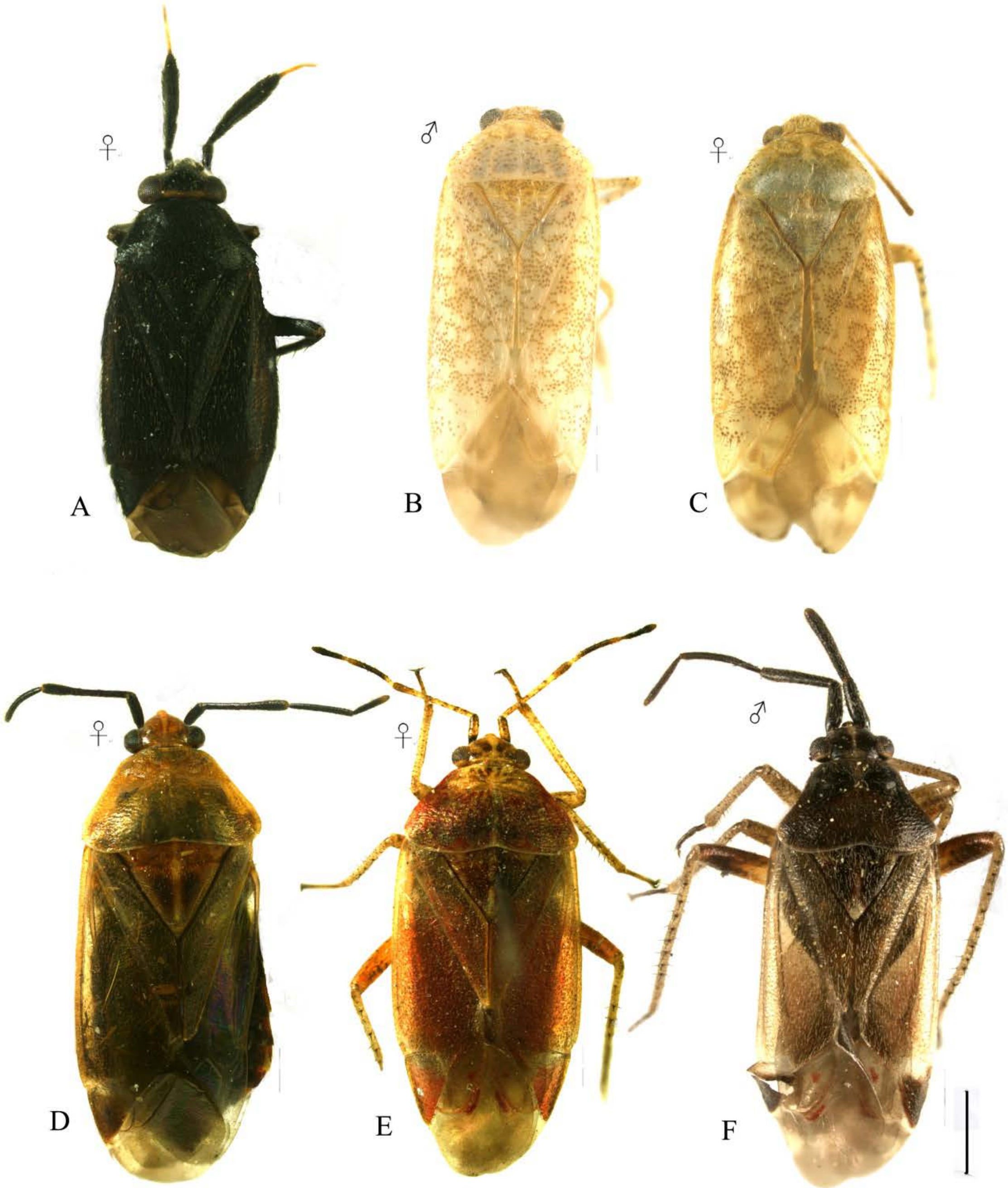

Fig. 11. Dorsal habitus of Phylini. A. *Atractotomus morio*. B-C. *Compsidolon elaegnicola*. D. *Harpocera choii*. E-F. *H. koreana*. Scale bar: 0.5mm.

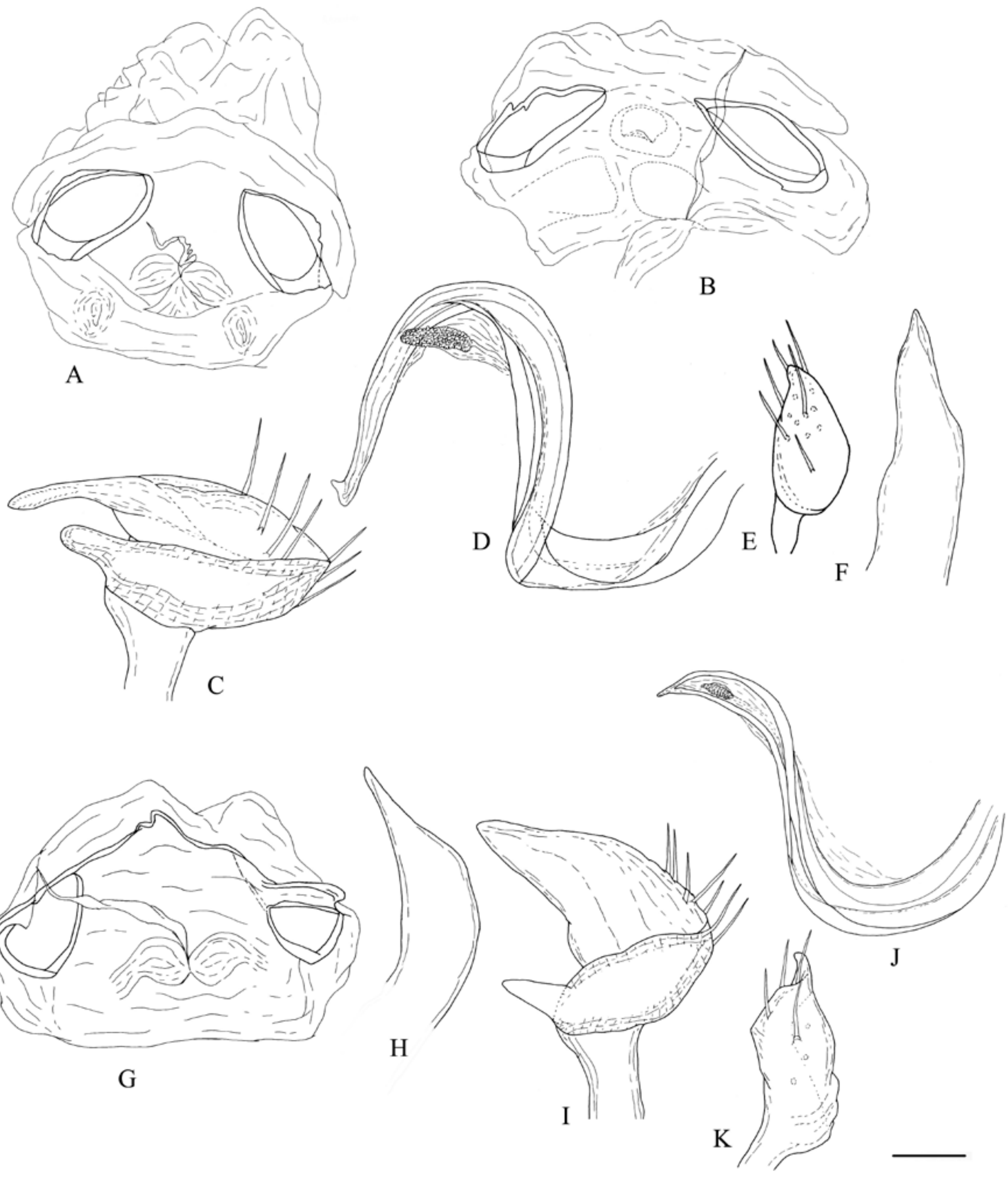

Fig. 12. Genital structure of Phylini. A. *Atactotomoidea morio*. B-F. *Compsidolon salicellum*. G-K. *Harpocera koreana*. A, B, G. Bursa copulatrix. C, I. Left paramere. D, J. Endosoma. E, K. Right paramere. F, H. Phallotheca. Scale bar: 0.1mm.

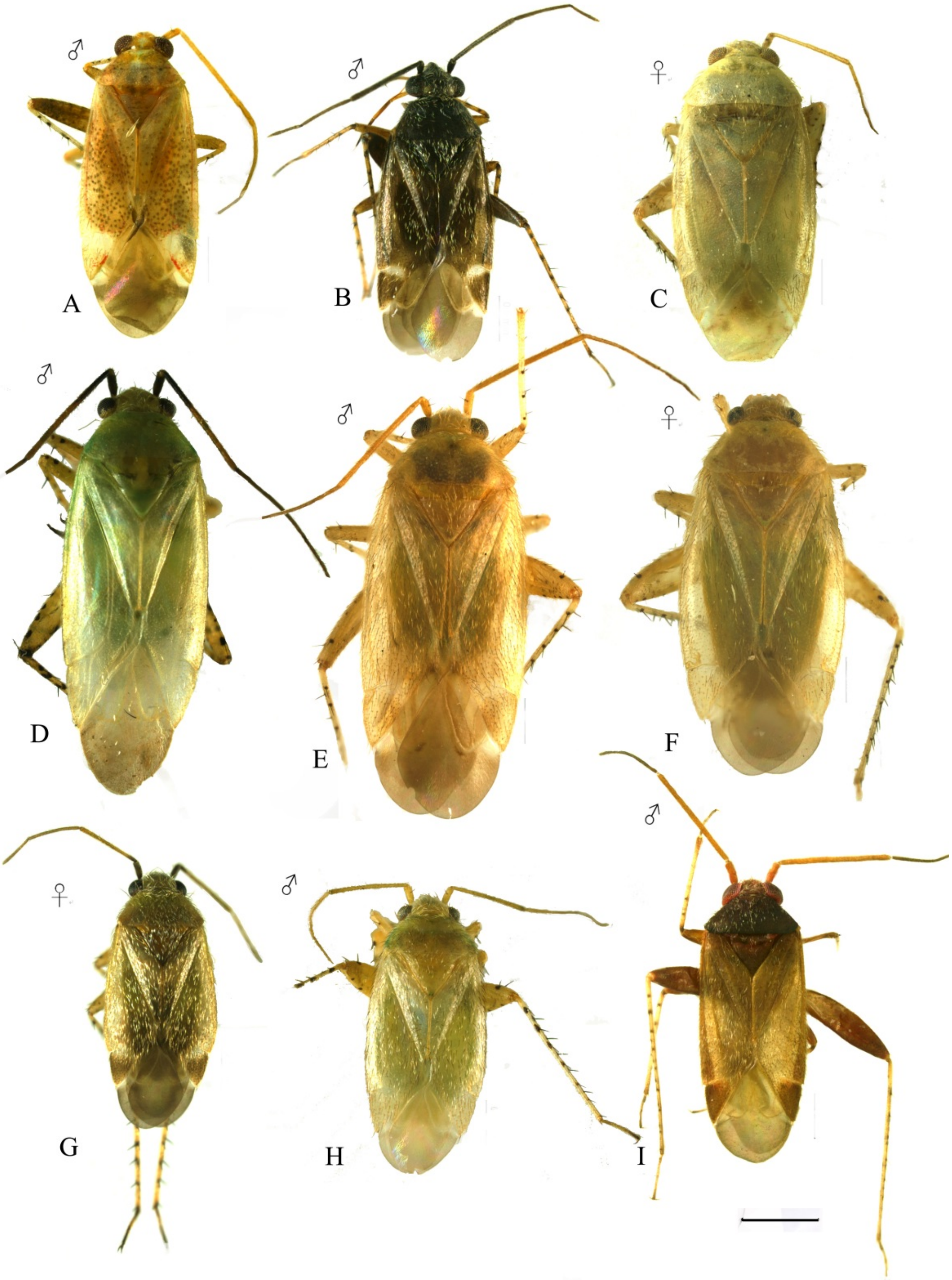

Fig. 13. Dorsal habitus of Phylini. A. *Compsidolon salicellum*. B. *Europiella artemisiae*. C. *E. gilva*. D. *E. kiritshenkoi*. E-F. *E. miyamotoi*. G. *E. livida*. H. *Euplagiognathus n. gen*. I. *Kasumiphylus kyushuensis*. Scale bar: 0.5mm.

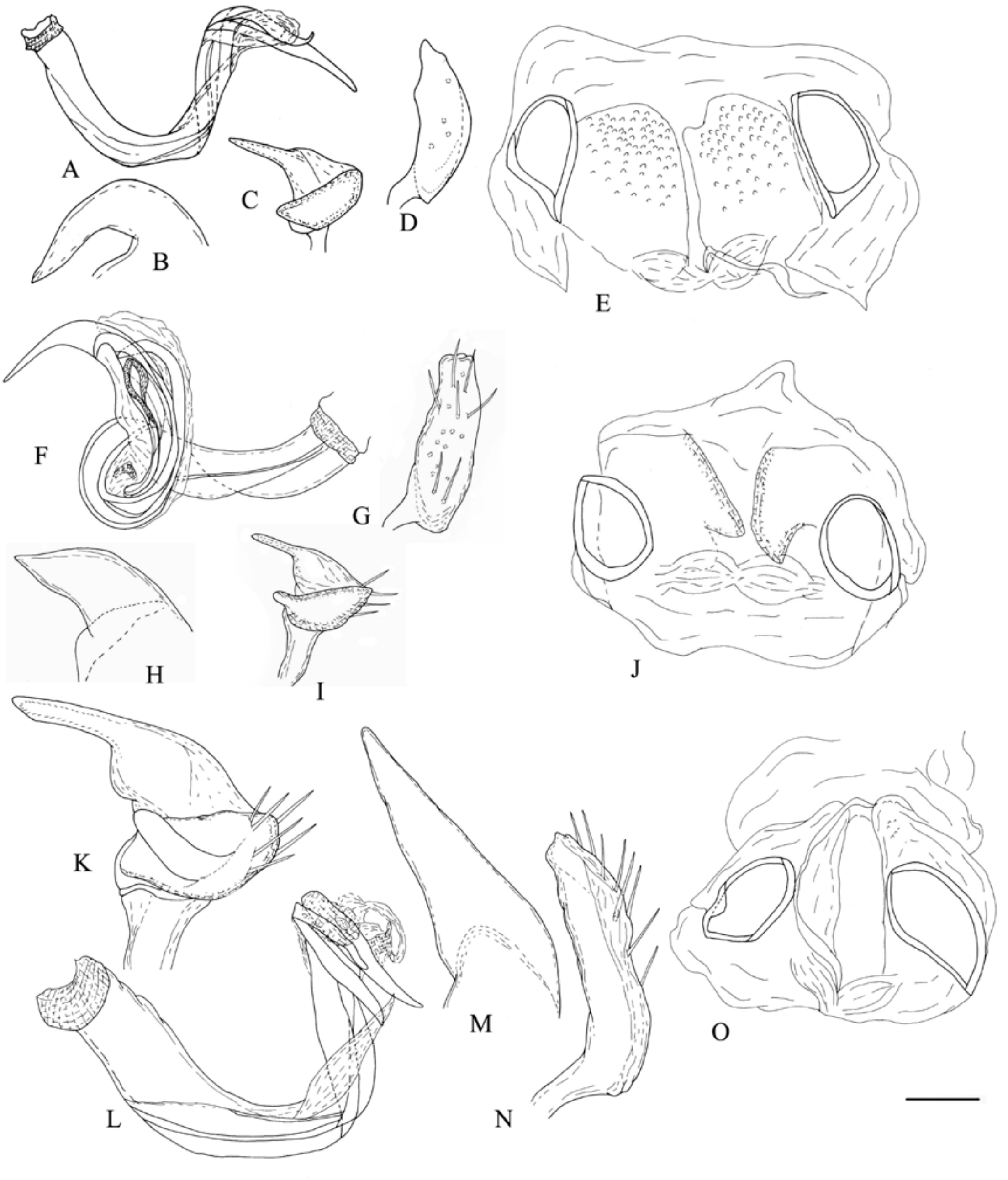

Fig. 14. Genital structure of Phylini. A-E. *Europiella artemisiae*. F-J. *E. kiritshenkoi*. K-O. *E. miyamotoi*. A, F, L. Endosoma. B, H, M. Phallotheca. C, I, K. Left paramere. D, G, N. Right paramere. E, J, O. Bursa copulatrix. Scale bar: 0.1mm.

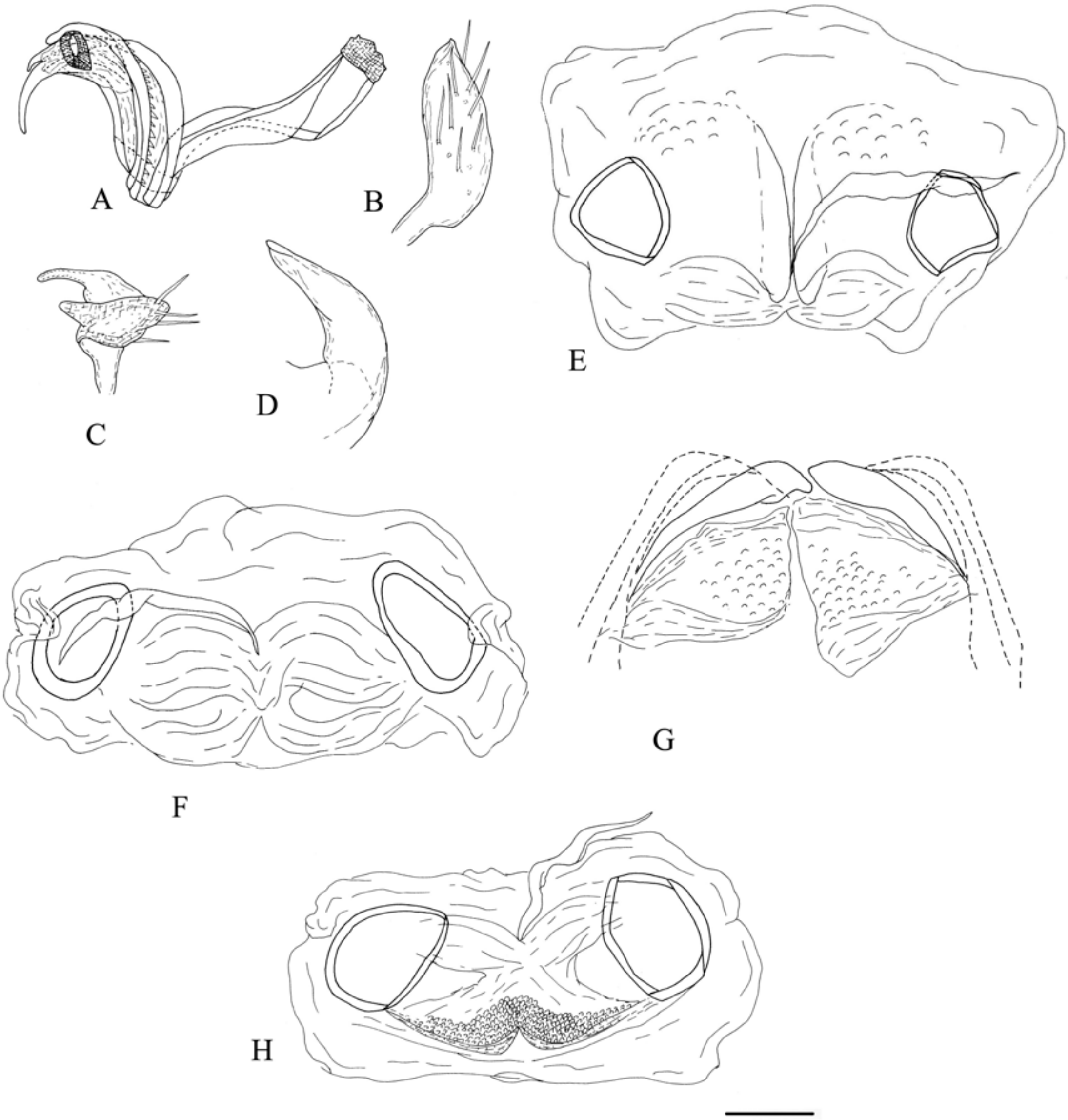

Fig. 15. Genital structures of Phylini. A-E. *Euplagiognathus lividella*. F-G. *Europiella livida*. H. *E*. *gilva*. A. Endosoma. B. Right paramere. C. Left paramere. D. Phallotheca. E, F, H. Bursa copulatrix. G. Posterior wall.

Fig. 16. Dorsal habitus of Phylini. A-B. *Macrotylus cruciatus*. C. *Orthophylus youngmuni*. D. *Moissonia befui*. E. *M. kalopani*. F. *M. yasunagai*. Scale bar. 0.5mm.

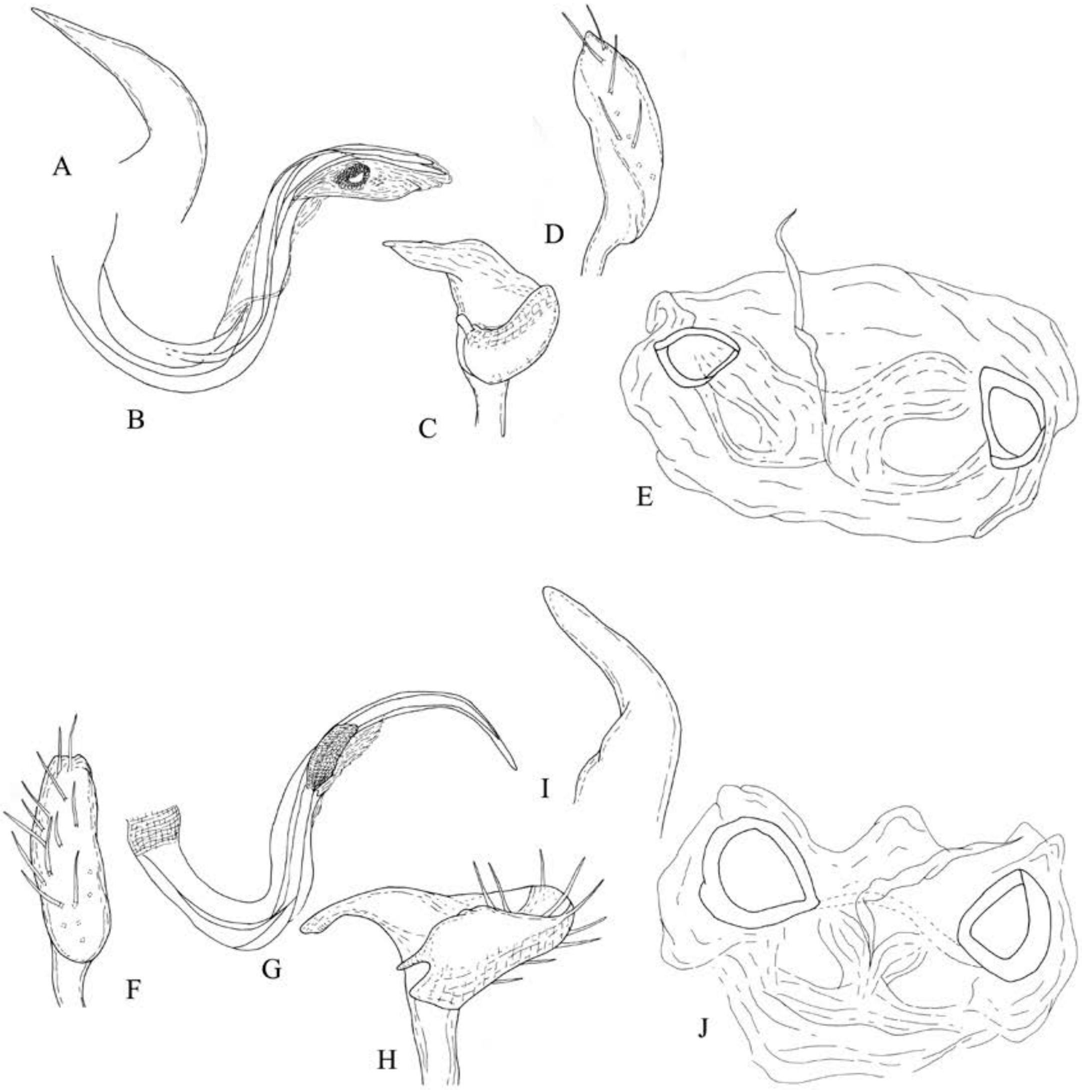

Fig. 17. Genital structure of Phylini. A-E. *Kasumiphylus kyushuensis*. F-J. *Macrotylus cruciatus.* A, I. Phallotheca. B, G. Endosoma. C, H. Left paramere. D, F. Right paramere. E, J. Bursa copulatrix. Scale bar: 0.1mm.

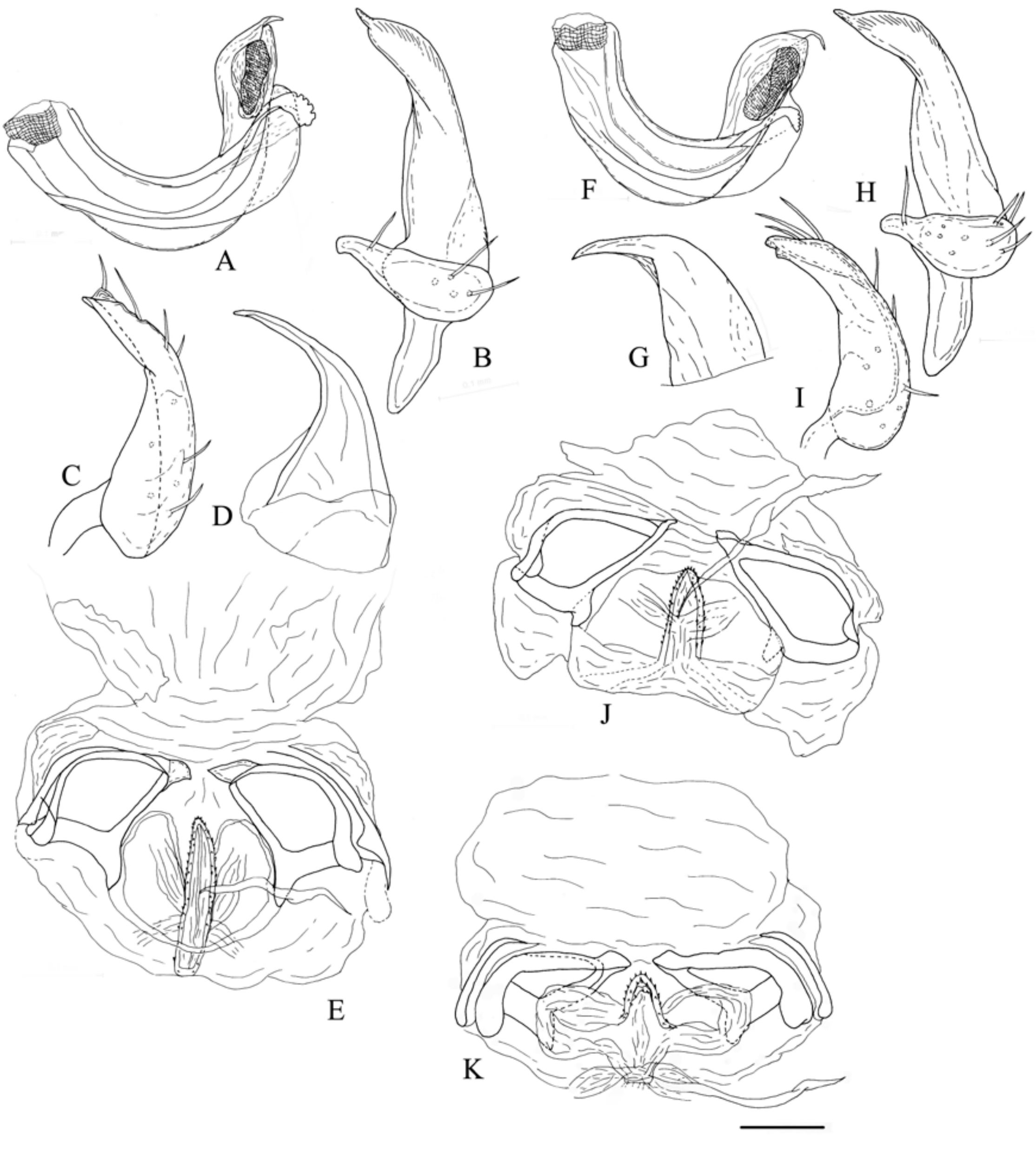

Fig. 18. Genital structures of Phylini. A-E. *Moissonia kalopani*. F-J. *M. yasunagai*. K. *M. befui*. A, F. Endosoma. B, H. Left paramere. C, I. Right paramere. D, G. Phallotheca. E, J, K. Bursa copulatrix. Scale bar: 0.1mm.

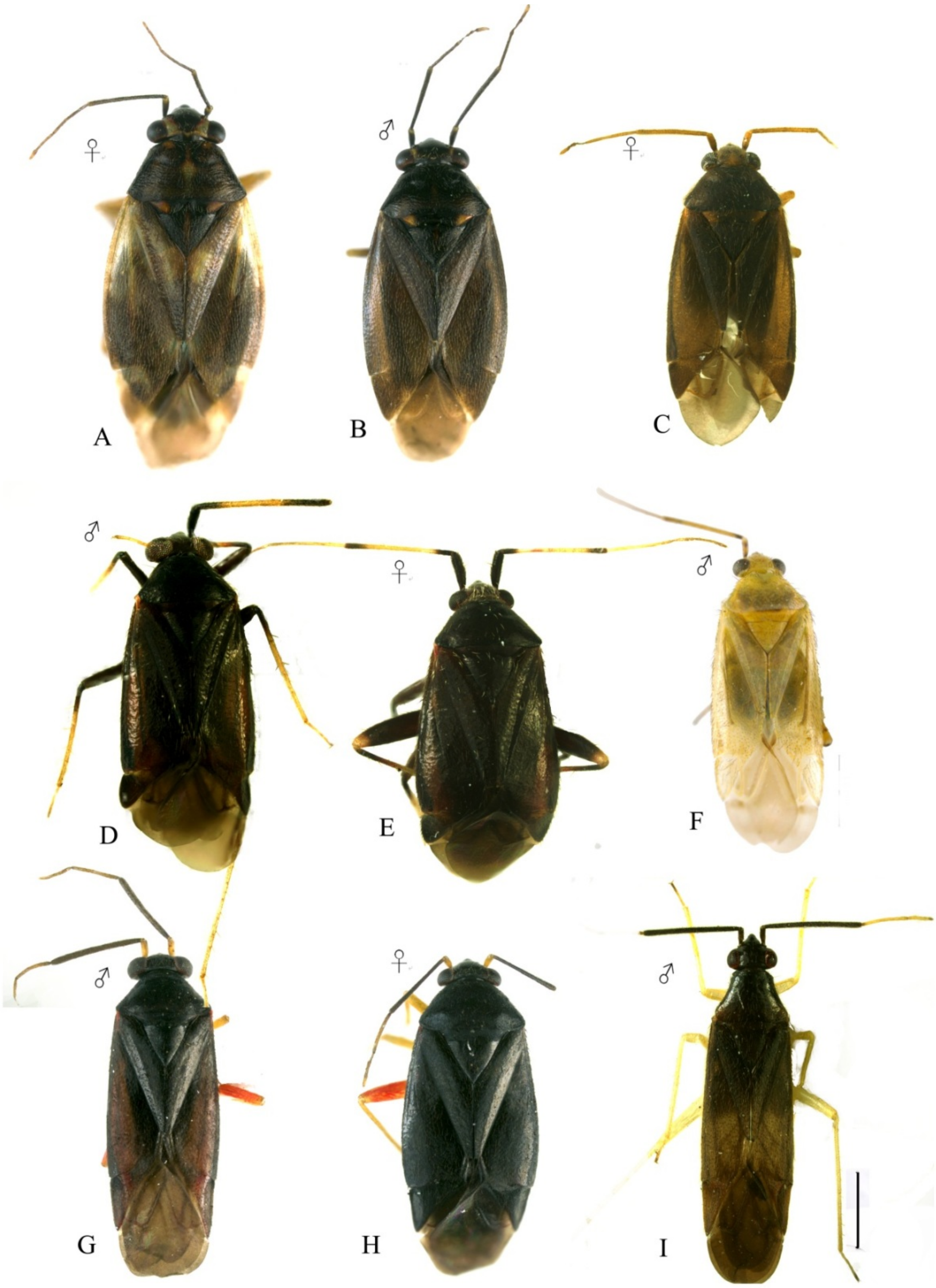

Fig. 19. Dorsal habitus of Phylini. A-B. *Monosynamma bohemanni*. C. *Parapsallus vitellinus*. D-E. *Orthonotus bicoloriceps*. F. *Plagiognathus chrysanthemi*. G-H. *Pseudophylus stundjuki*. I. *Phylus coryloides*. Scale bar: 0.5mm.

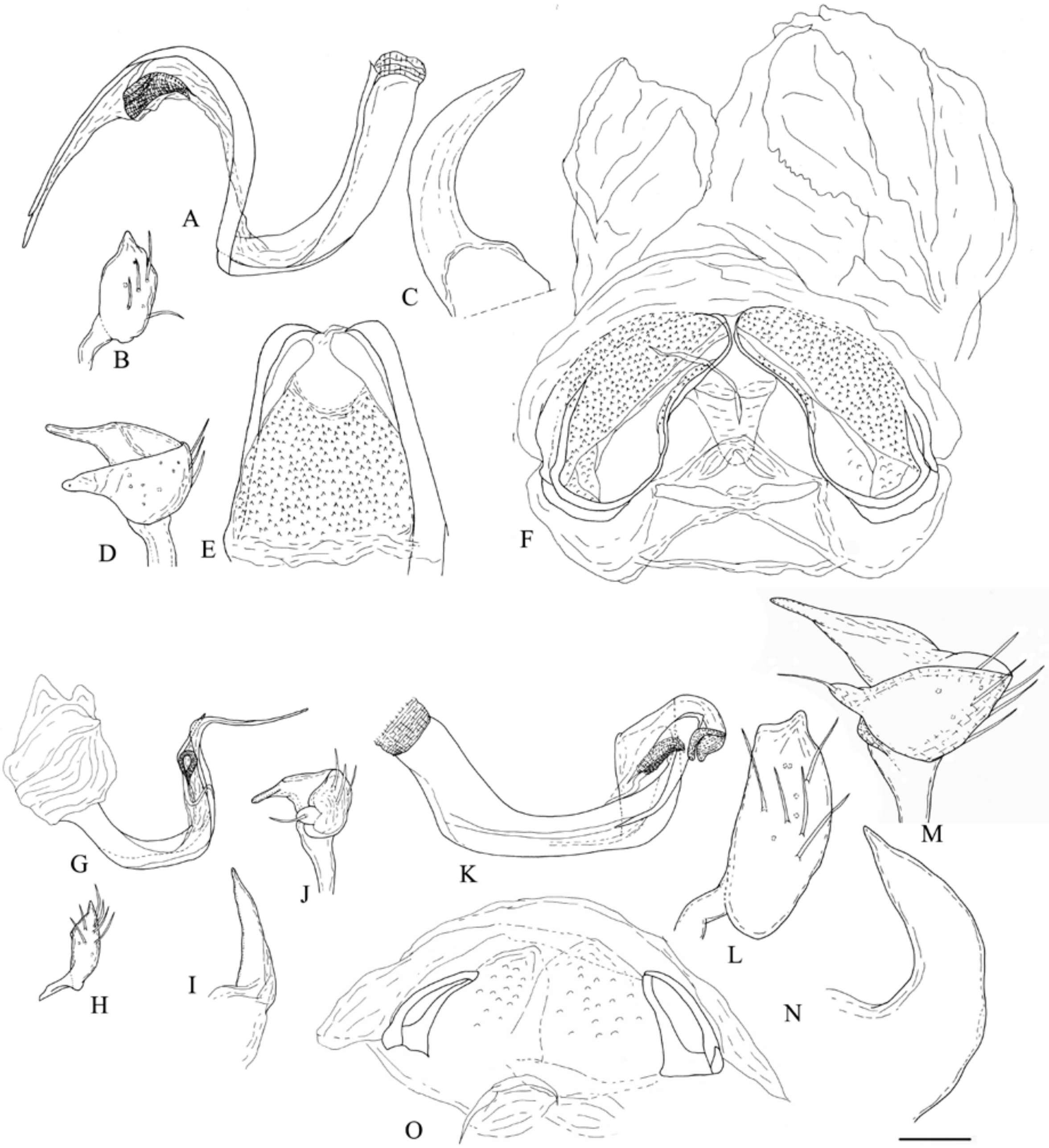

Fig. 20. Genital structures of Phylini. A-F, *Monosynamma bohemanni*. G-J. *Orthophylus yongmuni*. K-O. *Orthonotus bicoloriceps*. A, G, K. Endosoma. B, H, L. Right paramere. C, I, N. Phallotheca. D, J, M. Left paramere. E. Posterior wall. F, O. Bursa copulatrix. Scale bar: 0.1mm.

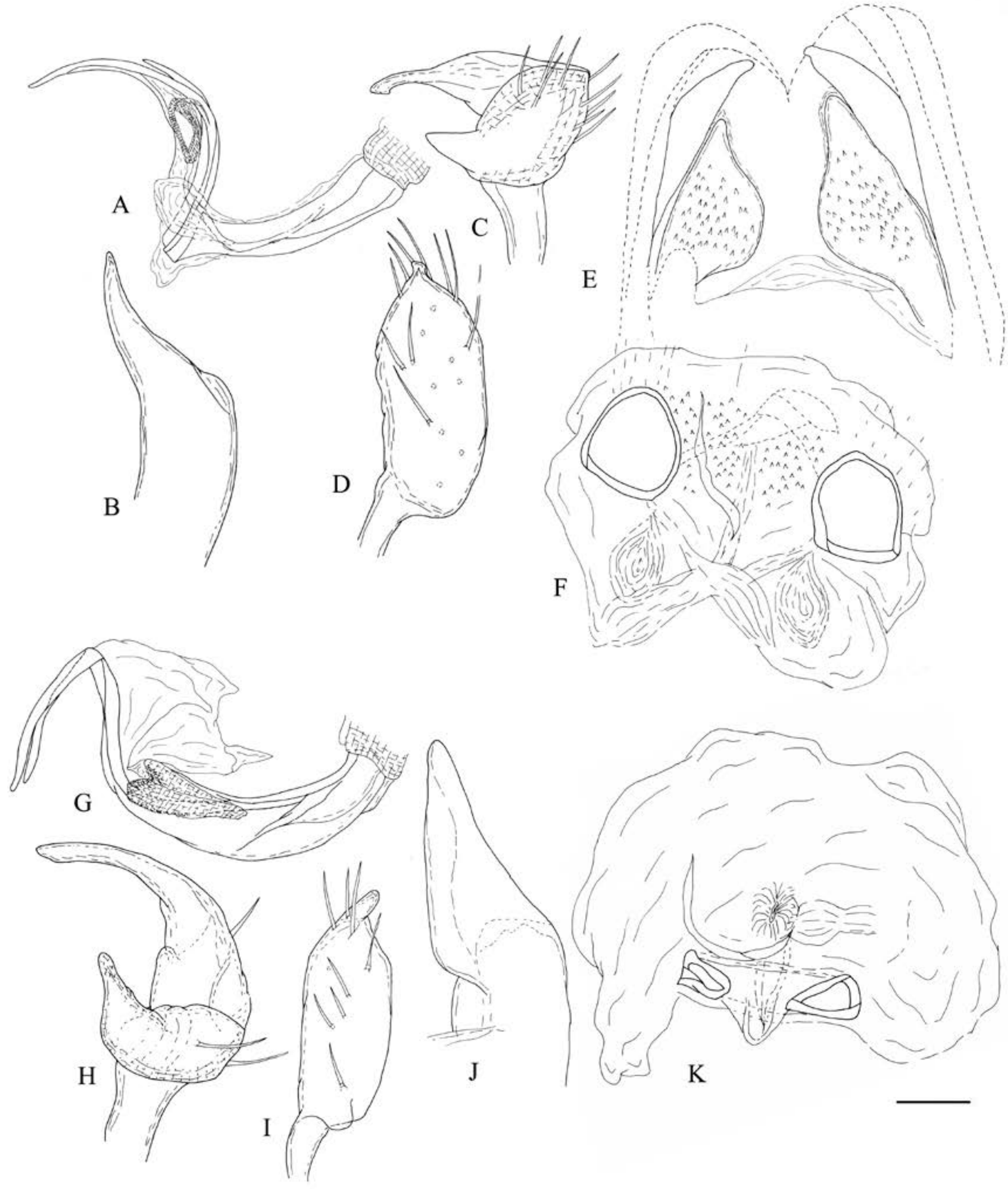

Fig. 21. Genital structures of Phylini. A-F. *Parapsallus vitellinus*. G-K. *Phylus coryloides*. A, G. Endosoma. B, J. Phallotheca. C, H. Left paramere. D, I. Right paramere. E. Posterior wall. F, K. Bursa copulatrix. Scale bar: 0.1 mm.

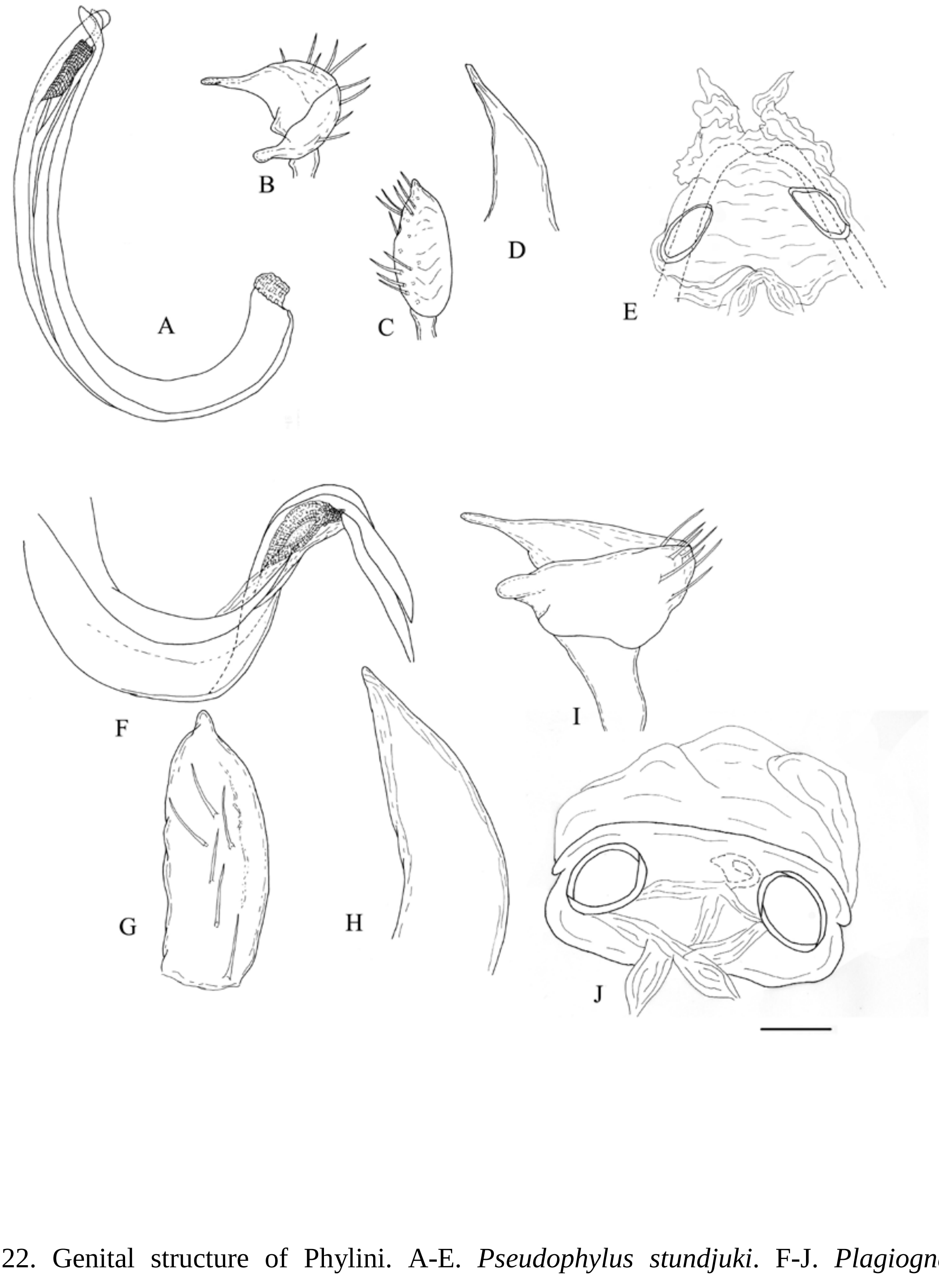

Fig. 22. Genital structure of Phylini. A-E. *Pseudophylus stundjuki*. F-J. *Plagiognathus chrysanthemi*. A, F. Endosoma. B, I. Left paramere. C, G. Right paramere. D, H. Phallotheca. E, J. Bursa copulatrix. Scale bar: 0.1mm

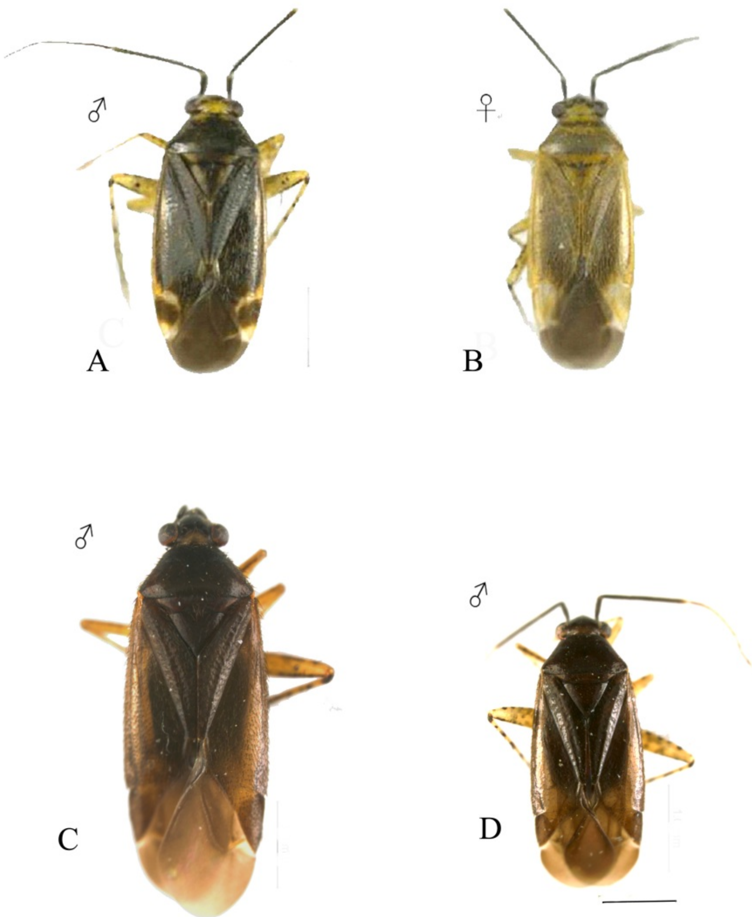

Fig. 23. Dorsal habitus of Phylini. A. *Plagiognathus amurensis*. B. *P*. *collaris*. D. *P*. *yomogi*.

Scale bar: 0.5mm.

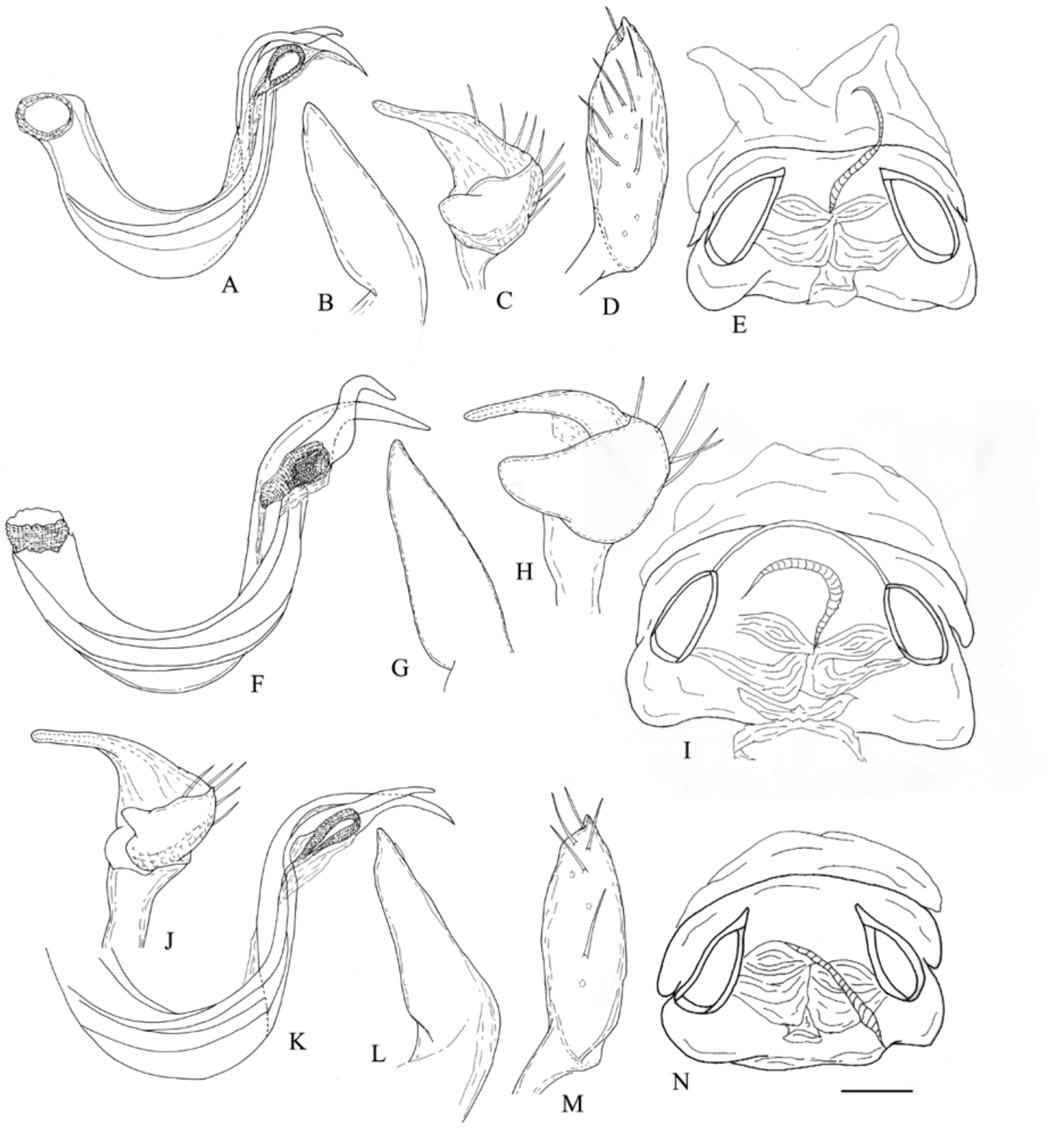

Fig. 24. Genital structures of Phylini. A-E. *Plagiognathus amurensis*. F-I. *P*. *collaris*. J-N. *P*. *yomogi*. A, F, K. Endosoma. B, G, L. Phallotheca. C, H, J. Left paramere. D, M. Right paramere. E, I, N. Bursa copulatrix. Scale bar: 0.1mm.

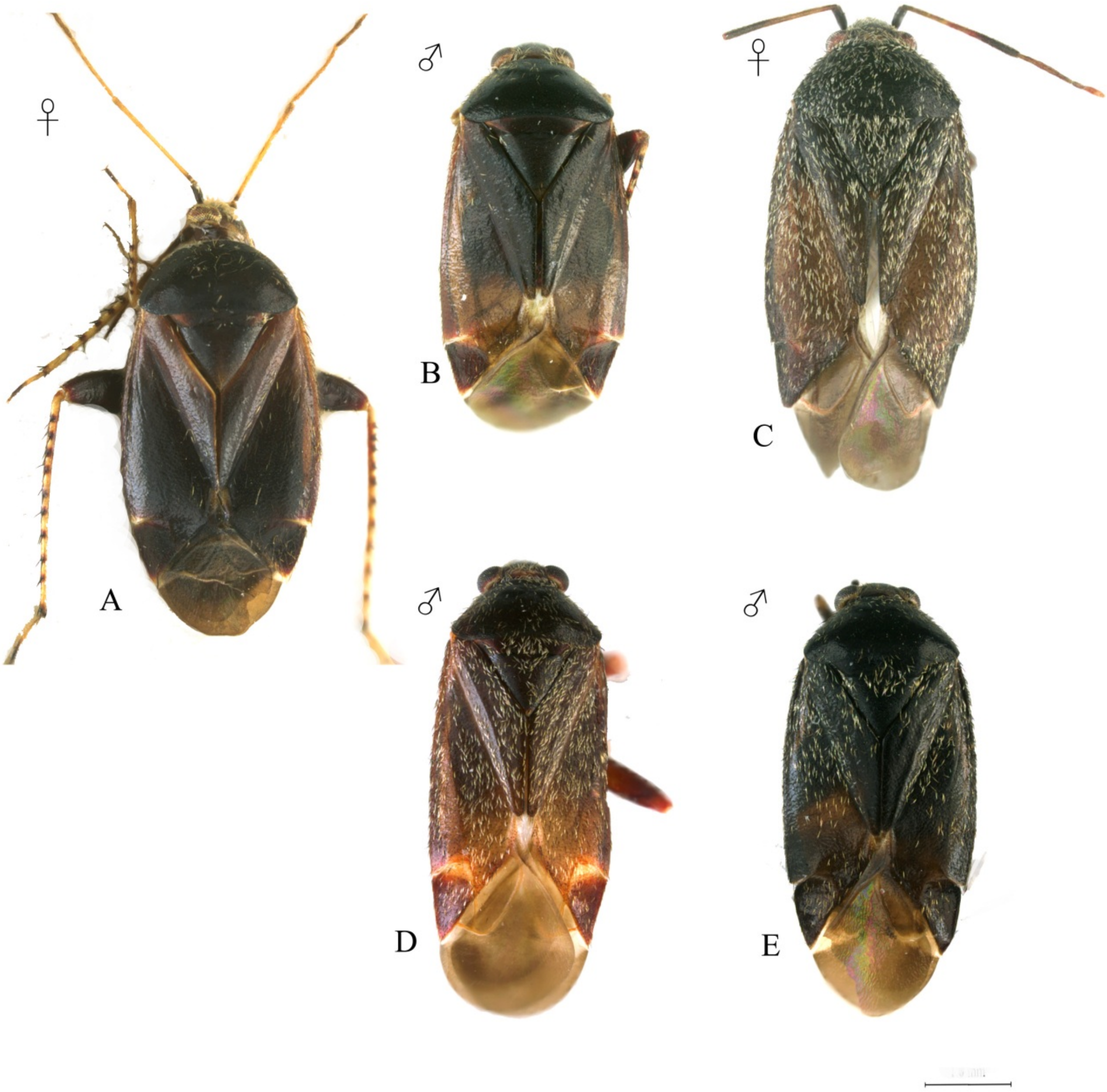

Fig. 25. Dorsal habitus of Phlini. A-B. *Psallus ater*. C. *P*. *atratus*. D. *P*. *betuleti*. E. *P*. *michaili*. Scale bar: 0.5mm.

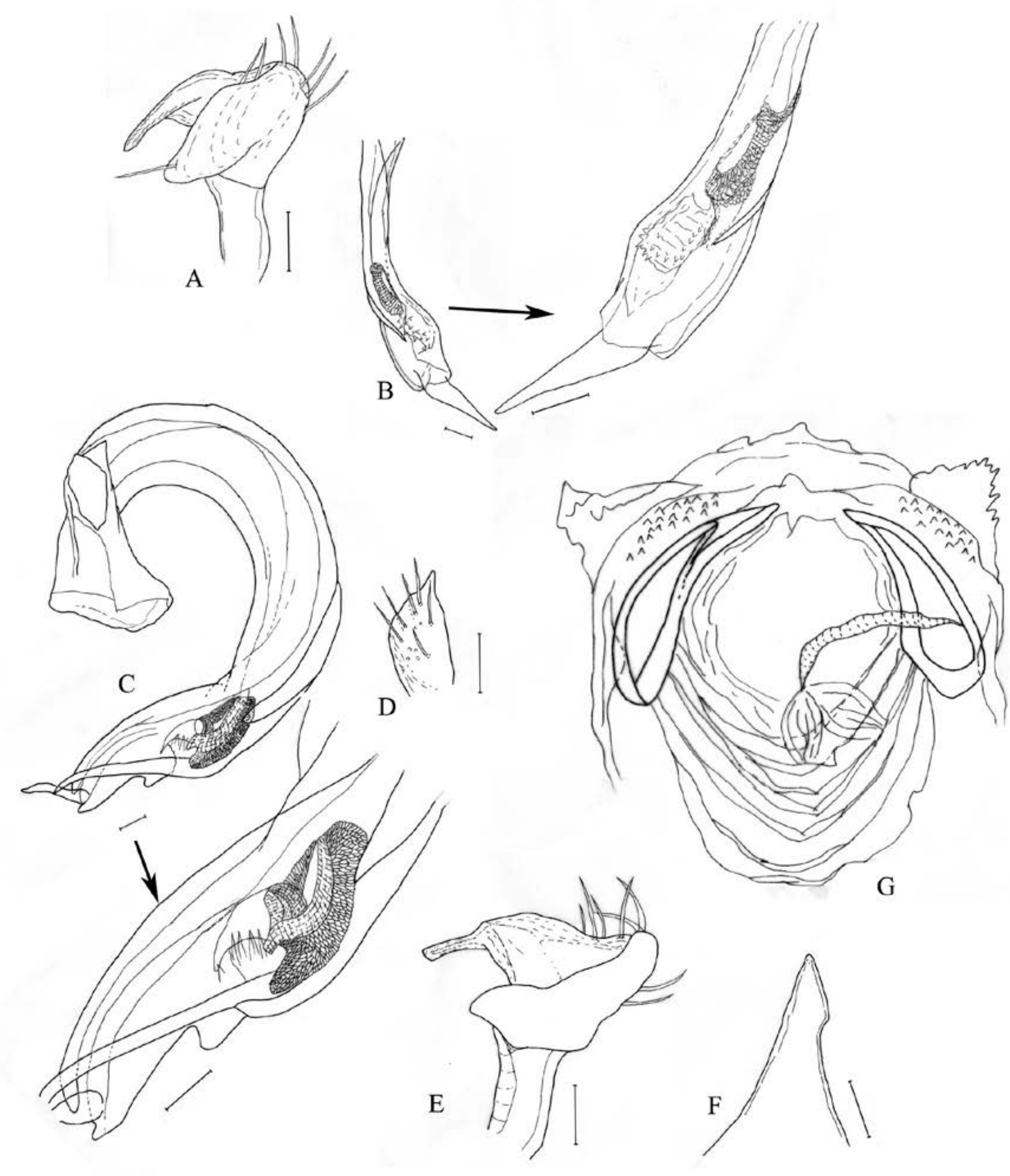

Fig. 26. Genital structures of Phylini. A-B. *Psallus aethiops*. C-G. *P*. *ater*. A, E. Left paramere. B, C. Endosoma. D. Right paramere. F. Phallotheca. G. Bursa copulatrix. Scale bar: 0.1mm.

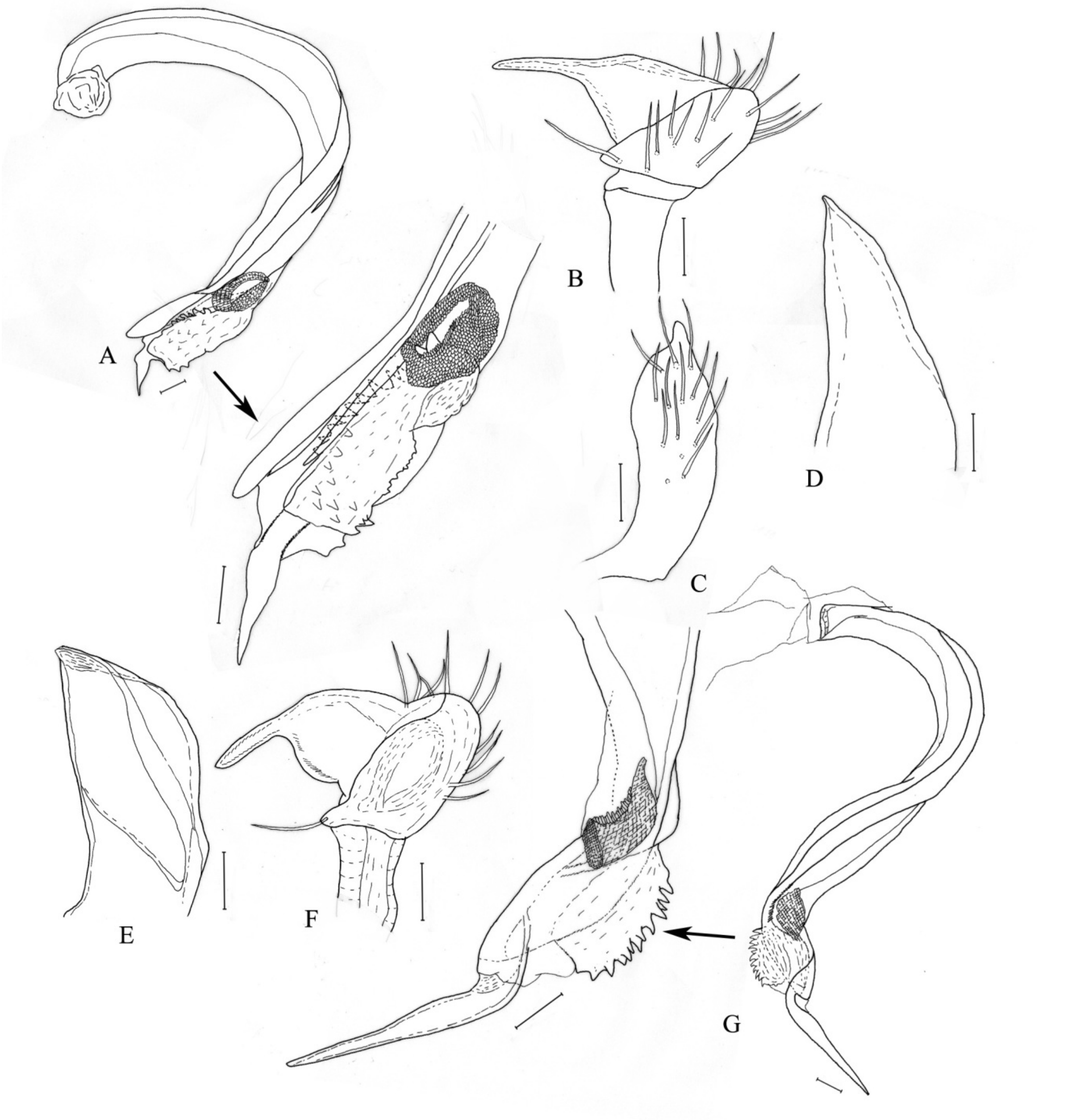

Fig. 27. Genital structures of Phylini. A-D. *Psallus atratus*. E-G. *P. betuleti*. A, G. Endosoma. B, F. Left paramere. C. Right paramere. D, E. Phallotheca. Scale bar: 0.1mm.

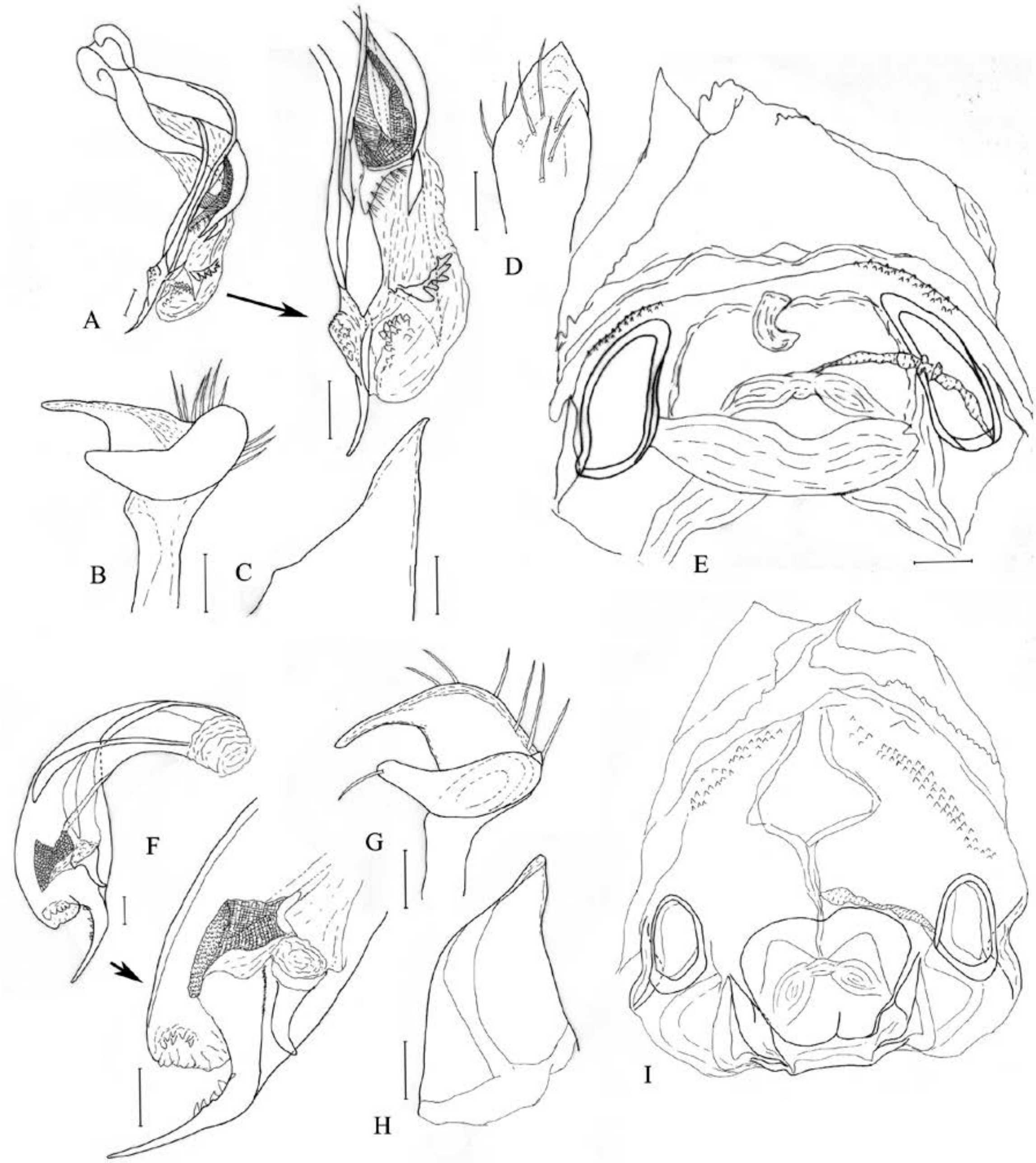

Fig. 28. Genital structures of Phylini. A-E. *Psallus michaili*. F-I. *P*. *roseoguttatus*. A, F. Endosoma. B, G. Left paramere. C, H. Phallotheca. D. Right paramere. E, I. Bursa copulatrix. Scale bar: 0.1mm.

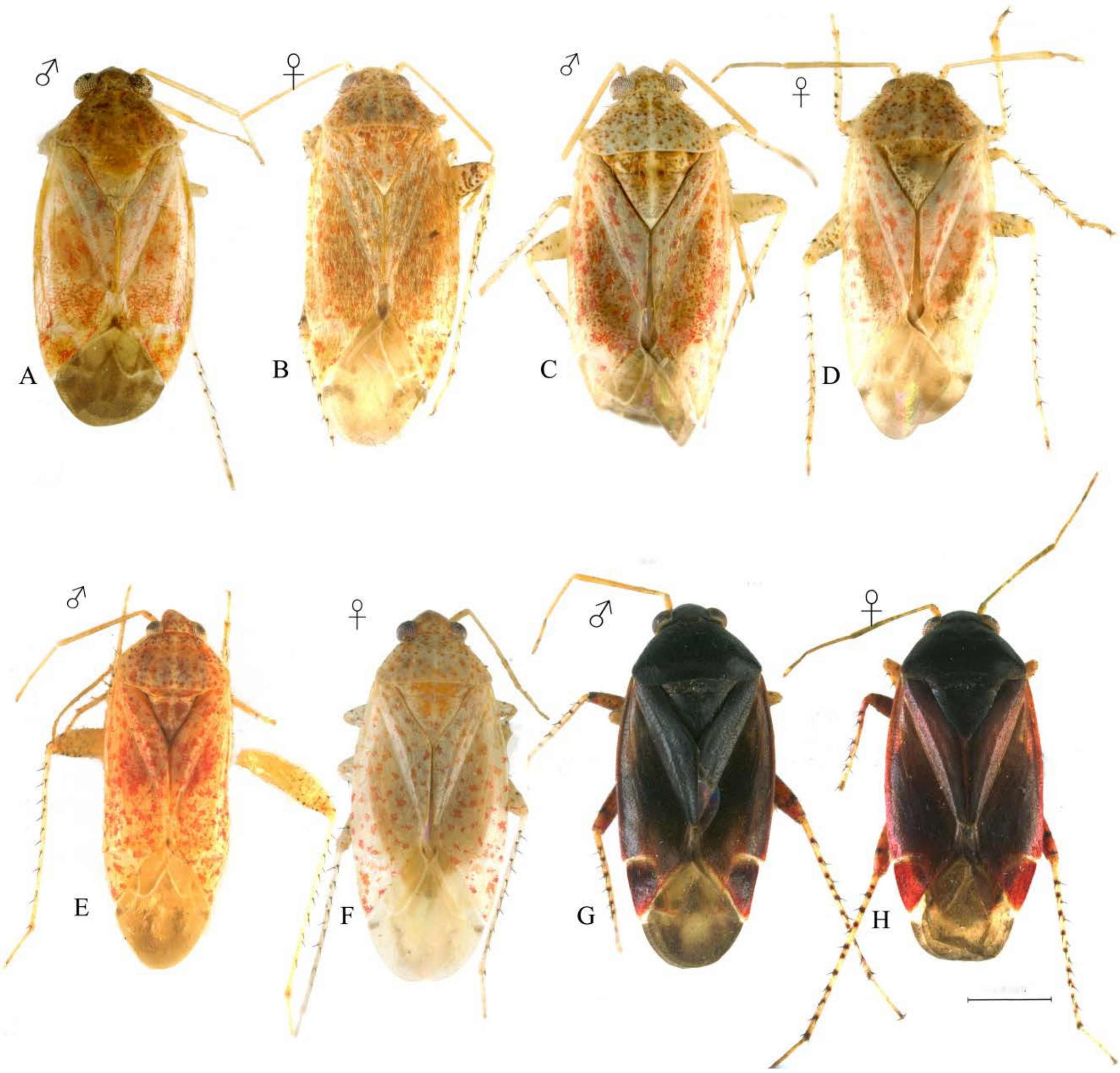

Fig. 29. Dosal habitus of Phylini. A-B. *Psallus roseoguttatus*. C-D. *P*. *clarus*. E-F. *P*. *tesongsanicus*. G-H. *P*. *suwonanus*. Scale bar: 0.5 mm.

Fig. 30. Genital structures of Phylini. A-E. *Psallus clarus*. F-J. *P*. *tesongsanicus*. A, G. Endosoma. B, H. Right paramere. C, I. Left paramere. D, F. Phallotheca. E, J. Bursa copulatrix. Scale bar: 0.1 mm.

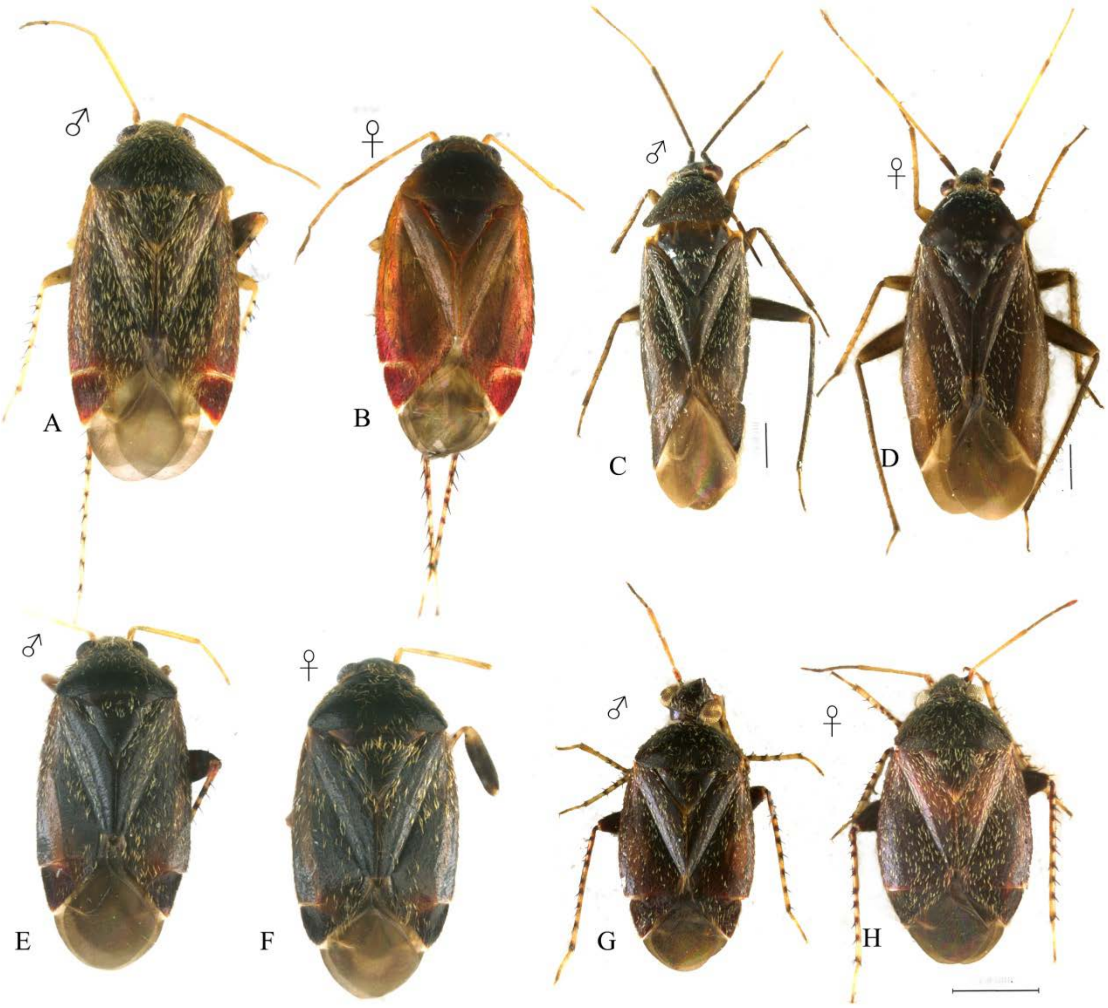

Fig. 31. Dorsal Habitus of Phylini. A-B. *Psallus tonnaichanus*. C-D. *P*. *samdzijonicus*. E-F. *P*. *castaneae*. G-H. *P*. *ernsti*. Scale bar: 0.5 mm.

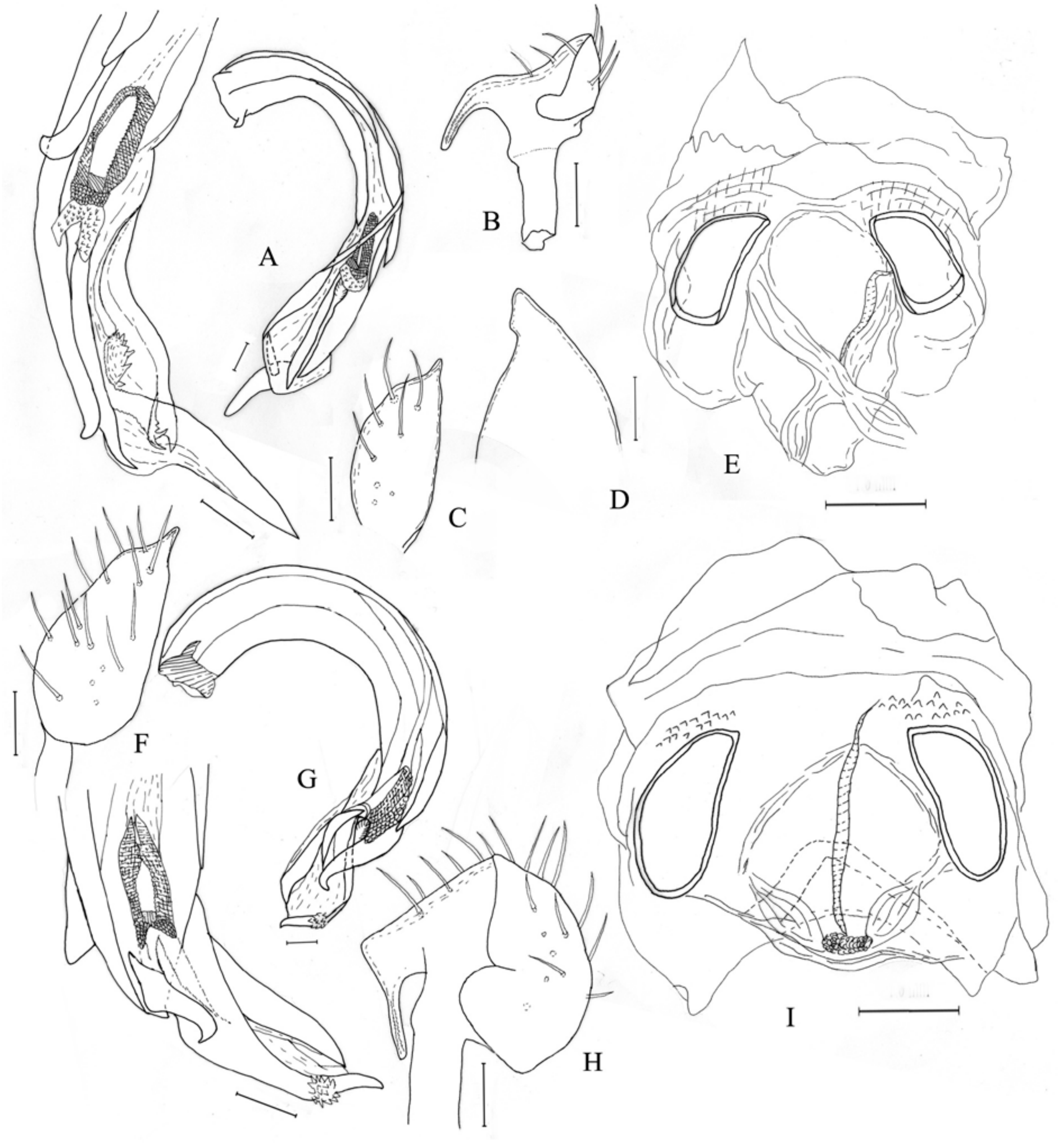

Fig. 32. Genital structures of Phylini. A-E. *Psallus tonnaichanus*. F-I. *P. suwonanus*. A, G. Endosoma. B, H. Left paramere. C, F. Right paramere. D. Phallotheca. E, I. Bursa copulatrix.

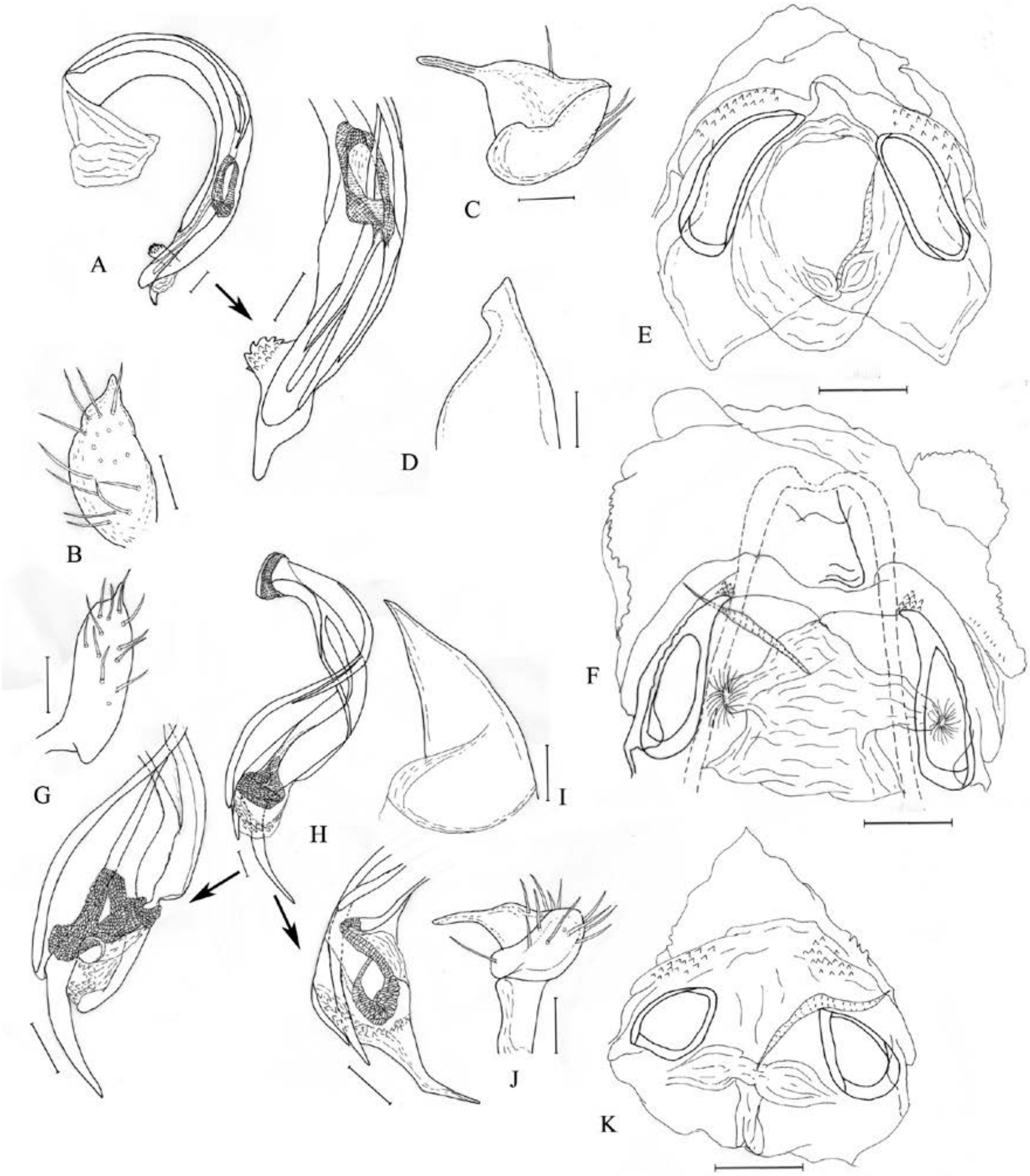

Fig. 33. Genital structures of Phylini. A-E. *Psallus castaneae*. F. *P*. *samdzijonicus*. G-K. *P*. *ernsti*. A, H. Endosoma. B, G. Right paramere. C, J. Left paramere. D, I. Phallotheca. E, F, K. Bursa copulatrix. Scale bar: 0.1 mm.

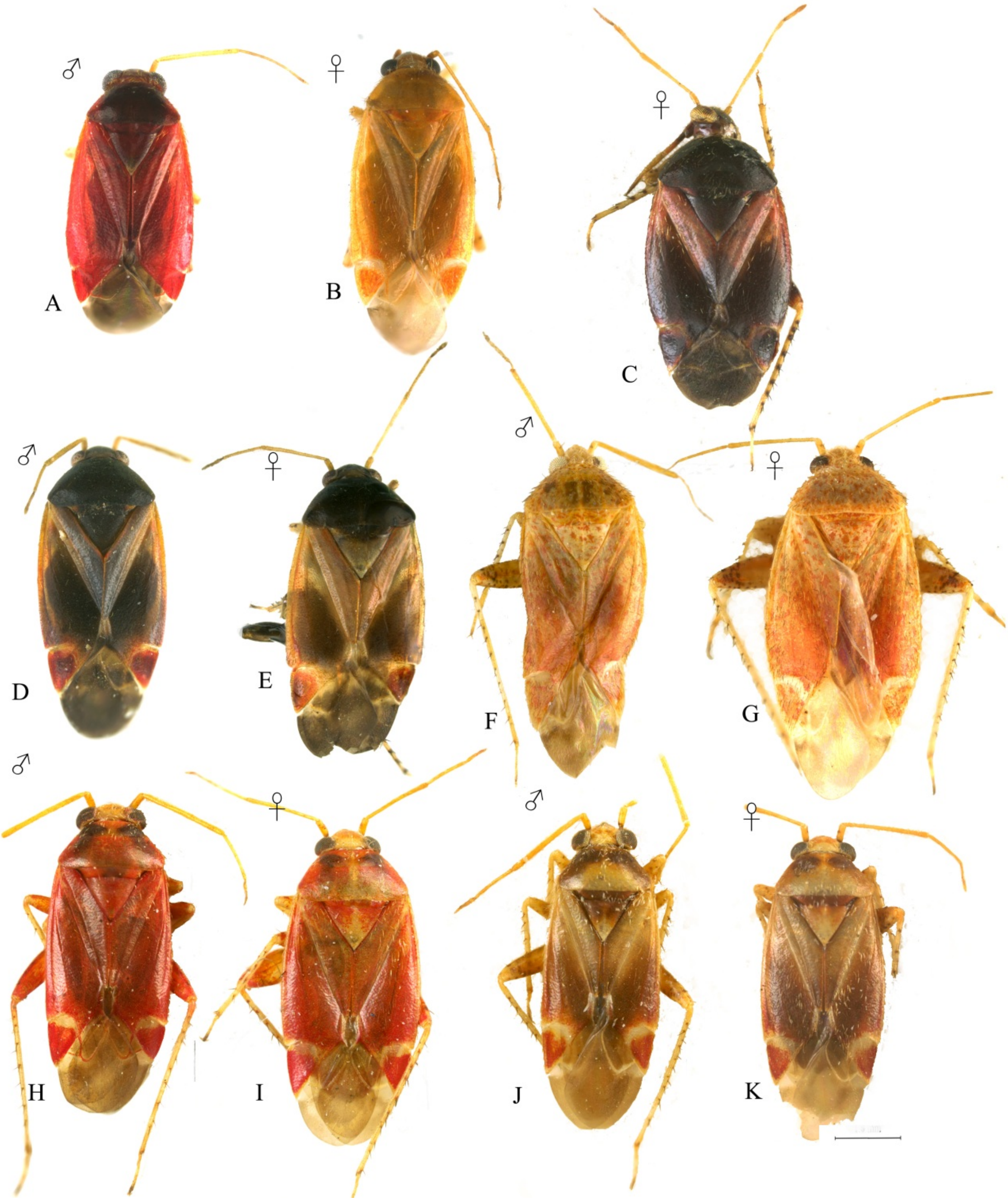

Fig. 34. Dorsal habitus of Phylini. A. *Psallus cinnabarinus*. B. *P*. *flavescens*. C. *P*. *kerzhneri*. D-E. *P*. *loginovae*. F-G. *P*. *amoenus*. H-K. *P*. *ulmi*. Scale bar: 0.5 mm.

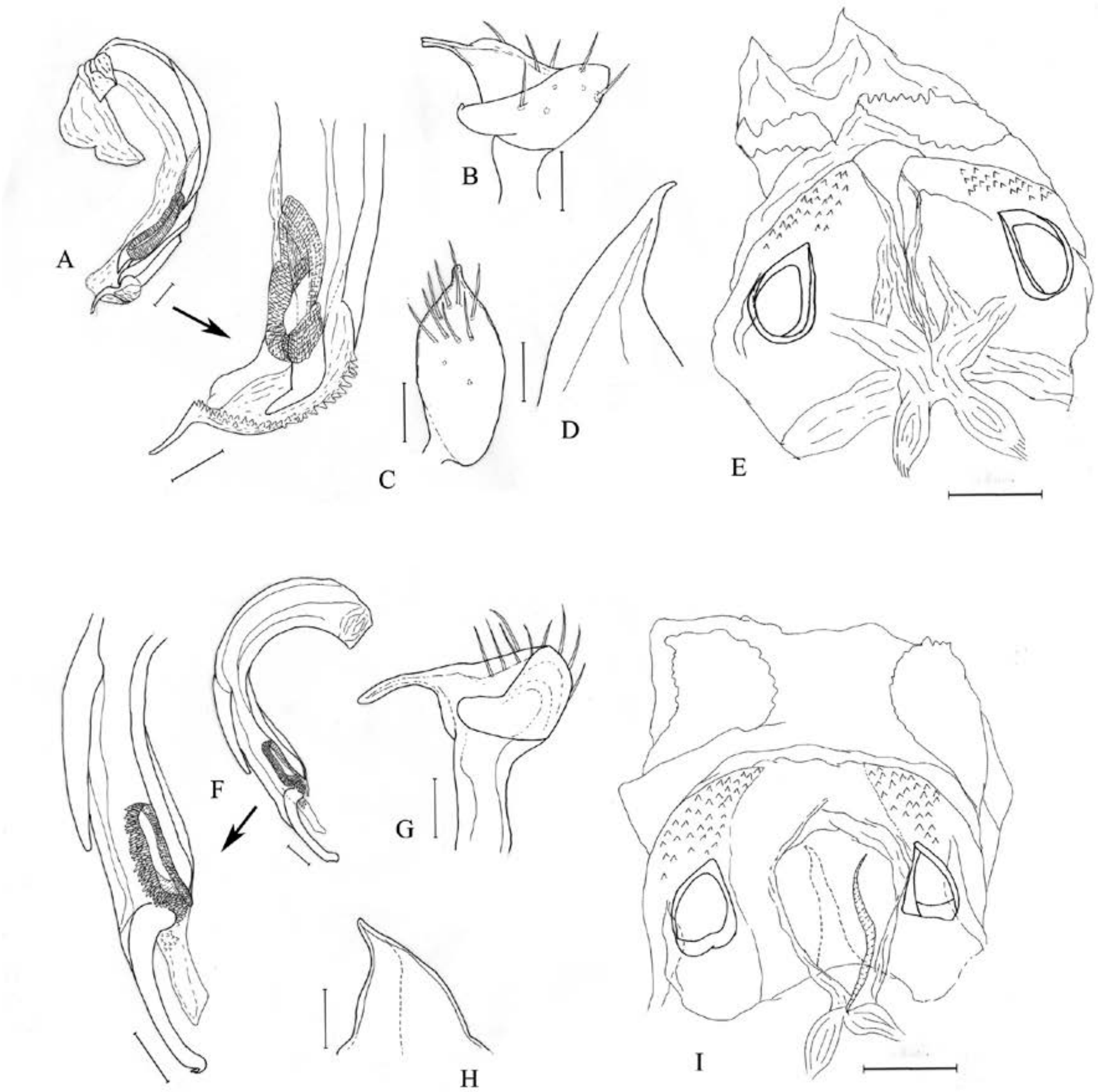

Fig. 35. Genital structures of Phylini. A-E. *Psallus cinnabarinus*. F-I. *P*. *flavescens*. A, F. Endosoma. B, G. Left paramere. C. Right paramere. D, H. Phallotheca. E, I. Bursa copulatrix. Scale bar: 0.1 mm.

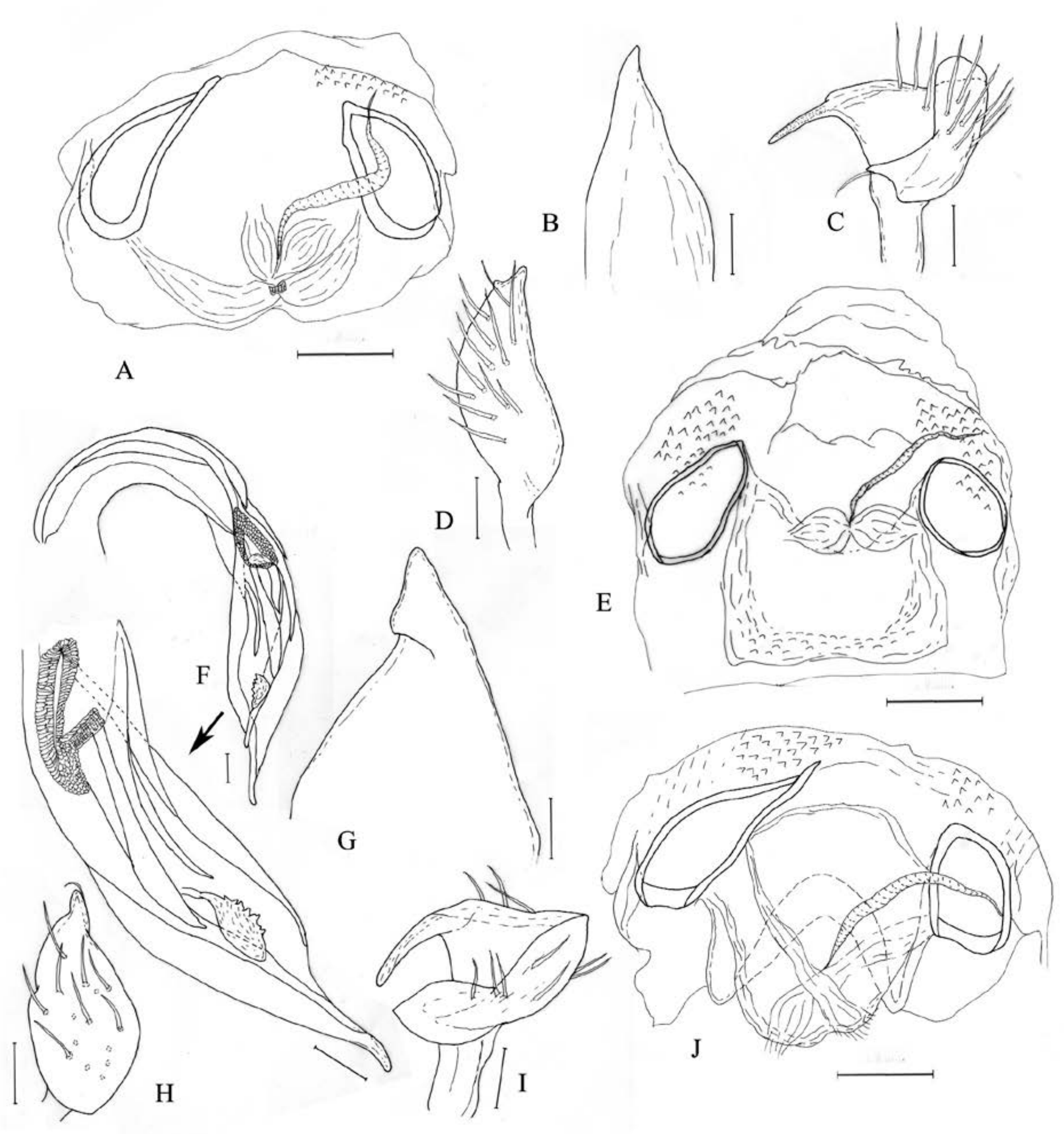

Fig. 36. Genital structures of Phylini. A. *Psallus kerzhneri*. B-E. *P*. *amoenus*. F-J. *P*. *loginovae*. B, G. Phallotheca. C, I. Left paramere. D, H. Right paramere. F. Endosoma. A, E, J. Bursa copulatrix. Scale bar: 0.5 mm.

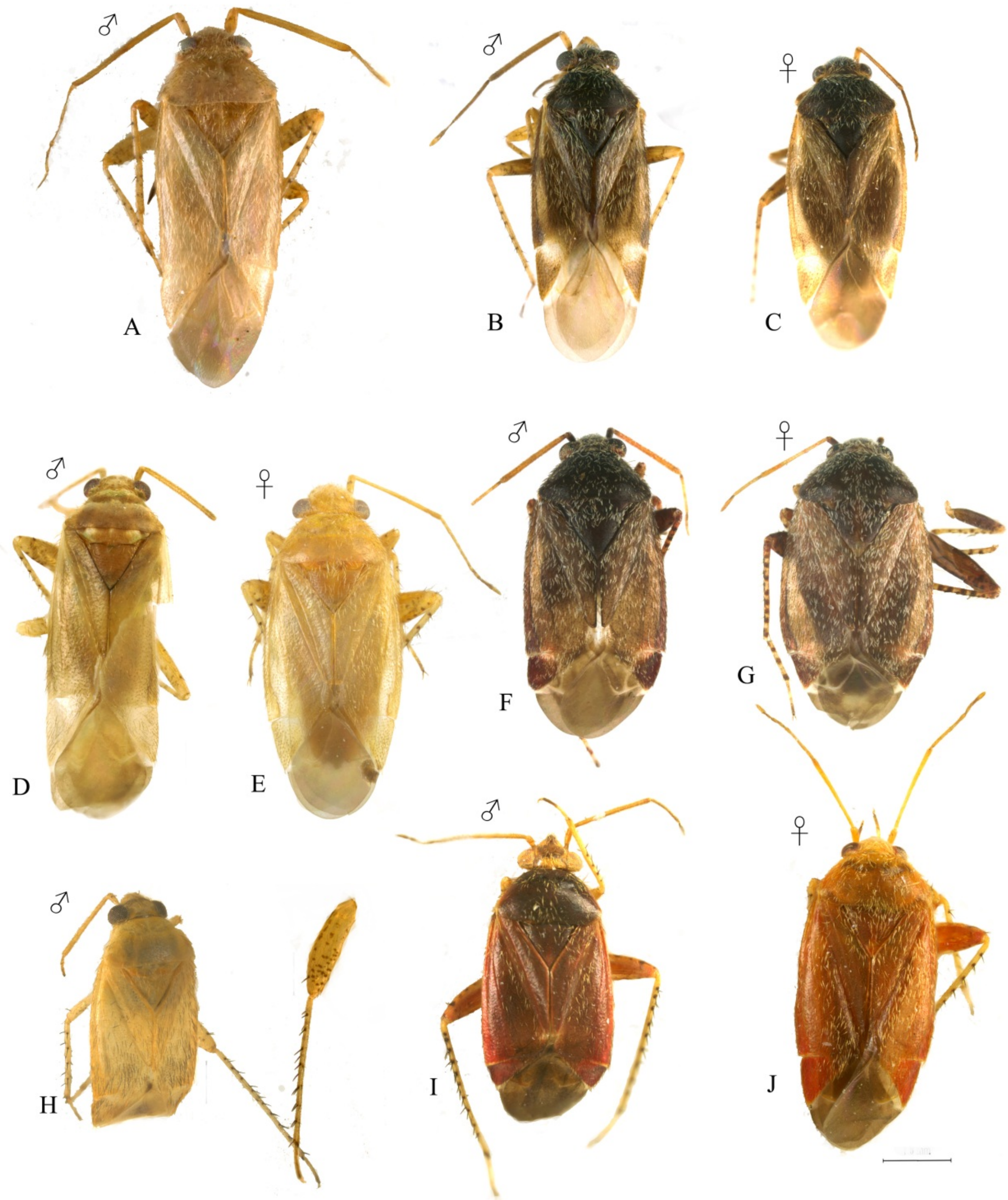

Fig. 37. Dorsal habitus of Phylini. A. *Psallus luridus*. B-C. *P*. *vittatus*. D-E. *P*. *kimi*. F-G. *P*. *bagjonicus*. H. *P*. *cheongtaensis*. I-J. *P*. *koreanus*. Scale bar: 0.5 mm.

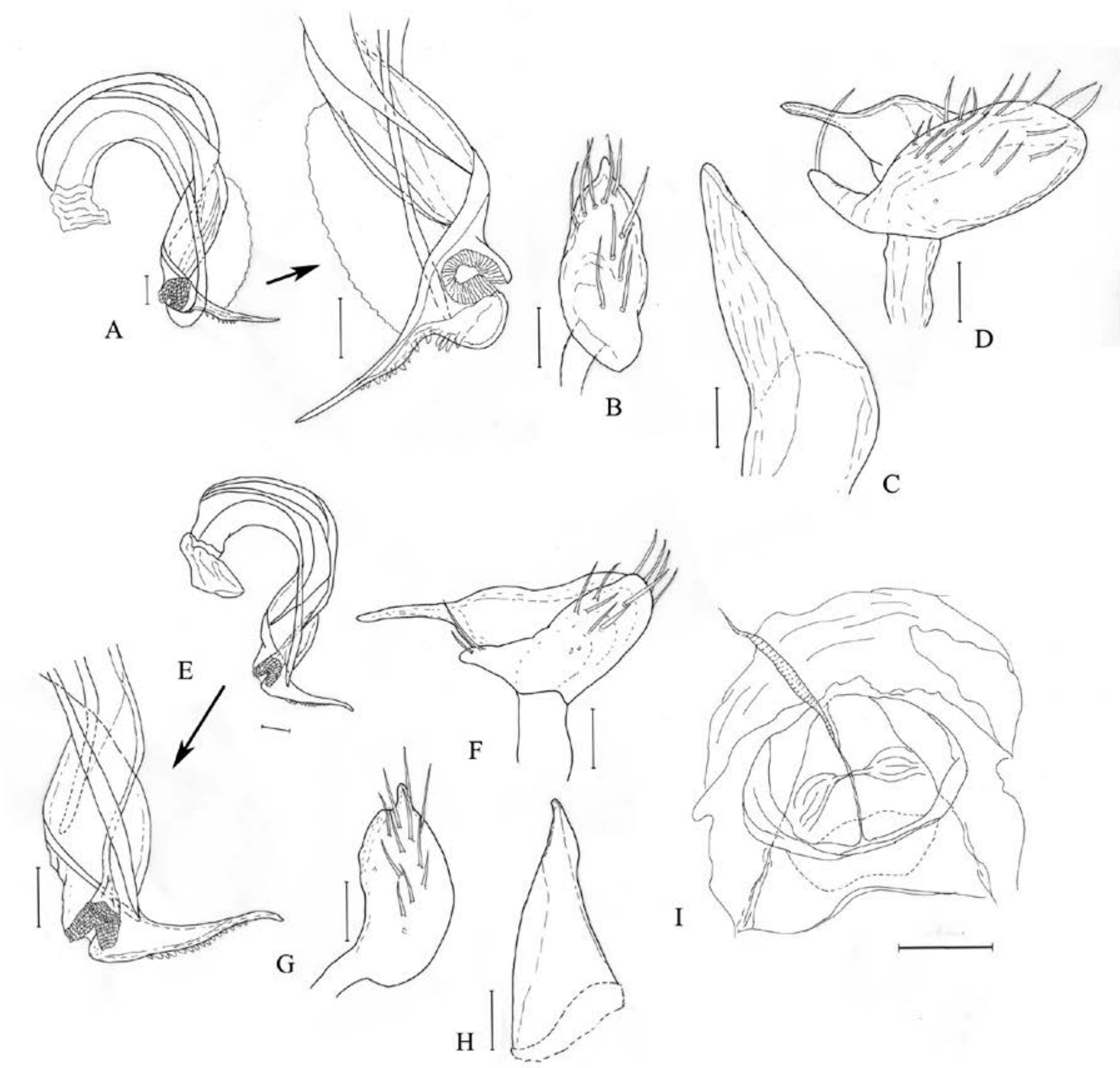

Fig. 38. Genital structure of Phylini. A-D. *Psallus luridus*. E-I. *P*. *vittatus*. A, E. Endosoma. B, G. Right paramere. C, H. Phallotheca. D, F. Right paramere. I. Bursa copulatrix. Scale bar: 0.1 mm.

Fig. 39. Genital structure of Phylini. A-D. *Psallus bagjonicus*. E-I. *P*. *cheongtaensis*. A, I. Endosoma. B, H. Phallotheca. C, G. Left paramere. E. Pygophore. F. Right paramere. D. Bursa copulatrix. Scale bar: 0.1 mm.

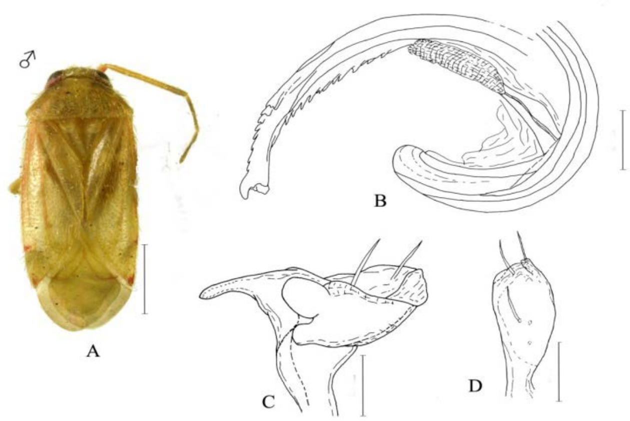

Fig. 40. *Rubrocuneocoris quercicola*. A. Dorsal view. B-D. Male genitalia. E. Endosoma. C. Left paramere. D. Right paramere. Scale bar: Dorsal habitus: 0.5mm. Genitalia: 0.1mm.

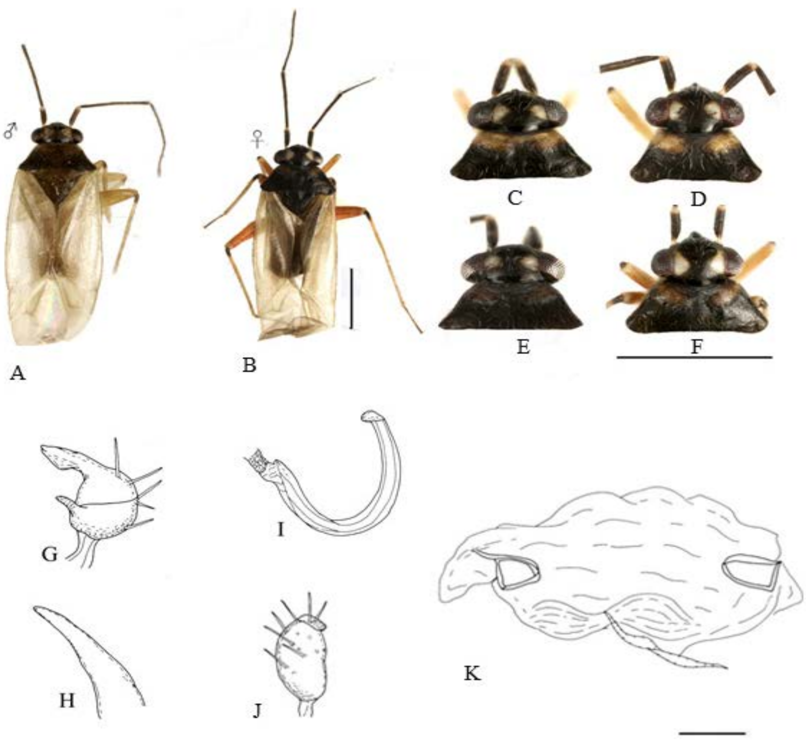

Fig. 41. *Tytthus chinensis*. A-B Dorsal view. C-D. Color variations on pronotum. G-J. Male genital structures. K. Female genital structure. G. Left paramere. H. Phallotheca. I. Endosoma. J. Right paramere. K. Bursa copulatrix. Scale bar: Dorsal view and thorax: 0.5 mm. Genitalia: 0.1mm.

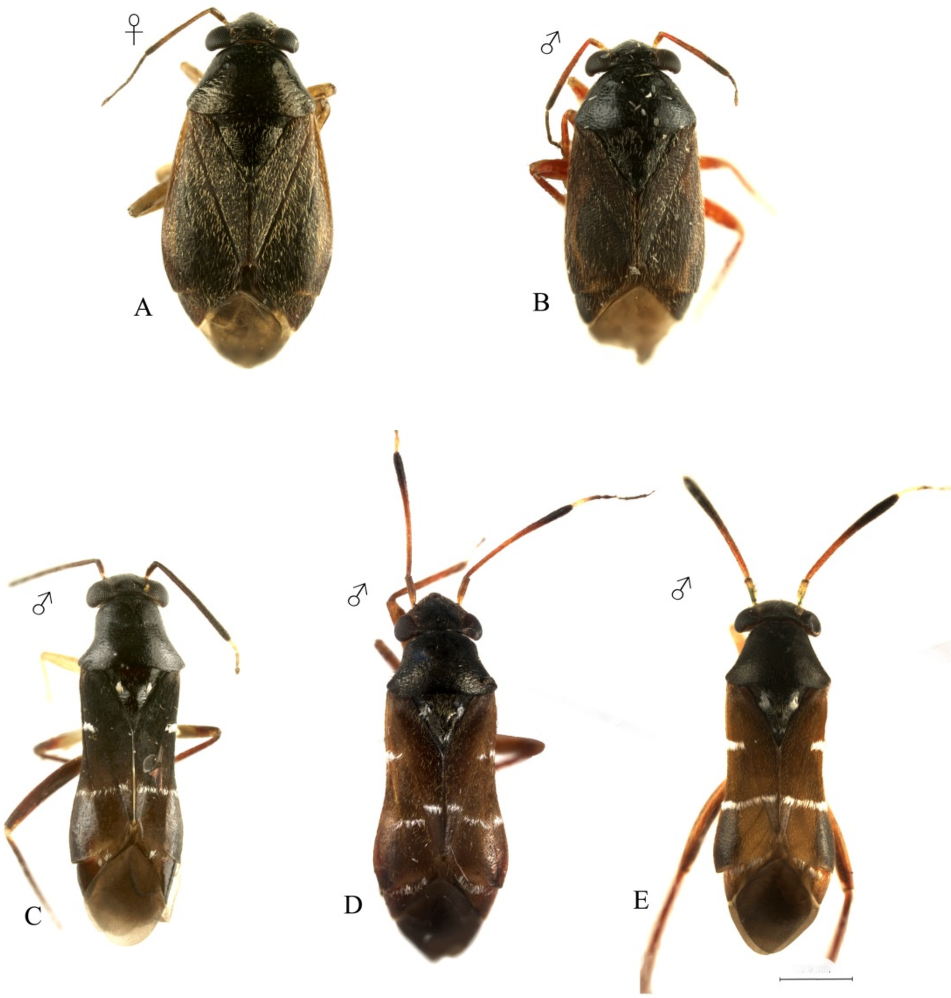

Fig. 42. Dorsal habitus of Pilophorini. A. *Pherolepis amplus*. B. *P*. *kiritshenkoi*. C. *Pilophorus choii*. D. *P*. *clavatus*. E. *P*. *erraticus*. Scale bar: 0.5 mm.

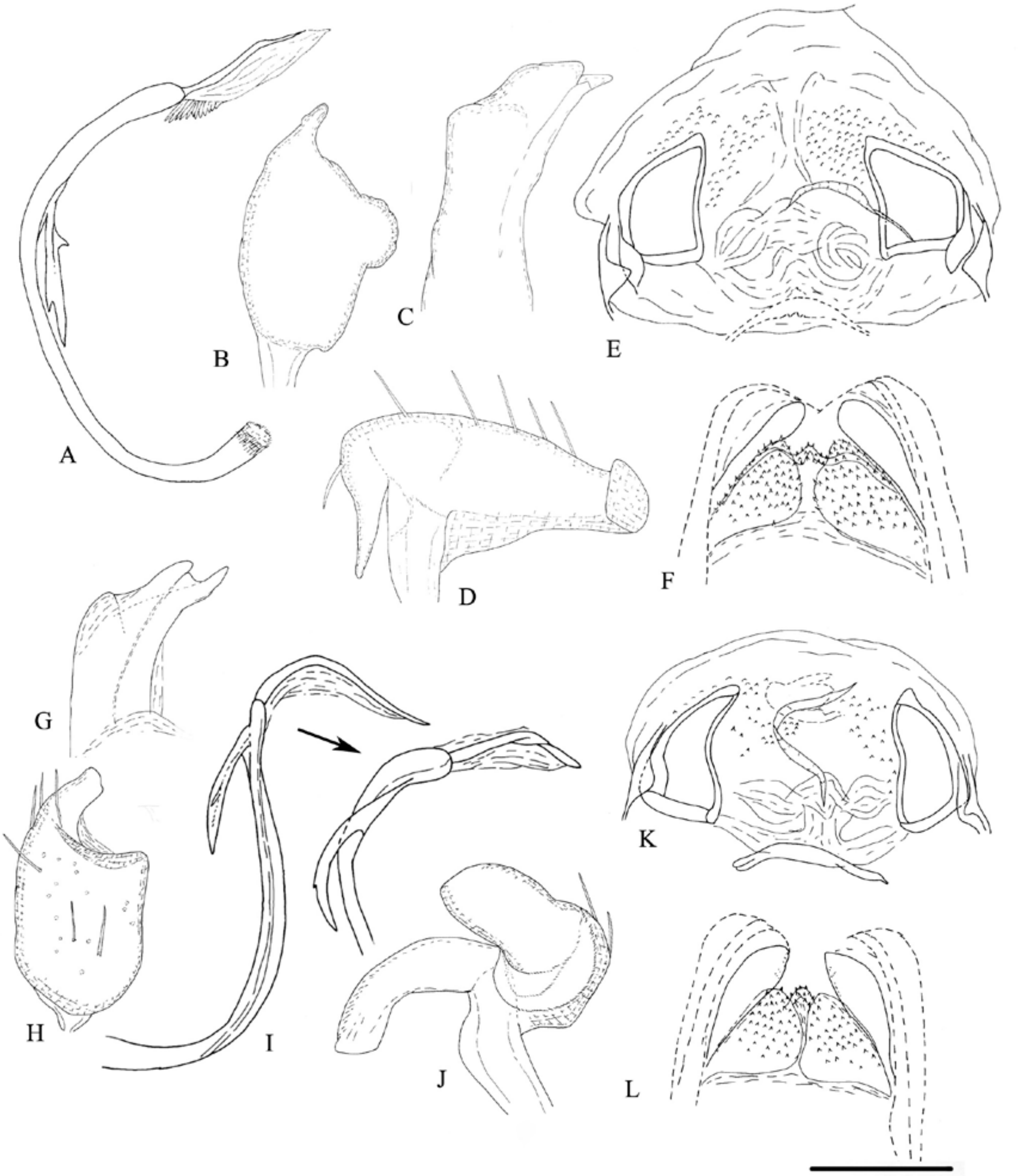

Fig. 43. Genital structures of Pilophorini. A-F. *Pherolepis amplus*. G-L. *P*. *kiritshenkoi*. A-D, G-J. Male genital structures. E-F, K-L. Female genital structures. A, I. Endosoma. B, H. Right paramere. C, G. Phallotheca. D, J. Left paramere. E, K. Bursa copulatrix. F, L. Posterior wall. Scale bar: 0.1 mm.

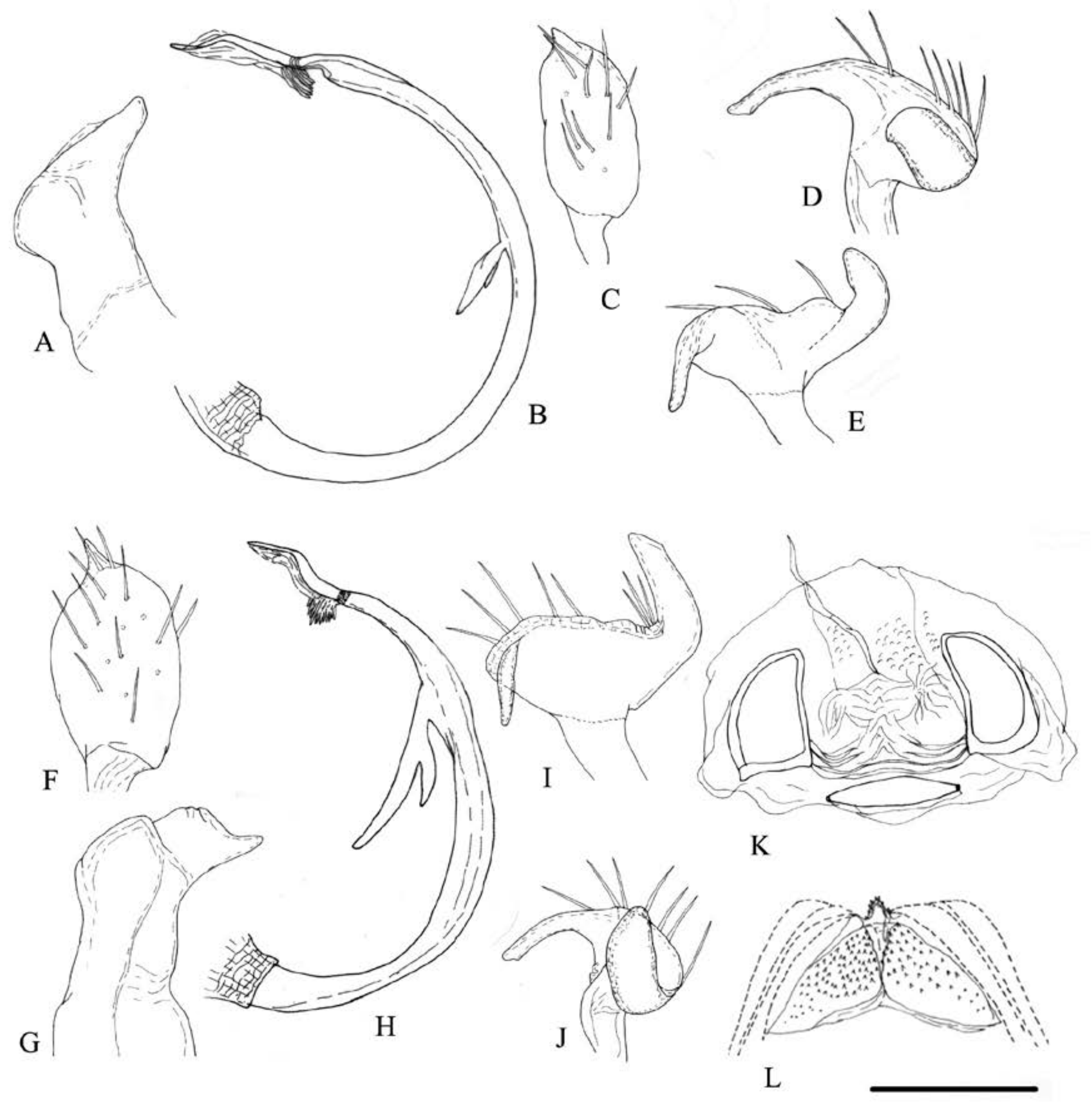

Fig. 44. Genital structures of Pilophorini. A-E. *Pilophorus choii*. F-L. *P*. *clavatus*. A-E, F-J. Male genital structures. K-L. Female genital structures. A, G. Phallotheca. B, H. Endosoma. C, F. Right paramere. D-E, I-J. Left paramere. K. Bursa copulatrix. L. Posterior wall. Scale bar: 0.1 mm.

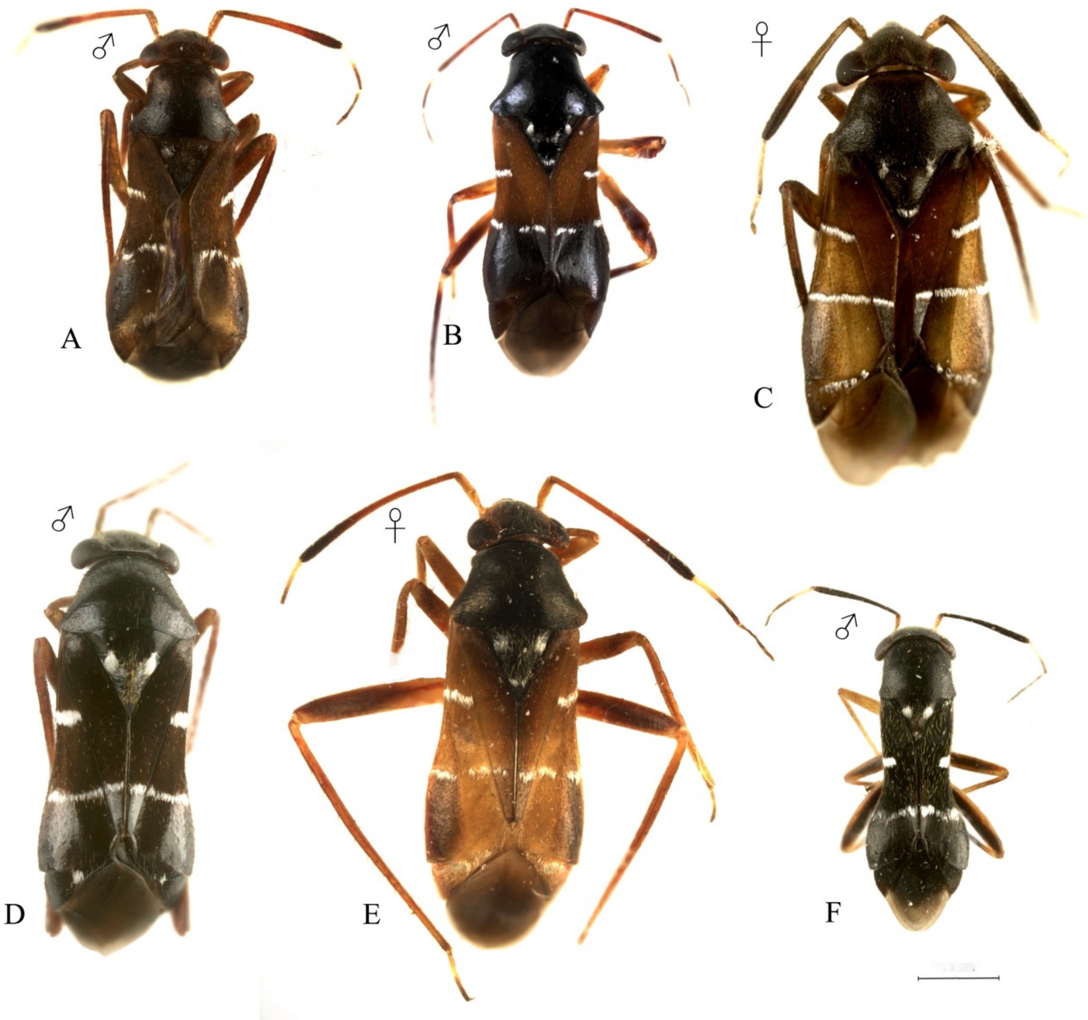

Fig. 45. Dosal habitus of Pilophorini. A. *Pilophorus koreanus*. B. *P*. *lucidus*. C. *P*. *miyamotoi*. D. *P*. *niger*. E. *P*. *setulosus*. F. *P*. *typicus*. Scale bar: 0.5 mm.

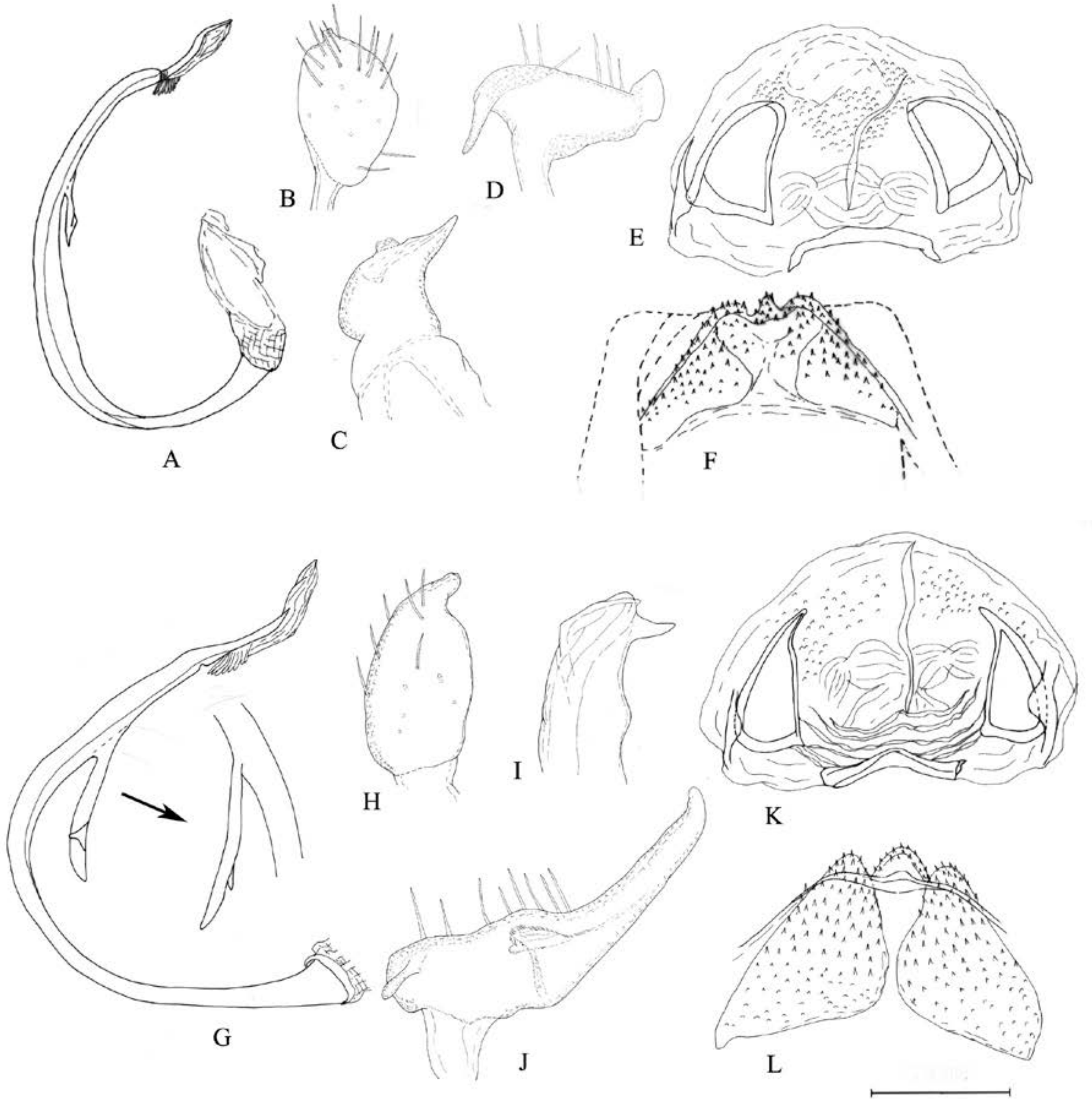

Fig. 46. Genital structures of Pilophorini. A-F. *Pilophorus erraticus*. G-L. *P*. *koreanus*. A, G. Endosoma. B, H. Right paramere. C, I. Phallotheca. D, J. Left paramere. E, K. Bursa copulatrix. F, L. Posterior wall. Scale bar: 0.1 mm.

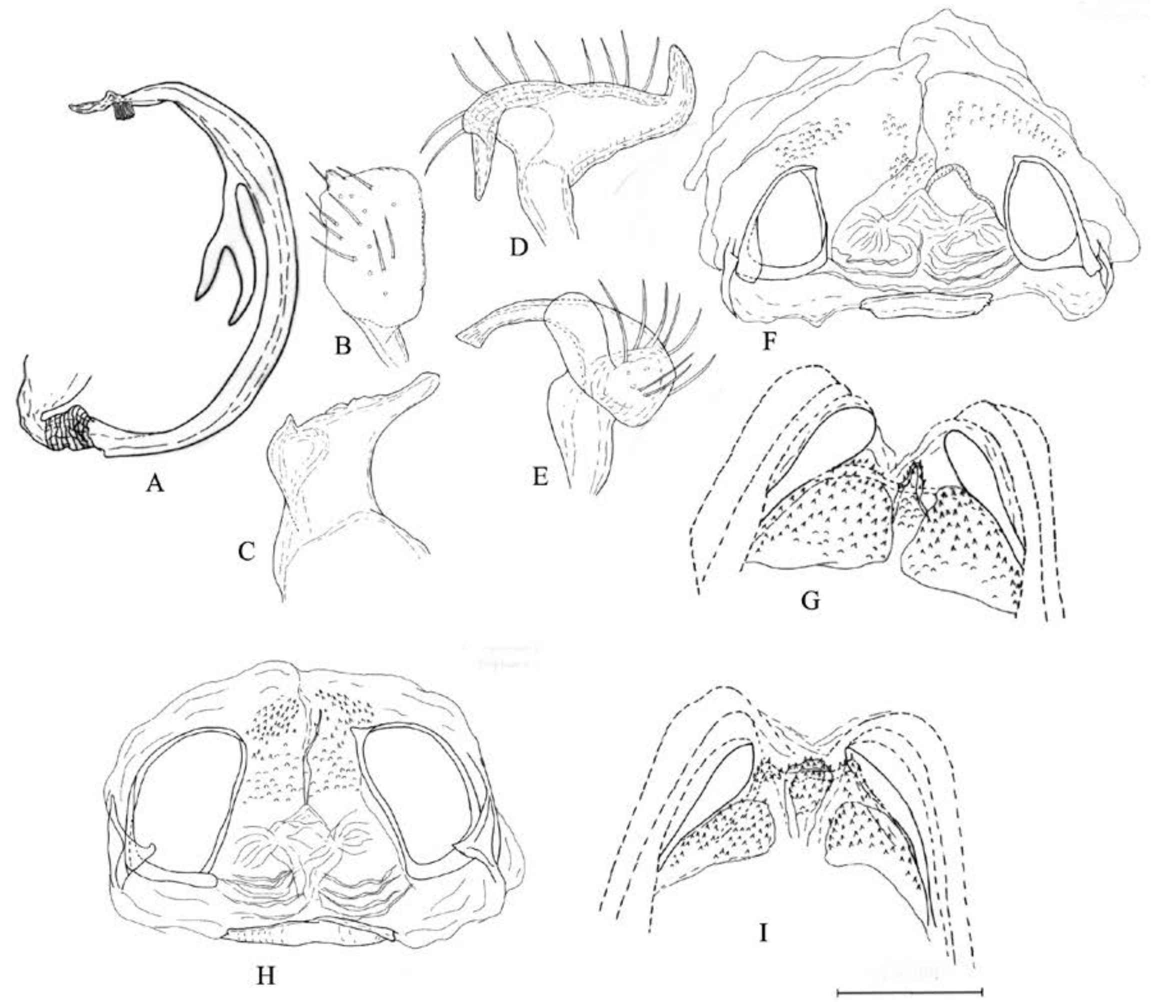

Fig. 47. Genital structures of Pilophorini. A-G. *Pilophorus lucidus*. H-I. *P*. *miyamotoi.* A. Endosoma. B. Rigtht paramere. C. Phallotheca. D, E. Left paramere. F, H. Bursa copulatrix. G, I. Posterior wall. Scale bar: 0.1 mm.

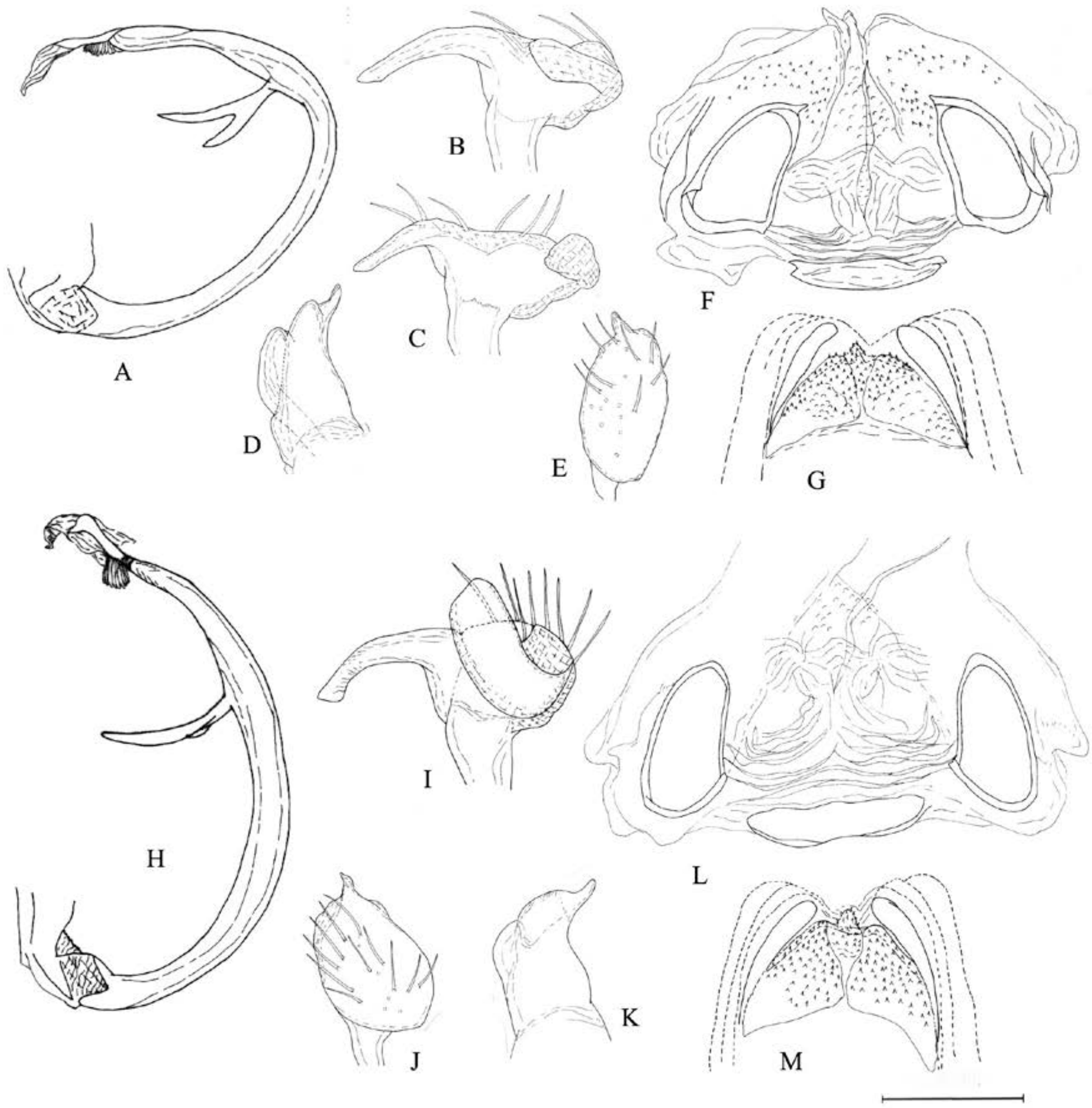

Fig. 48. Genital structure of Pilophorini. A-G. *Pilophorus niger*. H-M. *P*. *setulosus*. A, H. Endosoma. B-C, I. Left paramere. D, K. Phallotheca. E, J. Right paramere. F, L. Bursa copulatrix. G, M. Posterior wall. Scale bar: 0.1 mm.

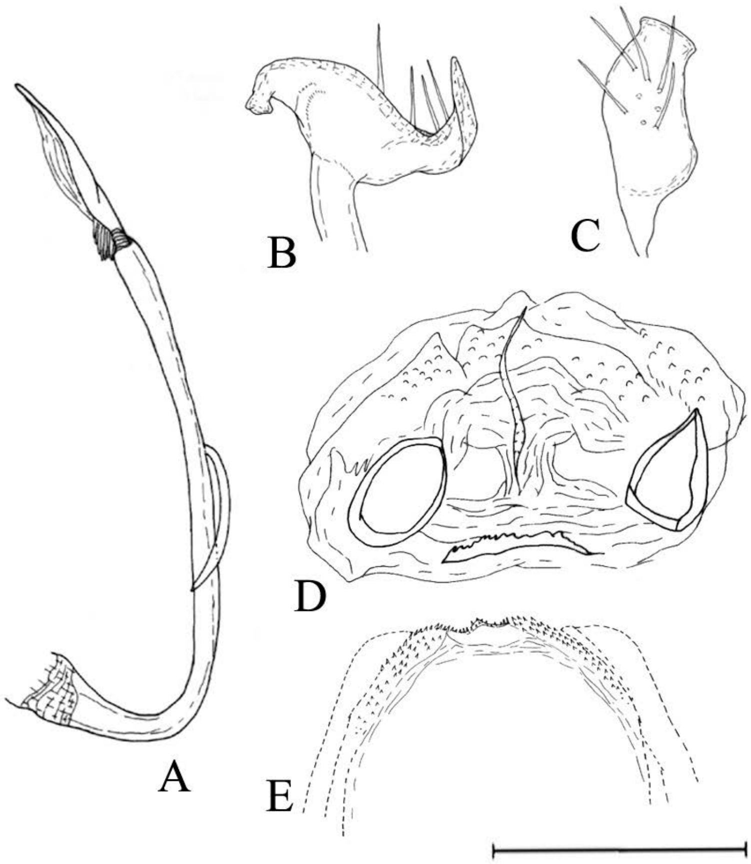

Fig. 49. Genital structure of Pilophorini. A-E. *Pilophorus typicus*. A. Endosoma. B. Left paramere. C. Right paramere. D. Bursa copulatrix. E. Posterior wall. Scale bar: 0.1 mm.

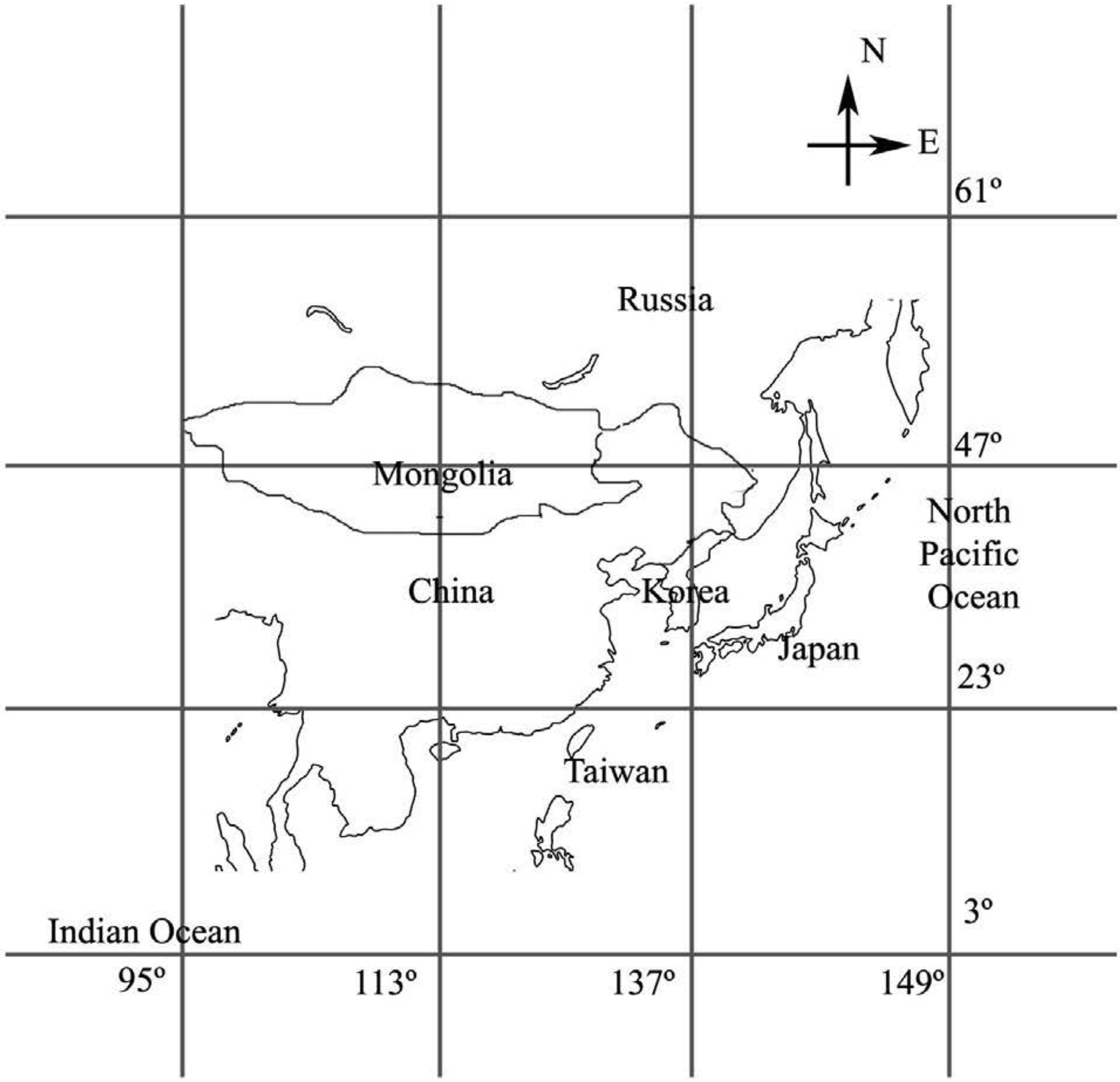

Fig. 50. Geographic map of Eastasia.

Table 1. Measurements of Phylinae from the Korean Peninsula

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
Acrorrhinium inexpectatum																
M (N= 2)	**Mean**	**4.67**	**0.79**	**2.5**	**0.82**	**0.93**	**2.38**	**1.55**	**0.92**	**1.96**	**3.15**	**0.43**	**0.94**	**0.33**	**1.34**	**1.52**
	SD	0.26	0.05	0.01	0.04	0.04	0.02	0.01	0.02	0.01	0.2	0.03	0.01	0.02	0.01	0.03
	Min	4.45	0.75	2.49	0.79	0.9	2.36	1.55	0.9	1.95	3.01	0.41	0.94	0.32	0.316	1.33
	Max	4.86	0.82	2.5	0.85	0.95	2.39	1.55	0.93	1.97	3.29	0.46	0.95	0.34	1.35	1.55
Hallodapus centrimaculatus																
M (N=1)	**Mean**	**2.65**	**0.44**	**1.2**	**0.34**	**0.27**	**0.92**	**0.76**		**0.97**	**1.42**	**0.38**	**0.5**	**0.21**	**0.74**	**0.86**
H. linnavuori																
M (N=2)	**Mean**	**3.04**	**0.54**	**1.34**	**0.41**	**0.35**	**0.97**	**0.93**	**0.58**	**1.03**	**1.41**	**0.37**	**0.56**	**0.33**	**0.86**	**1.02**
	SD	0.2	0.07	0.03	0.04	0.04	0.04	0.05	0.02	0.04	0.04	0.04	0.01	0.04	0.08	0.04
	Min	2.9	0.49	1.32	0.38	0.32	0.95	0.9	0.56	1	1.38	0.35	0.55	0.29	0.81	0.99
	Max	3.19	0.59	1.37	0.44	0.37	0.99	0.96	0.59	1.05	1.44	0.4	0.57	0.36	0.92	1.05
H. pumillus																
F (N=1)	**Mean**	**3.45**	**0.54**	**1.24**	**0.63**	**0.27**	**0.87**	**0.61**	**0.43**	**1.08**	**1.49**	**0.38**	**0.62**	**0.37**	**1.1**	**1.37**
Systellonotus malaise																
M (N=2)	**Mean**	**3.68**	**0.64**	**1.5**	**0.66**	**0.4**	**1.41**	**1.15**	**0.69**	**1.48**	**2.39**	**0.59**	**0.74**	**0.39**	**0.98**	**1.01**
	SD	0.11	0.05	0.01	0.04	0.03	0.03	0.09	0.12	0.1	0.09	0.01	0.01	0.01	0.02	0.01
	Min	3.61	0.61	1.49	0.64	0.38	1.39	1.09	0.6	1.4	2.33	0.58	0.73	0.38	0.97	1
	Max	3.76	0.68	1.5	0.69	0.43	1.44	1.21	0.77	1.55	2.45	0.6	0.74	0.4	1	1.02

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
Sejanus potanini																
M (N= 1)	**Mean**	**2.53**	**0.45**	**0.92**	**0.43**	**0.17**	**0.78**	**0.4**	**0.26**	**0.89**	**1.29**	**0.4**	**0.68**	**0.27**	**0.95**	**1.22**
F (N= 4)	**Mean**	**2.53**	**0.47**	**0.96**	**0.47**	**0.18**	**0.74**	**0.39**	**0.26**	**0.9**	**1.32**	**0.35**	**0.69**	**0.34**	**1.01**	**1.28**
	SD	0.17	0.02	0.03	0.01	0.01	0.04	0.02	0.02	0.04	0.09	0.03	0.01	0.03	0.08	0.12
	Min	2.31	0.46	0.92	0.46	0.18	0.7	0.37	0.24	0.85	1.24	0.33	0.68	0.3	0.91	1.15
	Max	2.68	0.5	0.99	0.48	0.19	0.79	0.41	0.28	0.95	1.42	0.38	0.71	0.37	1.1	1.42
Tytthus chinensis																
M (N=4)	**Mean**	**2.52**	**0.41**	**0.91**	**0.31**	**0.27**	**0.86**	**0.49**	**0.44**	**0.86**	**1.37**	**0.44**	**0.59**	**0.31**	**0.8**	**0.88**
	SD	0.13	0.05	0.03	0.03	0.01	0.04	0.04	0.05	0.05	0.04	0.03	0.01	0.02	0.02	0.04
	Min	2.38	0.36	0.88	0.29	0.26	0.8	0.43	0.37	0.82	1.35	0.42	0.58	0.28	0.78	0.83
	Max	2.66	0.46	0.93	0.35	0.28	0.9	0.52	0.49	0.89	1.4	0.47	0.6	0.32	0.83	0.93
F (N=5)	**Mean**	**3.21**	**0.45**	**0.98**	**0.35**	**0.28**	**0.88**	**0.57**	**0.5**	**1.08**	**1.52**	**0.44**	**0.66**	**0.33**	**0.96**	**1.14**
	SD	0.43	0.03	0.05	0.02	0.04	0.04	0.03	0.04	0.04	0.07	0.02	0.02	0.02	0.06	0.07
	Min	2.91	0.42	0.93	0.33	0.23	0.82	0.52	0.45	1.04	1.45	0.42	0.64	0.31	0.88	1.08
	Max	3.96	0.9	1.05	0.38	0.32	0.93	0.61	0.53	1.12	1.63	0.46	0.69	0.36	1.03	1.24
Atomoscelis asiatica																
M (N= 5)	**Mean**	**2.59**	**0.47**	**0.72**	**0.37**	**0.25**	**0.8**	**0.51**	**0.42**	**0.95**	**1.47**	**0.42**	**0.66**	**0.35**	**0.89**	**1.1**
	SD	0.1	0.04	0.01	0.02	0.02	0.04	0.03	0.02	0.02	0.04	0.03	0.01	0.04	0.03	0.07
	Min	2.5	0.43	0.7	0.34	0.22	0.74	0.48	0.39	0.92	1.41	0.4	0.64	0.31	0.87	1.04
	Max	2.76	0.52	0.74	0.4	0.26	0.86	0.54	0.45	0.98	1.5	0.47	0.67	0.38	0.93	1.21

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N= 3)	**Mean**	**2.52**	**0.47**	**0.75**	**0.36**	**0.23**	**0.75**	**0.52**	**0.45**	**0.96**	**1.48**	**0.44**	**0.66**	**0.38**	**0.91**	**1.24**
	SD	0.06	0.01	0.03	0.01	0.02	0.01	0.03	0.02	0.07	0.07	0.02	0.01	0.02	0.07	0.08
	Min	2.46	0.46	0.72	0.35	0.22	0.737	0.5	0.43	0.91	1.41	0.42	0.65	0.36	0.86	1.16
	Max	2.59	0.48	0.77	0.36	0.25	0.76	0.55	0.46	1.04	1.56	0.46	0.68	0.4	0.99	1.33
Atractotomus morio																
F (N= 2)	**Mean**	**4.03**	**0.68**	**1.62**	**0.73**	**0.33**	**1.38**	**0.47**	**0.39**	**1.49**	**2.04**	**0.64**	**0.93**	**0.42**	**1.42**	**1.8**
	SD	0.22	0.02	0.08	0.06	0.02	0.05	0.01	0.02	0.07	0.05	0.03	0	0.01	0.09	0.01
	Min	3.87	0.67	1.57	0.69	0.31	1.35	0.47	0.37	1.44	2.01	0.62	0.93	0.42	1.35	1.8
	Max	4.19	0.7	1.67	0.77	0.35	1.42	0.48	0.4	1.54	2.08	0.66	0.93	0.43	1.49	1.81
Atractotomoidea castanea																
M (N=5)	**Mean**	**2.48**	**0.34**	**1.04**	**0.44**	**0.18**	**0.78**	**0.38**	**0.28**	**0.88**	**1.35**	**0.33**	**0.6**	**0.3**	**0.94**	**1.23**
	SD	0.073	0.04	0.06	0.01	0.02	0.03	0.02	0.02	0.04	0.03	0.01	0.02	0.02	0.02	0.04
	Min	2.41	0.29	0.99	0.43	0.15	0.76	0.34	0.26	0.84	1.31	0.32	0.59	0.28	0.91	1.17
	Max	2.58	0.4	1.14	0.46	0.19	0.83	0.39	0.3	0.95	1.38	0.35	0.63	0.33	0.97	1.27
F (N=5)	**Mean**	**2.54**	**1.13**	**1.18**	**0.44**	**0.18**	**0.76**	**0.37**	**0.35**	**0.92**	**1.43**	**0.36**	**0.59**	**0.32**	**0.96**	**1.3**
	SD	0.21	1.72	0.08	0.04	0.011	0.01	0.03	0.04	0.02	0.03	0.03	0.02	0.01	0.02	0.02
	Min	2.26	0.34	1.11	0.4	0.17	0.74	0.33	0.29	0.91	1.4	0.32	0.58	0.3	0.92	1.28
	Max	2.71	0.42	1.28	0.5	0.19	0.78	0.39	0.38	0.95	1.47	0.39	0.61	0.33	0.97	1.33
Campylomma annulicorne																
M (N=1)	**Mean**	**2.67**	**0.43**	**0.99**	**0.46**	**0.2**	**0.59**			**0.84**	**1.32**	**0.37**	**0.76**	**0.28**	**0.91**	**1.23**

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N=3)	**Mean**	**2.68**	**0.45**	**0.95**	**0.5**	**0.17**	**0.58**	**0.32**	**0.22**	**0.88**	**1.29**	**0.38**	**0.68**	**0.32**	**1.01**	**1.22**
	SD	0.09	0.05	0.05	0.02	0.02	0.04	0.02	0.01	0.06	0.09	0.02	0.01	0.001	0.02	0.04
	Min	2.58	0.41	0.89	0.48	0.15	0.53	0.31	0.22	0.82	1.19	0.36	0.67	0.32	0.99	1.19
	Max	2.74	0.5	0.98	0.52	0.18	0.6	0.34	0.22	0.94	1.35	0.4	0.69	0.33	1.03	1.26
C. chinense																
M (N=5)	**Mean**	**2.5**	**0.38**	**0.95**	**0.4**	**0.12**	**0.58**	**0.39**	**0.26**	**0.8**	**1.2**	**0.35**	**0.63**	**0.25**	**0.9**	**1.04**
	SD	0.12	0.05	0.03	0.02	0.02	0.01	0.01	0.02	0.04	0.07	0.04	0.02	0.02	0.05	0.07
	Min	2.35	0.29	0.9	0.37	0.1	0.58	0.38	0.23	0.77	1.12	0.28	0.61	0.23	0.83	0.94
	Max	2.63	0.41	0.98	0.42	0.15	0.6	0.41	0.29	0.86	1.27	0.39	0.66	0.28	0.95	1.12
F (N=5)	**Mean**	**2.43**	**0.37**	**0.99**	**0.39**	**0.13**	**0.56**	**0.37**	**0.25**	**0.79**	**1.18**	**0.33**	**0.62**	**0.29**	**0.91**	**1.11**
	SD	0.07	0.02	0.04	0.02	0.02	0.05	0.03	0.02	0.03	0.05	0.02	0.01	0.01	0.03	0.06
	Min	2.33	0.35	0.95	0.38	0.1	0.51	0.34	0.21	0.75	1.11	0.31	0.61	0.28	0.88	1.04
	Max	2.53	0.4	1.05	0.41	0.16	0.65	0.41	0.28	0.84	1.22	0.36	0.64	0.3	0.96	1.15
C. lividicorne																
M (N=4)	**Mean**	**2.38**	**0.37**	**0.93**	**0.43**	**0.14**	**0.55**			**0.79**	**1.22**	**0.37**	**0.67**	**0.24**	**0.9**	**1.04**
	SD	0.15	0.02	0.04	0.02	0.01	0.04			0.02	0.05	0.05	0.02	0.01	0.04	0.07
	Min	2.23	0.35	0.9	0.41	0.13	0.52			0.78	1.17	0.32	0.65	0.23	0.86	0.98
	Max	2.51	0.38	0.98	0.45	0.14	0.6			0.83	1.29	0.44	0.7	0.26	0.96	1.11
F (N=1)	**Mean**	**2.35**	**0.37**	**0.92**	**0.44**					**0.85**			**0.62**	**0.29**	**0.92**	**1.04**

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
C. miyamotoi																
M (N=2)	**Mean**	**2.31**	**0.35**	**0.7**	**0.39**	**0.12**	**0.65**	**0.35**	**0.26**	**0.66**	**1.15**	**0.35**	**0.6**	**0.24**	**0.86**	**0.97**
	SD	0.36	0.02	0.01	0.02	0	0.01	0.01	0	0.01	0.09	0	0.07	0.04	0.03	0.05
	Min	2.05	0.33	0.69	0.37	0.12	0.64	0.35	0.26	0.66	1.09	0.34	0.55	0.21	0.84	0.94
	Max	2.56	0.364	0.71	0.4	0.12	0.65	0.36	0.26	0.67	1.21	0.35	0.65	0.27	0.89	1.01
F (N=4)	**Mean**	**2.41**	**0.35**	**0.7**	**0.41**	**0.12**	**0.48**	**0.32**	**0.26**	**0.68**	**0.85**	**0.34**	**0.57**	**0.28**	**0.89**	**1.01**
	SD	0.09	0.03	0.04	0.05	0.01	0.04	0.01	0.02	0.03	0.05	0.03	0.01	0.02	0.07	0.05
	Min	2.29	0.33	0.64	0.35	0.11	0.43	0.31	0.24	0.65	0.17	0.32	0.56	0.26	0.84	0.94
	Max	2.5	0.38	0.74	0.47	0.14	0.5	0.33	0.28	0.7	1.12	0.37	0.59	0.3	0.99	1.04
Compsidolon elaegnicola																
F (N=1)	**Mean**	**4.47**	**0.59**	**1.21**	**0.71**	**0.27**	**1.36**	**1.1**	**0.49**				**0.92**	**0.46**	**1.63**	**1.95**
C. salicellum																
M (N=3)	**Mean**	**3.26**	**0.55**	**1.43**	**0.43**	**0.25**	**1.24**	**0.84**	**0.57**	**1.27**	**1.96**	**0.51**	**0.67**	**0.25**	**0.99**	**1.24**
	SD	0.14	0.01	0.05	0.02	0.01	0.03	0.05	0.01	0.07	0.09	0.03	0.01	0	0.02	0.06
	Min	3.13	0.54	1.39	0.41	0.24	1.2	0.78	0.56	1.19	1.87	0.49	0.66	0.25	0.98	1.19
	Max	3.41	0.55	1.49	0.46	0.26	1.26	0.88	0.58	1.33	2.06	0.54	0.68	0.25	1.01	1.32
F (N=1)	**Mean**	**3.36**	**0.55**	**1.44**	**0.47**	**0.29**	**1.09**	**0.69**	**0.49**	**1.27**	**1.97**	**0.43**	**0.63**	**0.32**	**1.07**	**1.16**
Europiella artemisiae																
M (N=5)	**Mean**	**2.96**	**0.44**	**1.09**	**0.43**	**0.25**	**0.86**	**0.63**	**0.39**	**0.97**	**1.53**	**0.46**	**0.68**	**0.32**	**0.93**	**1.18**
	SD	0.18	0.04	0.07	0.02	0.01	0.08	0.03	0.02	0.08	0.08	0.04	0.02	0.03	0.05	0.06
	Min	2.69	0.39	1.01	0.41	0.23	0.77	0.59	0.37	0.88	1.44	0.43	0.65	0.29	0.88	1.1
	Max	3.19	0.5	1.19	0.45	0.26	0.95	0.66	0.41	1.09	1.63	0.53	0.7	0.35	1.01	1.24

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N=5)	**Mean**	**2.86**	**0.45**	**1.1**	**0.45**	**0.23**	**0.77**	**0.55**	**0.37**	**1.02**	**1.49**	**0.42**	**0.66**	**0.37**	**0.97**	**1.23**
	SD	0.16	0.04	0.06	0.02	0.02	0.03	0.04	0.03	0.06	0.06	0.03	0.03	0.02	0.05	0.06
	Min	2.68	0.4	1	0.43	0.21	0.73	0.48	0.33	0.93	1.42	0.39	0.62	0.34	0.92	1.16
	Max	3.08	0.5	1.17	0.48	0.25	0.8	0.58	0.42	1.09	1.57	0.46	0.7	0.4	1.03	1.29
E. gilva																
F (N=5)	**Mean**	**3.69**	**0.52**	**1.44**	**0.63**	**0.26**	**0.96**	**0.58**	**0.37**	**1.25**	**1.92**	**0.46**	**0.803**	**0.42**	**1.33**	**1.68**
	SD	0.14	0.07	0.03	0.03	0.02	0.02	0.04	0.03	0.04	0.05	0.04	0.02	0.04	0.05	0.06
	Min	3.55	0.44	1.4	0.57	0.22	0.92	0.52	0.34	1.22	1.86	0.42	0.77	0.38	0.57	1.26
	Max	3.86	0.66	1.49	0.65	0.28	0.97	0.62	0.41	1.32	1.99	0.51	0.83	0.48	1.4	1.74
E. kiritshenkoi																
M (N=5)	**Mean**	**4.39**	**0.62**	**1.14**	**0.63**	**0.35**	**1.54**	**1.09**	**0.55**	**1.57**	**2.49**	**0.64**	**0.86**	**0.47**	**1.29**	**1.62**
	SD	0.24	0.03	0.08	0.03	0.01	0.09	0.08	0.05	0.05	0.07	0.05	0.02	0.02	0.02	0.07
	Min	4.04	0.57	1.06	0.6	0.33	1.45	1.1	0.49	1.5	2.44	0.56	0.84	0.46	1.25	1.55
	Max	4.67	0.65	1.26	0.66	0.36	1.65	1.17	0.6	1.62	2.58	0.71	0.89	0.5	1.31	1.71
F (N=5)	**Mean**	**4.53**	**0.63**	**1.25**	**0.62**	**0.36**	**1.49**	**1.07**	**0.59**	**1.56**	**2.37**	**0.65**	**0.87**	**0.49**	**1.37**	**1.7**
	SD	0.08	0.03	0.03	0.04	0.04	0.04	0.07	0.03	0.03	0.12	0.02	0.02	0.06	0.04	0.04
	Min	4.43	0.59	1.21	0.55	0.31	1.46	0.98	0.57	1.54	2.23	0.61	0.86	0.42	1.32	1.64
	Max	4.62	0.66	1.28	0.65	0.4	1.56	1.15	0.64	1.62	2.53	0.68	0.91	0.54	1.43	1.73

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
E. lividella																
M (N=2)	**Mean**	**3.13**	**0.46**	**1.2**	**0.48**	**0.25**	**0.95**	**0.63**	**0.45**	**1.09**	**1.71**	**0.42**	**0.7**	**0.33**	**1.05**	**1.27**
	SD	0.07	0.05	0.07	0.02	0.01	0.02	0	0.03	0.09	0.02	0.08	0.02	0.02	0.02	0.07
	Min	3.08	0.43	1.15	0.46	0.25	0.93	0.63	0.43	1.02	1.7	0.37	0.68	0.32	1.04	1.22
	Max	3.17	0.5	1.25	0.49	0.26	0.97	0.63	0.47	1.15	1.73	0.48	0.72	0.35	1.06	1.32
F (N=2)	**Mean**	**3.18**	**0.49**	**1.29**	**0.47**	**0.27**	**0.91**	**0.6**	**0.44**	**1.11**	**1.17**	**0.45**	**0.7**	**0.39**	**1.03**	**1.37**
	SD	0.03	0.02	0.05	0.02	0	0	0.01	0.01	0.02	0.09	0.01	0.03	0.03	0.02	0
	Min	3.16	0.48	1.26	0.46	0.27	0.91	0.59	0.43	1.03	1.59	0.45	0.68	0.37	1.02	1.37
	Max	3.2	0.5	1.32	0.49	0.27	0.91	0.6	0.44	1.2	1.72	0.46	0.72	0.41	1.05	1.37
E. miyamotoi																
F (N=1)	**Mean**	**4.53**	**0.57**	**1.45**	**0.74**	**0.33**	**1.38**	**0.95**	**0.69**	**1.86**	**2.52**	**0.62**	**0.87**	**0.45**	**1.33**	**1.82**
Harpocera choii																
F (N=1)	**Mean**	**5.2**	**0.62**	**1.21**	**1.15**	**0.4**	**1.16**	**0.82**	**0.61**	**2.02**	**2.92**	**0.71**	**1**	**0.58**	**2.28**	**2.49**
H. orientalis																
M (N=1)	**Mean**	**5.84**	**0.71**	**1.04**	**0.95**	**0.49**	**0.96**	**0.88**	**0.68**	**1.85**	**2.56**	**0.59**	**0.97**	**0.51**	**1.77**	**1.87**
F (N=2)	**Mean**	**5.42**	**0.68**	**1.03**	**1.03**	**0.31**	**1.08**	**0.68**	**0.43**	**1.68**	**2.46**	**0.59**	**0.95**	**0.59**	**1.42**	**2.31**
	SD	0.18	0.05	0.01	0.08	0.06	0.03	0.03	0.06	0	0.07	0.02	0.02	0.09	0.98	0.08
	Min	5.29	0.65	1.02	0.98	0.26	1.06	0.67	0.39	1.68	2.41	0.57	0.93	0.52	0.73	2.25
	Max	5.55	0.71	1.04	1.09	0.35	1.11	0.7	0.48	1.68	2.51	0.6	0.97	0.65	2.11	2.37

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
Kasumiphylus kyushuensis																
M (N=2)	**Mean**	**3.04**	**0.49**	**1.3**	**0.49**	**0.28**	**1.2**	**0.72**	**0.56**	**1.28**	**1.92**	**0.54**	**0.71**	**0.22**	**1.06**	**1.19**
	SD	0.2	0.06	0	0.01	0.02	0	0.03	0	0.01	0.11	0.01	0.05	0	0.01	0.01
	Min	2.9	0.45	1.3	0.49	0.27	1.2	0.7	0.56	1.28	1.84	0.53	0.68	0.22	1.05	1.19
	Max	3.18	0.53	1.3	0.5	0.29	1.2	0.74	0.56	1.28	1.99	0.55	0.75	0.22	1.07	1.2
F (N=5)	**Mean**	**3.13**	**0.49**	**1.36**	**0.5**	**0.28**	**1.06**	**0.73**	**0.51**	**1.23**	**1.85**	**0.47**	**0.71**	**0.28**	**1.02**	**1.28**
	SD	0.14	0.02	0.06	0.02	0.02	0.06	0.04	0.02	0.02	0.07	0.02	0.02	0.02	0.02	0.04
	Min	2.91	0.46	1.3	0.46	0.26	1	0.7	0.49	1.21	1.77	0.43	0.68	0.24	1	1.24
	Max	3.29	0.52	1.45	0.52	0.295	1.104	0.75	0.52	1.26	1.95	0.49	0.73	0.29	1.04	1.33
Moissonia befui																
F (N=1)	**Mean**	**3.2**	**0.53**	**1.11**	**0.56**	**0.22**	**0.81**	**0.53**	**0.41**	**1.05**	**1.56**	**0.35**	**0.79**	**0.39**	**1.26**	**1.42**
M. kalopani																
M (N=5)	**Mean**	**3.2**	**0.51**	**0.98**	**0.54**	**0.2**	**0.87**	**0.52**	**0.37**	**1**	**1.45**	**0.39**	**0.76**	**0.38**	**1.16**	**1.35**
	SD	0.09	0.03	0.05	0.02	0.02	0.02	0.05	0.03	0.07	0.22	0.01	0.01	0.01	0.01	0.09
	Min	3.08	0.49	0.93	0.52	0.18	0.86	0.45	0.34	0.9	1.05	0.37	0.74	0.36	1.15	1.21
	Max	3.33	0.57	1.04	0.57	0.22	0.9	0.55	0.39	1.06	1.57	0.41	0.78	0.4	1.19	1.42
F (N=3)	**Mean**	**3.07**	**0.51**	**0.98**	**0.59**	**0.2**	**0.81**	**0.49**	**0.35**	**1.06**	**1.62**	**0.39**	**0.81**	**0.41**	**1.32**	**1.45**
	SD	0.06	0.03	0.02	0.02	0.01	0.02	0.03	0.04	0.01	0.04	0.02	0.02	0.01	0	0.02
	Min	3.03	0.48	0.96	0.57	0.19	0.79	0.48	0.32	1.05	1.58	0.36	0.79	0.4	1.31	1.44
	Max	3.11	0.55	0.99	0.61	0.22	0.83	0.51	0.37	1.06	1.66	0.4	0.83	0.42	1.32	1.46

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
M. yasunagai																
M (N=1)	**Mean**	**3.07**	**0.5**	**0.94**	**0.5**	**0.2**	**0.85**	**0.55**	**0.37**	**1.02**	**1.54**	**0.37**	**0.74**	**0.36**	**1.16**	**1.34**
F (N=5)	**Mean**	**3.32**	**0.51**	**1.03**	**0.57**	**0.21**	**0.83**	**0.52**	**0.44**	**1.06**	**1.6**	**0.41**	**0.78**	**0.39**	**1.28**	**1.49**
	SD	0.1	0.03	0.04	0.02	0.01	0.03	0.02	0.01	0.04	0.04	0.01	0.01	0.02	0.03	0.02
	Min	3.17	0.47	0.97	0.55	0.19	0.79	0.5	0.43	0.99	1.56	0.4	0.77	0.37	1.26	1.46
	Max	3.42	0.53	1.07	0.59	0.22	0.87	0.55	0.45	1.09	1.65	0.42	0.8	0.42	1.33	1.51
Monosynamma bohemanni																
M (N=5)	**Mean**	**3.7**	**0.63**	**1.37**	**0.65**	**0.27**	**0.94**	**0.5**	**0.39**	**1.23**	**1.76**	**0.49**	**0.86**	**0.46**	**1.25**	**1.64**
	SD	0.11	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.05	0.04	0.01	0.01	0.03	0.03
	Min	3.58	0.6	1.36	0.62	0.24	0.92	0.49	0.37	1.21	1.71	0.45	0.85	0.46	1.21	1.6
	Max	3.84	0.66	1.39	0.66	0.29	0.97	0.53	0.41	1.25	1.83	0.54	0.87	0.48	1.28	1.68
F (N=3)	**Mean**	**3.98**	**0.65**	**1.38**	**0.68**	**0.25**	**0.9**	**0.52**	**0.42**	**1.27**	**1.96**	**0.53**	**0.88**	**0.49**	**1.35**	**1.79**
	SD	0.23	0.04	0.02	0.04	0.02	0.04	0.02	0.01	0.06	0.06	0.02	0.02	0.01	0.04	0.08
	Min	3.68	0.61	1.36	0.65	0.23	0.85	0.5	0.4	1.2	1.8	0.52	0.86	0.47	1.28	1.66
	Max	4.32	0.7	1.41	0.75	0.28	0.96	0.54	0.43	1.35	2.02	0.56	0.91	0.51	1.4	1.88
Orthonotus bicoloriceps																
M (N=5)	**Mean**	**3.77**	**0.56**	**1.4**	**0.6**	**0.38**	**1.48**	**0.95**	**0.58**	**1.49**	**2.24**	**0.53**	**0.76**	**0.26**	**1.15**	**1.49**
	SD	0.2	0.02	0.01	0.04	0.03	0.07	0.05	0.03	0.07	0.19	0.03	0.02	0.04	0.05	0.04
	Min	3.45	0.54	1.39	0.55	0.35	1.39	0.9	0.55	1.4	2.02	0.5	0.73	0.24	1.08	1.41
	Max	3.95	0.58	1.41	0.65	0.41	1.57	0.99	0.6	1.56	2.48	0.55	0.79	0.34	0.23	1.53

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N=3)	**Mean**	**3.38**	**0.55**	**1.38**	**0.62**	**0.43**	**1.2**	**0.83**	**0.57**	**1.36**	**2.08**	**0.51**	**0.74**	**0.31**	**1.2**	**1.63**
	SD	0.09	0.06	0.04	0.04	0.01	0.03	0.03	0.03	0.02	0.07	0.01	0.02	0.02	0.05	0.05
	Min	3.27	0.48	1.35	0.57	0.42	1.17	0.8	0.54	1.34	1.98	0.5	0.71	0.28	1.14	1.56
	Max	3.5	0.62	1.44	0.64	0.44	1.24	0.86	0.62	1.39	2.14	0.52	0.77	0.32	1.25	1.69
Orthophylus yongmuni																
M (N=1)	**Mean**	**4.66**	**0.5**	**1.01**	**0.6**	**0.31**	**1.67**			**1.31**	**1.61**	**0.53**	**0.78**	**0.28**	**1.23**	**1.47**
Parapsallus vitellinus																
M (N=3)	**Mean**	**3.44**	**0.43**	**1.08**	**0.51**	**0.22**	**0.93**	**0.58**	**0.38**	**1.18**	**1.61**	**0.47**	**0.68**	**0.3**	**1.1**	**1.3**
	SD	0.02	0.06	0.06	0.02	0.01	0.02	0.01	0.02	0.07	0.09	0.05	0.01	0.02	0.01	0.02
	Min	3.41	0.36	1.02	0.49	0.22	0.9	0.57	0.36	1.1	1.52	0.41	0.67	0.29	1.09	1.28
	Max	3.45	0.47	1.12	0.52	0.23	0.95	0.59	0.39	1.23	1.7	0.5	0.7	0.32	1.11	1.32
F (N=4)	**Mean**	**3.37**	**0.47**	**1.03**	**0.51**	**0.23**	**0.95**	**0.59**	**0.37**	**1.09**	**1.62**	**0.5**	**0.69**	**0.34**	**1.09**	**1.44**
	SD	0.1	0.01	0.04	0.01	0.03	0.08	0.04	0.01	0.08	0.07	0.02	0.02	0.02	0.06	0.07
	Min	3.26	0.45	0.98	0.49	0.19	0.86	0.54	0.36	1.02	1.56	0.48	0.66	0.3	1.06	1.38
	Max	3.45	0.48	1.08	0.52	0.27	1.04	0.63	0.38	1.18	1.69	0.52	0.71	0.35	1.18	1.54
Phylus coryloides																
M (N=4)	**Mean**	**4.67**	**0.57**	**1.59**	**0.67**	**0.29**	**1.42**	**0.72**	**0.44**	**1.35**	**2.06**	**0.45**	**0.77**	**0.38**	**1.14**	**1.36**
	SD	0.39	0.01	0.02	0.04	0.02	0.07	0.04	0.02	0.07	0.11	0.01	0.03	0.03	0.08	0.12
	Min	4.22	0.56	1.57	0.65	0.26	1.36	0.67	0.42	1.29	1.98	0.45	0.74	0.33	1.08	1.24
	Max	5.01	0.57	1.62	0.72	0.32	1.53	0.75	0.46	1.43	2.14	0.46	0.81	0.41	1.26	1.48

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N=3)	**Mean**	**4.39**	**0.58**	**1.57**	**0.7**	**0.26**	**1.23**	**0.69**	**0.4**	**1.23**	**2.05**	**0.48**	**0.76**	**0.42**	**1.15**	**1.31**
	SD	0.34	0.05	0.01	0.03	0.01	0.03	0.07	0.01	0.02	0.05	0.02	0.03	0.03	0.04	0.03
	Min	4.14	0.53	1.55	0.66	0.25	1.2	0.62	0.39	1.21	1.99	0.45	0.74	0.39	1.12	1.28
	Max	4.78	0.62	1.58	0.72	0.27	1.25	0.76	0.42	1.25	2.08	0.49	0.79	0.44	1.2	1.33
Pseudophylus stundjuki																
M (N=5)	**Mean**	**3.63**	**0.54**	**1.07**	**0.61**	**0.26**	**1.11**	**0.54**	**0.39**	**1.09**	**1.67**	**0.43**	**0.79**	**0.31**	**1.12**	**1.36**
	SD	0.06	0.02	0.01	0.01	0.01	0.05	0.02	0.02	0.06	0.03	0.02	0.02	0.01	0.03	0.05
	Min	3.59	0.51	1.06	0.6	0.24	1.07	0.52	0.37	1.02	1.64	0.39	0.72	0.29	1.08	1.31
	Max	3.74	0.57	1.08	0.62	0.28	1.2	0.56	0.41	1.16	1.72	0.44	0.78	0.32	1.16	1.4
F (N=5)	**Mean**	**3.2**	**0.52**	**1.03**	**0.59**	**0.21**	**0.78**	**0.46**	**1**	**1.01**	**1.41**	**0.39**	**0.69**	**0.35**	**1.1**	**1.44**
	SD	0.06	0.05	0.04	0.02	0.02	0.03	0.02	1.46	0.03	0.04	0.01	0.03	0.02	0.02	0.02
	Min	3.12	0.48	0.98	0.57	0.2	0.75	0.43	0.32	0.96	1.38	0.37	0.67	0.32	1.08	1.42
	Max	3.25	0.59	1.1	0.61	0.24	0.8	0.48	3.62	1.055	1.48	0.41	0.75	0.36	1.12	1.47
Plagiognathus amurensis																
M (N=10)	**Mean**	**3.33**	**0.45**	**1.12**	**0.52**	**0.29**	**1.04**	**0.71**	**0.45**	**1.12**	**1.9**	**0.41**	**0.71**	**0.38**	**1.07**	**1.32**
	SD	0.24	0.05	0.13	0.06	0.03	0.12	0.08	0.06	0.11	0.18	0.03	0.03	0.02	0.08	0.11
	Min	3.07	0.38	1.01	0.46	0.24	0.88	0.59	0.39	1.02	1.71	0.41	0.68	0.36	0.96	1.15
	Max	3.83	0.57	1.44	0.67	0.33	1.33	0.87	0.61	1.35	2.2	0.5	0.76	0.44	1.23	1.55
F (N=10)	**Mean**	**3.4**	**0.49**	**1.25**	**0.55**	**0.29**	**0.96**	**0.66**	**0.41**	**1.21**	**1.86**	**0.46**	**0.73**	**0.42**	**1.17**	**1.52**
	SD	0.29	0.03	0.09	0.06	0.03	0.09	0.05	0.05	0.08	0.15	0.03	0.02	0.02	0.1	0.17
	Min	3.05	0.45	1.11	0.47	0.26	0.87	0.55	0.34	1.05	1.65	0.42	0.72	0.4	1.05	1.33
	Max	3.84	0.53	1.38	0.63	0.35	1.1	0.73	0.5	1.33	2.11	0.5	0.77	0.47	1.37	1.8

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
P. chrysanthemi																
M (N=2)	**Mean**	**4.25**	**0.47**		**0.59**	**0.26**	**1.15**	**0.87**	**0.44**	**1.43**	**1.56**	**0.53**	**0.78**	**0.33**	**1.21**	**1.55**
	SD	0.12	0.01		0.02	0.01	0.11	0.02	0.02	0.01	0.43	0.09	0.03	0.03	0.01	0.06
	Min	4.17	0.46		0.57	0.25	1.08	0.86	0.42	1.43	1.26	0.47	0.76	0.31	1.2	1.52
	Max	4.34	0.48		0.6	0.28	1.23	0.89	0.45	1.44	1.86	0.6	0.8	0.35	1.22	1.59
F (N=2)	**Mean**	**3.38**	**0.43**		**0.49**	**0.26**	**0.93**			**1.22**	**1.62**	**0.56**	**0.68**	**0.37**	**1.11**	**1.44**
	SD	0.3	0.02		0.07	0	0.05			0.12	0.18	0.05	0.04	0.03	0.11	0.05
	Min	3.17	0.41		0.45	0.26	0.9			1.14	1.49	0.53	0.65	0.34	1.04	1.41
	Max	3.6	45		0.54	0.26	0.97			1.3	1.75	0.59	0.71	0.39	1.19	1.48
P. collaris																
M (N=3)	**Mean**	**4.29**	**0.55**	**1.54**	**0.65**	**0.28**	**1.18**	**0.82**	**0.42**	**1.5**	**2.25**	**0.58**	**0.8**	**0.39**	**1.27**	**1.5**
	SD	0.45	0.01	0.09	0.09	0.03	0.13	0.06	0.03	0.07	0.16	0.04	0.05	0.04	0.09	0.3
	Min	3.92	0.54	1.46	0.56	0.24	1.1	0.76	0.39	1.45	2.14	0.55	0.76	0.35	1.19	1.16
	Max	4.79	0.55	1.65	0.74	0.31	1.34	0.88	0.44	1.54	2.36	0.6	0.85	0.42	1.37	1.71
F (N=3)	**Mean**	**4.3**	**0.56**	**1.54**	**0.64**	**0.3**	**1.18**	**0.78**	**0.42**	**1.52**	**2.36**	**0.59**	**0.79**	**0.41**	**1.32**	**1.56**
	SD	0.48	0.11	0.15	0.11	0.04	0.06	0.07	0.08	0.1	0.27	0.08	0.04	0.02	0.13	0.32
	Min	3.91	0.44	1.38	0.52	0.25	1.13	0.73	0.36	1.45	2.17	0.54	0.74	0.38	1.22	1.3
	Max	4.84	0.64	1.67	0.75	0.34	1.24	0.84	0.48	1.59	2.55	0.65	0.83	0.43	1.47	1.92

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
P. yomogi																
M (N=4)	**Mean**	**3.06**	**0.36**	**1.15**	**0.52**	**0.27**	**0.94**	**0.71**	**0.45**	**1.12**	**1.82**	**0.44**	**0.64**	**0.34**	**1.03**	**1.4**
	SD	0.11	0.03	0.07	0.02	0.01	0.05	0.03	0.07	0.1	0.03	0.02	0	0.02	0.03	0.14
	Min	2.91	0.33	1.08	0.49	0.27	0.88	0.69	0.41	1.04	1.79	0.41	0.64	0.32	0.99	1.31
	Max	3.16	0.41	1.22	0.54	0.3	1.01	0.76	0.56	1.23	1.85	0.46	0.65	0.37	1.08	1.6
F (N=3)	**Mean**	**3.05**	**0.43**	**1.18**	**0.53**	**0.27**	**0.91**	**0.66**	**0.41**	**1.82**	**0.41**	**0.4**	**0.67**	**0.38**	**1.1**	**1.47**
	SD	0.17	0.03	0.04	0.01	0	0.02	0.08	0.01	0.1	0.03	0.01	0.01	0.01	0.06	0.05
	Min	2.89	0.39	1.15	0.52	0.27	0.88	0.6	0.4	1.74	0.39	0.4	0.66	0.37	1.06	1.43
	Max	3.23	0.45	1.22	0.54	0.27	0.94	0.75	0.41	1.93	0.44	0.41	0.68	0.39	1.16	1.52
Psallus ater																
M (N = 5)	**Mean**	**3.47**	**0.55**	**1.39**	**0.71**	**0.21**	**1.04**	**0.57**	**0.37**	**1.27**	**2.1**	**0.52**	**0.79**	**0.37**	**1.38**	**1.7**
	SD	0.027	0.07	0.08	0.03	0.03	0.09	0.01	0.03	0.13	0.13	0.05	0.03	0.03	0.07	0.1
	Min	3.21	0.44	1.26	0.65	0.17	0.89	0.55	0.34	1.09	1.92	0.45	0.75	0.35	1.26	1.58
	Max	3.86	0.61	1.48	0.74	0.25	1.12	0.58	0.4	1.41	2.24	0.55	0.83	0.41	1.48	1.82
P. atratus																
F (N = 1)	**Mean**	**4.39**	**0.68**	**1.61**	**0.84**	**0.2**	**1.16**	**0.6**	**0.36**	**1.45**	**2.14**	**0.58**	**0.89**	**0.45**	**1.61**	**1.99**
P. bagjonicus																
M (N = 1)	**Mean**	**3.52**	**0.56**		**0.68**	**0.2**	**1.07**	**0.45**	**0.28**	**1.08**	**1.7**		**0.83**	**0.37**	**1.31**	**1.52**
F (N = 5)	**Mean**	**3.3**	**0.56**	**1.23**	**0.67**	**0.19**	**0.89**	**0.38**	**0.24**	**1.09**	**1.68**	**0.39**	**0.76**	**0.39**	**1.36**	**1.75**
	SD	0.24	0.04	0.04	0.02	0.04	0.04	0	0.0002	0.02	0.02	0.05	0.02	0.01	0.04	0.08
	Min	3.01	0.51	1.2	0.66	0.13	0.84	0.38	0.24	1.07	1.66	0.34	0.73	0.38	1.31	1.64
	Max	3.63	0.61	1.27	0.7	0.21	0.93	0.38	0.25	1.12	1.2	0.45	0.8	0.41	1.41	1.82

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
P. castanea																
M (N = 5)	**Mean**	**3.16**	**0.55**	**1.14**	**0.66**	**0.21**	**0.88**	**0.47**	**0.32**	**1.1**	**1.76**	**0.45**	**0.77**	**0.36**	**1.32**	**1.59**
	SD	0.16	0.03	0.03	0.02	0.01	0.04	0.02	0.01	0.03	0.07	0.03	0.02	0.02	0.05	0.02
	Min	2.99	0.5	1.11	0.63	0.2	0.83	0.44	0.3	1.06	0.16	0.41	0.07	0.34	1.26	1.57
	Max	3.37	0.57	1.18	0.7	0.24	0.93	0.49	0.33	1.14	1.81	0.5	0.79	0.39	1.37	1.62
F (N = 5)	**Mean**	**3.21**	**0.52**	**1.25**	**0.66**	**0.36**	**0.89**	**0.53**	**0.31**	**1.13**	**1.69**	**0.46**	**0.74**	**0.39**	**1.32**	**1.6**
	SD	0.13	0.03	0.1	0.02	0.45	0.05	0.02	0.03	0.04	0.02	0.02	0.01	0.01	0.04	0.04
	Min	3.1	0.49	1.11	0.63	0.14	0.82	0.51	0.25	1.09	1.67	0.43	0.72	0.39	1.29	1.54
	Max	3.42	0.57	1.36	0.69	1.17	0.95	0.56	0.33	1.19	1.73	0.48	0.76	0.41	1.37	1.63
P. cheongtaensis																
M (N=1)	**Mean**	**3.4**	**0.48**	**1.44**	**0.66**	**0.21**	**1.01**	**0.46**	**0.37**	**1.25**	**1.8**	**0.46**	**0.85**	**0.37**	**1.27**	**1.55**
P. *cinnabarinus*																
M (N = 5)	**Mean**	**3.06**	**0.52**	**1.19**	**0.6**	**0.21**	**1.07**	**0.64**	**0.36**	**1.14**	**1.91**	**0.41**	**0.78**	**0.32**	**1.14**	**1.44**
	SD	0.08	0.04	0.1	0.05	0.02	0.05	0.04	0.02	0.06	0.07	0.03	0.02	0.01	0.05	0.05
	Min	2.99	0.48	1.11	0.52	0.2	1	0.59	0.33	1.04	1.84	0.39	0.75	0.31	1.08	1.38
	Max	3.19	0.58	1.3	0.64	0.24	1.13	0.71	0.38	1.22	2.02	0.45	0.81	0.35	1.22	1.49
F (N = 1)	**Mean**	**3.54**	**0.53**	**1.31**	**0.68**	**0.22**	**1.11**	**0.65**	**0.38**	**1.13**	**2.01**	**0.45**	**0.77**	**0.46**	**1.21**	**1.67**
P. clarus																
M (N = 5)	**Mean**	**3.99**	**0.62**	**1.48**	**0.73**	**0.29**	**1.23**	**0.59**	**0.29**	**1.37**	**2.21**	**0.44**	**0.87**	**0.34**	**1.52**	**1.8**
	SD	0.16	0.02	0.06	0.02	0.01	0.04	0.04	0.01	0.06	0.09	0.02	0.01	0.02	0.02	0.1
	Min	3.79	0.6	1.41	0.7	0.27	1.17	0.55	0.28	1.27	2.15	0.42	0.85	0.32	1.5	1.67
	Max	4.17	0.65	1.57	0.75	0.31	1.27	0.63	0.3	1.42	2.37	0.48	0.89	0.36	1.55	1.96

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N = 5)	**Mean**	**4.29**	**0.66**	**1.52**	**0.72**	**0.23**	**1.2**	**0.59**	**0.33**	**1.47**	**2.2**	**0.46**	**0.88**	**0.4**	**1.55**	**1.82**
	SD	0.27	0.04	0.06	0.05	0.006	0.05	0.03	0.009	0.1	0.09	0.04	0.03	0.02	0.05	0.1
	Min	3.94	0.6	1.46	0.68	0.22	1.15	0.56	0.32	1.29	2.08	0.41	0.84	0.37	1.51	1.7
	Max	4.57	0.69	1.59	0.8	0.24	1.28	0.62	0.34	1.53	2.3	0.49	0.93	0.43	1.64	1.91
P. flavescens																
M (N = 2)	**Mean**	**3.4**	**0.5**	**1.07**	**0.56**	**0.24**	**1.08**	**0.51**	**0.37**	**1.26**	**2.01**	**0.52**	**0.75**	**0.32**	**1.15**	**1.42**
	SD	0.03	0.02	0.05	0.01	0.01	0.11	0.11	0.01	0.02	0.02	0.02	0.01	0.002	0.07	0.05
	Min	3.39	0.48	1.03	0.55	0.23	1	0.43	0.36	1.25	2	0.5	0.74	0.32	1.1	1.39
	Max	3.42	0.51	1.1	0.57	0.24	1.16	0.6	0.38	1.27	2.03	0.53	0.76	0.32	1.2	1.46
M (N = 4)	**Mean**	**3.35**	**0.56**	**1.42**	**0.54**	**0.22**	**1.1**	**0.57**	**0.38**	**1.2**	**1.99**	**0.41**	**0.71**	**0.36**	**1.18**	**1.53**
	SD	0.23	0.02	0.38	0.05	0.03	0.01	0.01	0.03	0.07	0.03	0.07	0.02	0.01	0.04	0.62
	Min	3.13	0.54	1.2	0.51	0.18	1.08	0.56	0.36	1.13	1.97	0.37	0.7	0.35	1.13	1.46
	Max	3.66	0.59	1.99	0.61	0.24	1.11	0.57	0.4	1.28	2.01	0.46	0.74	0.37	1.23	1.59
P. ernesti																
M (N = 4)	**Mean**	**2.91**	**0.49**	**1.2**	**0.59**	**0.16**	**0.72**	**0.39**	**0.29**	**0.71**	**1.32**	**0.33**	**0.74**	**0.37**	**1.21**	**1.48**
	SD	0.32	0.03	0.02	0.03	0.03	0.04	0.02	0.03	0.06	0.03	0.01	0.01	0.01	0.02	0.09
	Min	2.61	0.45	1.18	0.55	0.13	0.7	0.37	0.25	0.67	1.29	0.32	0.72	0.36	1.18	1.38
	Max	3.22	0.53	1.22	0.62	0.18	0.74	0.42	0.31	0.76	1.34	0.34	0.76	0.39	1.22	1.55
F (N = 5)	**Mean**	**3**	**0.5**	**1.3**	**0.6**	**0.34**	**0.68**	**0.36**	**0.28**	**0.62**	**1.39**	**0.39**	**0.74**	**0.37**	**1.2**	**1.51**
	SD	0.08	0.04	0.08	0.04	0.45	0.06	0.03	0.01	0.07	0.07	0.04	0.03	0.03	0.05	0.12
	Min	2.93	0.43	1.22	0.55	0.13	0.61	0.32	0.26	0.56	1.3	0.32	0.7	0.33	1.14	1.4
	Max	3.12	0.55	1.38	0.66	0.16	0.76	0.41	0.3	0.69	1.48	0.42	0.79	0.42	1.28	1.72

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
P. longinovae																
M (N = 6)	**Mean**	**3.36**	**0.56**	**1.29**	**0.7**	**0.22**	**0.93**	**0.55**	**0.32**	**1.22**	**1.88**	**0.48**	**0.78**	**0.39**	**1.38**	**1.64**
	SD	0.26	0.03	0.08	0.02	0.04	0.04	0.02	0.03	0.06	0.06	0.05	0.01	0.02	0.03	0.03
	Min	3.02	0.53	1.2	0.67	0.17	0.86	0.52	0.3	1.12	1.79	0.4	0.77	0.37	1.35	1.61
	Max	3.77	0.61	1.41	0.73	0.27	0.99	0.58	0.37	1.28	1.94	0.54	0.79	0.41	1.44	1.7
F (N = 6)	**Mean**	**3.38**	**0.57**	**1.43**	**0.74**	**0.19**	**0.99**	**0.59**	**0.34**	**1.26**	**1.91**	**0.52**	**0.76**	**0.4**	**1.41**	**1.71**
	SD	0.27	0.02	0.01	0.04	0.02	0.34	0.03	0.02	0.05	0.06	0.02	0.02	0.01	0.06	0.06
	Min	2.98	0.53	1.42	0.68	0.16	0.94	0.55	0.31	1.19	1.84	0.5	0.73	0.39	1.32	1.62
	Max	3.75	0.61	1.44	0.79	0.21	1.03	0.64	0.37	1.34	2.02	0.54	0.78	0.43	1.47	1.79
P. michaili																
M (N = 2)	**Mean**	**4.05**	**0.54**	**1.29**	**0.76**	**0.21**	**1.02**			**1.33**	**2.03**	**0.48**	**0.83**	**0.34**	**1.5**	**1.84**
	SD	0.08	0.03	0.01	0.01	0.02	0.07			0.04	0.02	0.01	0.01	0.02	0.02	0.06
	Min	0.82	0.52	1.29	0.75	0.2	0.97			1.31	2.01	0.05	0.82	0.32	1.48	1.79
	Max	0.84	0.56	1.3	0.77	0.22	1.07			1.36	2.04	0.08	0.84	0.35	1.51	1.88
F (N = 2)	**Mean**	**3.7**	**0.55**	**1.33**	**0.76**	**0.21**	**0.98**	**0.45**	**0.28**	**1.34**	**2.02**	**0.45**	**0.86**	**0.41**	**1.53**	**1.84**
	SD	0.14	0.01	0.04	0.01	0.01	0.08	0.03	0.01	0.03	0.1	0.07	0.01	0.01	0.04	0.02
	Min	3.6	0.54	1.3	0.75	0.21	0.92	0.43	0.27	1.32	1.96	0.4	0.85	0.41	1.5	1.82
	Max	3.8	0.55	1.35	0.77	0.22	1.04	0.47	0.29	1.37	2.09	0.5	0.87	0.42	1.55	1.85

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
P. suwonanus																
M (N = 6)	**Mean**	**3.57**	**0.49**	**1.14**	**0.68**	**0.2**	**0.94**	**0.54**	**0.34**	**1.25**	**1.79**	**0.55**	**0.83**	**0.36**	**1.36**	**1.61**
	SD	0.25	0.05	0.04	0.02	0.01	0.05	0.04	0.02	0.05	0.05	0.04	0.02	0.004	0.02	0.05
	Min	0.35	0.41	1.1	0.64	0.18	0.88	0.51	0.32	1.21	1.71	0.5	0.81	0.36	1.34	1.53
	Max	4.01	0.53	1.19	0.71	0.22	0.99	0.6	0.38	1.34	1.87	0.59	0.86	0.37	1.39	1.68
F (N = 6)	**Mean**	**3.68**	**0.57**	**1.15**	**0.71**	**0.2**	**0.96**	**0.53**	**0.34**	**1.31**	**1.88**	**0.54**	**0.84**	**0.39**	**1.41**	**1.75**
	SD	0.23	0.04	0.02	0.03	0.01	0.02	0.02	0.03	0.03	0.05	0.03	0.01	0.01	0.03	0.07
	Min	3.35	0.51	1.13	0.67	0.18	0.93	0.51	0.31	1.28	1.8	0.5	0.82	0.37	1.37	1.68
	Max	4.02	0.62	1.2	0.76	0.22	0.99	0.55	0.38	1.34	1.94	0.57	0.86	0.41	1.45	1.87
P. rogeoguttatus																
F (N = 2)	**Mean**	**3.98**	**0.62**	**1.53**	**0.67**	**0.24**	**1.22**	**0.69**	**0.53**	**1.43**	**2.21**		**0.78**	**0.41**	**1.41**	**1.82**
	SD	0.01	0.02	0.04	0.08	0	0.16	0.03	0.15	0.06	0.01		0.03	0.02	0.11	0.13
	Min	3.98	0.61	1.5	0.61	0.23	1.11	0.67	0.42	1.39	2.2		0.76	0.4	1.32	1.73
	Max	3.99	0.64	1.56	0.73	0.24	1.33	0.71	0.63	1.47	2.21		0.8	0.43	1.49	1.91
P. tesongsanicus																
F (N = 1)	**Mean**	**4.15**	**0.59**	**1.64**	**0.63**	**0.2**	**1.12**	**0.61**		**1.33**	**2.02**	**0.49**	**0.79**	**0.4**	**1.29**	**1.68**
P. tonnichanus																
M (N = 5)	**Mean**	**3.1**	**0.53**	**1.21**	**0.61**	**0.21**	**0.94**	**0.53**	**0.36**	**1.13**	**1.78**	**0.49**	**0.74**	**0.36**	**1.21**	**1.51**
	SD	0.3	0.03	0.06	0.04	0.01	0.06	0.03	0.02	0.06	0.09	0.03	0.04	0.02	0.08	0.15
	Min	2.7	0.48	1.15	0.57	0.19	0.88	0.48	0.34	1.08	1.68	0.46	0.69	0.33	1.1	1.32
	Max	3.44	0.55	1.27	0.65	0.23	1.03	0.58	0.38	1.23	1.9	0.53	0.79	0.38	1.3	1.68

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N = 5)	**Mean**	**3**	**0.52**	**1.25**	**0.59**	**0.19**	**0.92**	**0.49**	**0.31**	**1.14**	**1.71**	**0.51**	**0.75**	**0.38**	**1.18**	**1.44**
	SD	0.18	0.08	0.02	0.04	0.01	0.05	0.04	0.02	0.07	0.05	0.04	0.02	0.02	0.07	0.06
	Min	2.69	0.41	1.23	0.52	0.18	0.87	0.44	0.3	1.04	1.63	0.47	0.71	0.36	1.06	1.33
	Max	3.14	0.59	1.26	0.63	0.2	1.01	0.53	0.33	1.2	1.74	0.56	0.76	0.41	1.23	1.49
Rubrocuneocoris quercicola																
M (N=1)	**Mean**	**2.69**	**0.46**	**1.2**	**0.45**	**0.25**	**0.87**	**0.39**	**0.33**	**0.88**	**1.3**	**0.37**	**0.64**	**0.26**	**1.01**	**1.11**
Pherolepis amplus																
M (N=1)	**Mean**	**3.6**	**0.62**	**1.53**	**0.77**	**0.24**	**0.93**	**0.4**		**1.15**	**1.68**	**0.34**	**1.02**	**0.44**	**1.3**	**1.58**
F (N=4)	**Mean**	**3.87**	**0.74**	**1.51**	**0.79**	**0.27**	**0.93**	**0.45**	**0.4**	**1.17**	**1.72**	**0.4**	**1.05**	**0.59**	**1.41**	**1.77**
	SD	0.22	0.04	0.04	0.05	0.02	0.02	0.04	0.03	0.05	0.08	0.05	0.01	0.17	0.04	0.11
	Min	3.62	0.7	1.46	0.73	0.24	0.91	0.41	0.36	1.1	1.65	0.37	1.04	0.49	1.37	1.66
	Max	4.08	0.78	1.55	0.84	0.3	0.95	0.51	0.41	1.21	1.83	0.45	1.05	0.84	1.44	1.91
P. kiritshenkoi																
M (N=2)	**Mean**	**3.65**	**0.65**	**1.44**	**0.74**	**0.23**	**0.94**	**0.34**	**0.45**	**1.05**	**1.59**	**0.45**	**1.1**	**0.52**	**1.36**	**1.57**
	SD	0.02	0.06	0.06	0.05	0.01	0	0.04		0.11	0.03	0.06	0.03	0.05	0.03	0
	Min	3.64	0.62	1.8	0.71	0.22	0.93	0.31	0.45	0.97	1.57	0.4	1.08	0.48	1.33	1.57
	Max	3.66	0.69	1.48	0.78	0.24	0.94	0.37	0.45	1.12	1.61	0.49	1.12	0.55	1.38	1.57
F (N=1)	**Mean**	**3.8**	**0.71**		**0.75**	**0.22**	**0.92**			**1.05**	**1.61**	**0.42**	**1.11**	**0.57**	**1.44**	**1.65**
Pilophorus choi																
M (N=1)	**Mean**	**4.07**	**0.73**	**1.24**	**0.81**	**0.29**	**1.14**	**0.48**	**0.46**	**1.35**	**2.07**	**0.4**	**0.73**	**0.39**	**1.2**	**1.13**

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
P. clavatus																
M (N=1)	**Mean**	**4.37**	**0.63**	**1.46**	**0.77**	**0.36**	**1.43**	**0.61**		**1.41**	**2.26**	**0.41**	**1.01**	**0.49**	**1.31**	**1.45**
F (N=3)	**Mean**	**3.19**	**0.66**	**1.36**	**0.8**	**0.31**	**1.3**	**0.53**	**0.47**	**1.32**	**2.23**	**0.43**	**0.98**	**0.51**	**1.22**	**1.36**
	SD	0.12	0.09	0.03	0.13	0.01	0.05	0.02	0.02	0.11	0.04	0.01	0.01	0.02	0.03	0.01
	Min	3.77	0.59	1.36	0.72	0.3	1.25	0.51	0.45	1.26	2.2	0.43	0.98	0.5	1.19	1.35
	Max	3.98	0.75	1.4	0.95	0.31	1.36	0.55	0.48	1.44	2.28	0.44	0.99	0.54	1.26	1.37
P. erraticus																
M (N=4)	**Mean**	**4.17**	**0.75**	**1.4**	**0.84**	**0.29**	**1.41**	**0.52**	**0.51**	**1.46**	**2.35**	**0.44**	**0.97**	**0.49**	**1.22**	**1.27**
	SD	0.18	0.05	0.05	0.03	0.02	0.04	0.03	0.07	0.1	0.05	0.04	0.02	0.02	0.05	0.08
	Min	3.92	0.7	1.35	0.81	0.27	1.377	0.5	0.43	1.33	2.3	0.41	0.96	0.46	1.15	1.15
	Max	4.32	0.8	1.46	0.88	0.31	1.47	0.57	0.6	1.57	2.39	0.49	0.99	0.5	1.27	1.35
F (N=4)	**Mean**	**4.06**	**0.82**	**1.42**	**0.89**	**0.31**	**1.57**	**0.52**	**0.49**	**1.52**	**2.44**	**0.44**	**1.02**	**0.54**	**1.21**	**1.28**
	SD	0.16	0.05	0.05	0.04	0.06	0.03	0.04	0.04	0.08	0.02	0.02	0.02	0.02	0.03	0.01
	Min	3.85	0.75	1.36	0.86	0.29	1.51	0.49	0.46	1.45	2.32	1.42	1	0.51	1.18	1.27
	Max	4.21	0.85	1.49	0.94	0.32	1.64	0.56	0.52	1.54	2.51	0.45	1.04	0.56	1.24	1.3
P. koreanus																
M (N=3)	**Mean**	**3.56**	**0.7**	**1.17**	**0.76**	**0.26**	**1.2**	**0.45**	**0.42**	**1.19**	**1.79**	**0.4**	**0.91**	**0.45**	**1.1**	**1.17**
	SD	0.12	0.02	0.05	0.02	0.01	0.5	0.03	0.05	0.06	0.09	0.04	0.02	0.02	0.02	0.04
	Min	3.43	0.68	1.11	0.74	0.26	1.16	0.43	0.38	1.12	1.68	0.35	0.89	0.43	1.08	1.12
	Max	3.68	0.71	1.21	0.77	0.27	1.25	0.48	0.48	1.24	1.85	0.43	0.93	0.46	1.11	1.21

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
F (N=3)	**Mean**	**3.65**	**0.72**	**1.22**	**0.79**	**0.26**	**1.26**	**0.48**	**0.39**	**1.25**	**1.91**	**0.4**	**0.91**	**0.47**	**1.14**	**1.17**
	SD	0.05	0.02	0.02	0.04	0.02	0.03	0.05	0.03	0.05	0.09	0.02	0.03	0.01	0.05	0.07
	Min	3.59	0.7	1.2	0.75	0.25	1.22	0.43	0.36	1.2	1.81	0.38	0.89	0.47	1.09	1.11
	Max	3.69	0.74	1.24	0.822	0.28	1.28	0.53	0.41	1.29	1.98	0.42	0.94	0.48	1.19	1.25
P. lucidus																
M (N=2)	**Mean**	**3.34**	**0.57**	**1.17**	**0.73**	**0.21**	**0.88**	**0.38**	**0.42**	**1.02**	**1.65**	**0.34**	**0.84**	**0.38**	**1.11**	**1.06**
	SD	0.06	0.07	0.01	0.06	0.01	0.04	0	0.02	0.04	0.01	0.01	0.03	0.03	0.05	0.14
	Min	3.3	0.52	1.17	0.68	0.2	0.85	0.37	0.4	1	1.64	0.34	0.82	0.36	1.08	0.96
	Max	3.38	0.62	1.18	0.77	0.21	0.91	0.38	0.44	1.05	1.66	0.34	0.85	0.4	1.15	1.16
F (N=2)	**Mean**	**3.68**	**0.61**	**1.18**	**0.79**	**0.2**	**0.94**	**0.38**	**0.4**	**1.17**	**1.77**	**0.37**	**0.88**	**0.41**	**1.22**	**1.21**
	SD	0.2	0.09	0.01	0.07	0	0.07	0.05	0.03	0.04	0.03	0.04	0.08	0.03	0.01	0.11
	Min	3.54	0.55	1.17	0.75	0.2	0.89	0.34	0.38	1.15	1.75	0.35	0.82	0.39	1.21	1.13
	Max	3.82	0.67	1.19	0.84	0.2	0.98	0.42	0.42	1.2	1.79	0.4	0.93	0.43	1.23	1.29
P. niger																
M (N=3)	**Mean**	**4.44**	**0.88**	**1.72**	**0.92**	**0.34**	**1.79**	**0.73**	**0.54**	**1.74**	**2.77**	**0.53**	**1.08**	**0.52**	**1.39**	**1.47**
	SD	0.36	0.02	0.07	0.03	0.02	0.09	0.02	0.03	0.03	0.1	0.02	0.03	0.03	0.05	0.08
	Min	4.16	0.89	1.64	0.89	0.31	1.7	0.71	0.51	1.71	2.69	0.51	1.05	0.49	1.35	1.42
	Max	4.85	0.9	1.76	0.95	0.36	1.88	0.74	0.56	1.77	2.88	0.55	1.11	0.54	1.46	1.56
F (N=2)	**Mean**	**4.46**	**0.9**	**1.75**	**0.91**	**0.38**	**1.64**	**0.71**	**0.57**	**1.74**	**2.58**	**0.51**	**1.1**	**0.54**	**1.36**	**1.56**
	SD	0.03	0.02	0.02	0.08	0.06	0.03	0.01	0.02	0.01	0.16	0.04	0.01	0.05	0	0.02
	Min	4.44	0.89	1.74	0.85	0.34	1.62	0.7	0.55	1.73	2.47	0.48	1.09	0.5	1.36	1.55
	Max	4.47	0.92	1.76	0.96	0.43	1.67	0.71	0.58	1.74	2.7	0.54	1.11	0.58	1.36	1.57

Table 1. (Continued)

		Length											Width			
		Total body	Head	Labium	Pronotum	Antenna				Hind leg			Head	Vertex	Pronotum	Hemelytra
						Seg. I	Seg. II	Seg. III	Seg. IV	Femur	Tibia	Tarsus				
P. miyamotoi																
F (N=2)	**Mean**	**4.27**	**0.84**	**1.46**	**0.81**	**0.31**	**1.4**	**0.52**	**0.47**	**1.5**	**2.09**	**0.52**	**1.18**	**0.61**	**1.41**	**1.75**
	SD	0.4	0.02	0.4	0.03	0.05	0.03	0.01	0.02	0.1	0.14	0.01	0.05	0	0.02	0.19
	Min	3.99	0.82	1.18	0.79	0.28	1.38	0.51	0.45	1.43	1.99	0.51	1.15	0.61	1.4	1.61
	Max	4.56	0.85	1.74	0.83	0.34	1.42	0.53	0.48	1.56	2.19	0.52	1.21	0.62	1.43	1.88
P. setulosus																
M (N=2)	**Mean**	**4.6**	**0.69**	**1.64**	**0.84**	**0.35**	**1.66**	**0.66**	**0.51**	**1.6**	**2.52**	**0.51**	**1.05**	**0.5**	**1.42**	**1.52**
	SD	0.35	0.07	0.02	0.02	0.05	0.07	0.02	0.02	0.08	0.1	0	0.01	0.01	0.01	0
	Min	4.35	0.65	1.62	0.82	0.31	1.61	0.64	0.5	1.55	2.45	0.51	1.04	0.5	1.41	1.52
	Max	4.84	0.74	1.65	0.86	0.39	1.7	0.67	0.53	1.66	2.59	0.51	1.06	0.5	1.43	1.52
F (N=1)	**Mean**	**4.49**	**0.67**	**1.61**	**0.88**	**0.38**	**1.69**	**0.66**	**0.57**	**1.6**	**2.59**	**0.49**	**1.04**	**0.53**	**1.39**	**1.46**
P. typicus																
M (N=5)	**Mean**	**2.93**	**0.7**	**1**	**0.66**	**0.19**	**0.91**	**0.44**	**0.48**	**0.98**	**1.71**	**0.41**	**0.79**	**0.45**	**0.86**	**0.84**
	SD	0.12	0.06	0.02	0.06	0.01	0.05	0.02	0.03	0.05	0.08	0.04	0.02	0.01	0.06	0.05
	Min	2.81	0.62	0.94	0.64	0.18	0.84	0.41	0.44	0.92	1.65	0.37	0.77	0.43	0.76	0.77
	Max	3.11	0.78	1.11	0.68	0.21	0.99	0.45	0.52	1.05	1.83	0.46	0.82	0.46	0.91	0.9
F (N=5)	**Mean**	**3**	**0.72**	**1.03**	**0.64**	**0.18**	**0.88**	**0.44**	**0.51**	**1.02**	**1.8**	**0.44**	**0.83**	**0.48**	**0.77**	**0.89**
	SD	0.09	0.04	0.08	0.03	0.03	0.03	0.03	0.03	0.05	0.04	0.02	0.05	0.01	0.03	0.03
	Min	2.86	0.66	0.93	0.61	0.16	0.83	0.4	0.47	0.94	1.74	0.42	0.75	0.46	0.74	0.86
	Max	3.08	0.76	1.1	0.69	0.22	0.91	0.47	0.55	1.06	1.84	0.46	0.86	0.5	0.81	0.93

****Note***. M= Male, F= Female, N= Number of specimens measured, and SD= Standard deviation.

** Those specimens which were newly described, or species collected during field survey in South Korea were measured.

Table 2. Distribution of Subfamily Phylinae in Eastasia

No.	Genus	Species	Representative countries					
			China	Japan	Korea	Mongolia	Russia (FE)	Taiwan
Tribe: Auricillocorini Schuh, 1984								
1	*Cleotomiris*	*chinensis*	*					
2	*Cleotomiroides*	sp	*					
3	*Wygomiris*	*mingorum*	*					
		taipokau	*					
Tribe: Hallodapini Van Duzee, 1916								
4	*Acrorrhinium*	*hongkong*	*					
		inexpectatum		*	*		*	
5	*Hallodapus*	*albofasciatus*	*	*				*
		brunneus	*	*				*
		centrimaculatus	*	*	*			
		fasciatus	*					
		kyushuensis		*				
		linnavuorii		*	*		*	
		persimilis						*
		pumilus			*		*	
		ravenar	*	*				
		sibiricus	*				*	
6	*Systellonotus*	*malaisei*		*	*		*	
Tribe: Leucophoropterini Schuh, 1974								
7	*Lasiolabops*	*cosmopolites*		*				
8	*Sejanus*	*amami*		*				
		crassicornis						*
		breviniger		*				
		juglandis		*				
		neofunereus		*				
		potanini		*	*			
Tribe: Phylini Douglas and Scott, 1865								
9	*Acrotelus*	*pilosicornis*	*			*		
10	*Atomoscelis*	*asiatica*	*		*		*	
		onustus				*	*	
		pubescens	*					
11	*Atractotomoidea*	*castanea*		*	*			
		insulicola		*				
12	*Atractotomous*	*morio*		*	*			

Table 2. (cont.)

No.	Genus	Species	Representative countries					
			China	Japan	Korea	Mongolia	Russia (FE)	Taiwan
13	*Brachyarthrum*	*limitatum*		*			*	
14	*Camptotylus*	*reuteri*	*					
15	*Camptotylidea*	*flavescens*					*	
		flavida	*					
		punctulata	*					
		suturalis	*					
16	*Camtpzorus*	*lactucae*				*		
17	*Campylomma*	*annulicorne*	*	*	*			
		boharti		*				
		boninensis		*				
		chichijima		*				
		chinensis	*	*	*			*
		lividicorne		*	*			
		lividum	*	*				
		verbasci	*					
		erurycepalum		*				
		miyamotoi		*	*			
18	*Chlamydatus*	*allii*					*	
		acanthioides					*	
		drymophilus					*	
		opacus					*	
		pachycerus	*			*		
		pallidipes	*					
		Pulicarius	*		*	*	*	
		pullus	*		*	*	*	
		saltitans					*	
		wilkinsoni				*	*	
19	*Compsidolon*	*elaegnicola*		*	*			
		kerzhneri	*				*	
		pumilum	*			*	*	
		punctulatum	*					
		salicellum		*	*		*	
20	*Conostethus*	*hungaricus*				*	*	
21	*Criocoris*	*crassicornis*	*			*		
		quadrimaculatus				*	*	
22	*Decota*	*hesperia*	*			*	*	
		nigritarsis				*	*	
23	*Decomia*	*okutoshii*		*				

Table 2. (cont.)

No.	Genus	Species	Representative countries					
			China	Japan	Korea	Mongolia	Russia (FE)	Taiwan
		cephalotes		*				*
24	*Decomioides*	*schneirlai*	*					
		philippinensis		*				
25	*Eumecotarsus*	*breviceps*	*			*	*	
		chinensis	*					
26	*Eremophylus*	*hirtus*		*				
27	*Europiella*	*artemisiae*	*	*	*		*	
		decolor	*				*	
		gilva	*		*		*	
		kiritshenkoi	*		*		*	
		leucopus	*				*	
		livida	*		*		*	
		lividella	*	*	*		*	
		miyamotoi		*	*		*	
		moesta	*					
28	*Eurycolpus*	*flaveolus*	*			*	*	
29	*Excentricoris*	*pectipes*	*			*	*	
30	*Glaucopternum*	*albonigrum*				*		
		emeljanovi				*		
		gobicum	*			*		
		maculipenne				*		
		majus				*		
		putshkovi				*		
		zygophylli				*		
31	*Harpocera*	*choii*			*		*	
		koreana			*			
		orientalis		*			*	
32	*Kasumiphylus*	*kyushuensis*		*	*		*	
		ryukyuensis		*				
33	*Leucodellus*	*albidus*	*					
		pallescens	*					
		xizangensis	*					
34	*Leucopterum*	*candidatum*	*					
35	*Macrotylus*	*cruciatus*			*	*	*	
		dimidiatus					*	
		mundulus	*		*	*	*	
		zinovievi				*	*	
36	*Maurodactylus*	*albidus*	*					
37	*Megaloceolus*	*molliculus*					*	

Table 2. (cont.)

No.	Genus	Species	Representative countries					
			China	Japan	Korea	Mongolia	Russia (FE)	Taiwan
38	*Moissonia*	*befui*		*	*			
		importunitas		*				
		kalopani			*			
		punctata		*				
		takaii		*				
		yasunagai			*			
39	*Monochroica*	*alashanensis*	*					
40	*Monocris*	*griseolus*				*		
41	*Monosynamma*	*bohemanni*		*	*	*	*	
42	*Nasocoris*	*argyrotrichus*	*			*		
		tesquorum				*	*	
43	*Oncotylus*	*viridiflavus*	*					
44	*Opuna*	*annulata*		*				
45	*Orthonotus*	*alpestris*	*					
		bicoloripes		*	*		*	
		pallidipennis	*					
		tibialis	*					
46	*Parapsallus*	*vitellinus*		*	*		*	
47	*Phaeochiton*	*caraganae*	*			*		
		ebulum				*		
48	*Phaxia*	*festiva*				*		
49	*Phoenicocoris*	*modestus*				*	*	
		obscurellus				*	*	
		quiliananus	*					
50	*Phylus*	*coryloides*	*	*	*		*	
		nigricapsus			*		*	
		miyamotoi		*				
51	*Pseudophylus*	*stundjuki*		*	*		*	
52	*Placochilus*	*paraseladonicus*	*					
53	*Plagiognathus*	*alashanensis*	*					
		amurensis	*	*	*		*	
		arbustorm				*		
		chrysanthemi	*	*	*		*	
		collaris	*	*	*		*	
		maculosus	*					
		obscuriceps	*				*	
		pallescens	*					
		pini		*				
		yomogi	*	*	*		*	

Table 2. (cont.)

No.	Genus	Species	Representative countries					
			China	Japan	Korea	Mongolia	Russia (FE)	Taiwan
54	*Plesiodema*	*pinetella*				*	*	
		stlaniki		*			*	
55	*Psallopsis*	*halostachydis*	*					
		haloxyli				*		
		kalidiicola				*		
		kirgisica	*			*		
		minima	*			*		
		neglecta				*		
56	*Psallus* (*A*)	*aethiops*			*		*	
		ater	*		*			
		atratus			*			
		betuleti	*		*		*	
		crataegi				*		
		graminicola					*	
		michaili			*			
		pullus		*				
		stacklberg		*			*	
	(*C*)	*clarus*	*		*		*	
		roseoguttatus		*	*			
		tesongsanicus			*			
	(*H*)	*aterrimus*		*				
		endoensis		*				
		tonnaichanus	*	*	*		*	
	(*M*)	*holomelas*	*					
		samdzijonicus			*			
	(*Ph*)	*castaneae*	*		*			
		cinnabarinus		*	*		*	
		flavescens	*	*	*		*	
		fukienanus	*					
		kerzhneri			*			
		loginovae			*		*	
		mali	*					
		miyamotoi		*				
		takaii		*				
		ulmi	*	*	*	*	*	
		ussuriensis					*	
	(*Pt*)	*ermolenkoi*		*			*	
		hani	*					
		kimi			*		*	

Table 2. (cont.)

No.	Genus	Species	Representative countries					
			China	Japan	Korea	Mongolia	Russia (FE)	Taiwan
		laricinus				*	*	
		luridus	*		*		*	
		nipponicus		*				
		vittatus	*		*	*	*	
		yasunagai		*				
	(*P*)	*amoenus*			*		*	
		bagjonicus			*			
		falleni	*				*	
		guttatus	*					
		haematodes		*			*	
		koreanus			*		*	
		nigricornis		*				
		oyashimanus		*				
		salicis		*			*	
		sanguinarius			*			
57	*Rubrocuneocoris*	*albescens*		*				
		falcis						*
		maculosus						*
		trifidus						*
		quercicola			*		*	
58	*Sacculifer*	*picticeps*	*			*	*	
59	*Salicarus*	*bimaculatus*	*					
		fulvicornis	*			*	*	
		pusillus				*	*	
		roseri		*				
60	*Sasajiophylus*	*crapulatus*		*				
61	*Solenoxyphus*	*artemisiae*	*					
		lepidus	*			*		
62	*Sthenaropsis*	*gobica*	*			*		
		obscura				*		
63	*Tuponia*	*albescens*	*					
		chinensis	*					
		Cristifera				*		
		fuscipes				*		
		gobica				*		
		kerzhneri				*		
		arcufera	*			*		
		brevicula	*					
		elegans	*			*		

Table 2. (cont.)

No.	Genus	Species	Representative countries					
			China	Japan	Korea	Mongolia	Russia (FE)	Taiwan
		mongolica	*			*		
		roseipennis	*					
		soongorica						
64	*Tytthus*	*chinensis*	*	*	*		*	
		mundulus		*				
		pygmaeus					*	
Tribe: Pilophorini Douglas and Scott, 1876								
65	*Druthmarus*	*coxalis*						*
		miyamotoi		*				
66	*Hypseloecus*	*takahasii*		*				
67	*Pherolepis*	*aenescens*	*			*	*	
		amplus	*		*		*	
		fasciatus		*	*		*	
		kiritshenkoi			*		*	
68	*Pilophorus*	*alstoni*	*					
		aureus	*					
		bistriatus	*					
		castaneus	*					
		choii			*		*	
		cinnamopterus					*	
		clavatus	*		*	*	*	
		confusus					*	
		dailanh	*					
		decimaculatus	*					
		erracticus		*	*		*	
		formosanus		*				*
		koreanus	*		*			
		latus	*					*
		lucidus	*	*	*		*	
		miyamotoi		*	*		*	
		mongolicus				*	*	
		niger	*	*	*	*	*	
		okamotoi		*	*		*	
		pseudoperplexus		*	*		*	
		setulosus	*	*	*		*	
		typicus	*	*	*			*
		varidicornis		*			*	
		yunganensis	*					
69	*Spinolosus*	*badius*	*					
70	*Sthenaridea*	*piceonigra*	*	*				*
		rufescens		*				*

Table. 3. Collection information for species [newly sequenced] in this study

No.	Family	Subfamily	Species	Country	Date
1	Miridae	Phylinae	*Acrorrhinium rhinoceros* (Distant)	Cambodia	19.02.2012
2	Miridae	Phylinae	*A. Inexpectatum* Josifov	Korea	08.08.2011
3	Miridae	Phylinae	*Hallodapus albofasciatus* (Motschulsky)	Cambodia	21.02.2012
4	Miridae	Phylinae	*H. brunneu* (Poppius)	Cambodia	26.01.2011
5	Miridae	Phylinae	*H. fasciatus*(Poppius)	Cambodia	27.01.2011
6	Miridae	Phylinae	*H. pseudosimilis* Schuh	Cambodia	21.02.2011
7	Miridae	Phylinae	*H. ravenar* (Poppius)	Cambodia	21.02.2011
8	Miridae	Phylinae	*Alloeomius muiri* Schuh_1	Cambodia	21.02.2012
9	Miridae	Phylinae	*Alloeomius muiri* Schuh_2	Cambodia	19.12.2011
10	Miridae	Phylinae	*Europiella puspae* Duwal et al.	Nepal	15.06.2006
11	Miridae	Phylinae	*Psallus* sp.	Korea	19.05.2010
12	Miridae	Phylinae	*Psallus atratus* Josifov	Korea	04.01.2010
13	Miridae	Phylinae	*Atomoscelis asiaticus* Josifov	China	18.07.2012
14	Miridae	Phylinae	*Tytthus chinensis* Stal_1	Cambodia	12.11.2010
15	Miridae	Phylinae	*Tytthus chinensis* Stal_2	Taiwan	22.10.2011
16	Miridae	Phylinae	*Campylomma annulicorne* Signoret	China	18.07.2012
17	Miridae	Phylinae	*Campylomma lividicorne* Reuter	Cambodia	23.10.2011
18	Miridae	Phylinae	*Campylomma chinensis* Schuh	Korea	31.10.2009
19	Miridae	Phylinae	*Decomia* sp.	Cambodia	27.01.2011
20	Miridae	Phylinae	*Kasumiphylus kyusuensis* Linnavuori	Korea	09.03.2008
21	Miridae	Phylinae	*Papuamimus* sp. nov.	Cambodia	21.05.2010
22	Miridae	Phylinae	*Lasiolabops* sp.	Cambodia	07.11.2011
23	Miridae	Phylinae	*Sthenaridea rufescens* (Poppius, 1915)	Cambodia	13.11.2010
24	Miridae	Phylinae	*Sthenaridea* sp.	Taiwan	22.10.2011
25	Miridae	Phylinae	*Sthenaridea piceonigra* (Motschulsky, 1863)	Cambodia	13.11.2010
26	Miridae	Phylinae	*Pilophorus pilosus* Odhiambo	Cambodia	20.05.2010
27	Miridae	Phylinae	*Pilophorus* sp. nov.1	Cambodia	21.02.2012
28	Miridae	Phylinae	*Pilophorus* sp. nov.2	Cambodia	21.05.2010
29	Miridae	Phylinae	*Pilophorus pleiku* Schuh	Cambodia	06.11.2011
30	Miridae	Phylinae	*Pherolepis amplus* Kulik	Korea	23.08.2011
31	Miridae	Phylinae	*Wygomiris indochinensis* Schuh	Cambodia	21.02.2012
32	Miridae	Phylinae	*Cleotomiris* sp.nov.	Cambodia	28.01.2011
33	Miridae	Phylinae	*Cleotomiris schneirlai* Schuh	Cambodia	19.12.2011
34	Miridae	Mirinae	Mirini sp.	Cambodia	17.02.2012
35	Miridae	Mirinae	*Adelphocorisella* sp.	Cambodia	17.02.2012

No.	Family	Subfamily	Species	Country	Date
36	Miridae	Mirinae	*Charagochilus* sp.	Cambodia	19.02.2012
37	Miridae	Mirinae	*Eurystylus* sp.	Cambodia	27.01.2011
38	Miridae	Orthotylinae	*Malacocorisella* sp.	Cambodia	06.11.2012
39	Miridae	Orthotylinae	*Cyrthorhinus lividipennis* Reuter_1	Cambodia	12.11.2010
40	Miridae	Orthotylinae	*Cyrthorhinus lividipennis* Reuter_2	Taiwan	22.10.2011
41	Miridae	Orthotylinae	*Dryophilocoris kerzhneri* Jung and Yasunaga	Korea	19.05.2010
42	Miridae	Orthotylinae	*Coridromius chinensis* Liu and Zhao	Cambodia	22.10.2011
43	Miridae	Deraeocorinae	*Fingulus* sp.	Cambodia	06.11.2012
44	Miridae	Deraeocorinae	*Termatophylum* sp.	Taiwan	22.10.2011
45	Miridae	Cylapinae	*Fulvius* sp.1	Cambodia	07.11.2011
46	Miridae	Cylapinae	*Peritropis* sp.1	Cambodia	28.01.2011
47	Miridae	Cylapinae	*Peritropis* sp.2	Cambodia	27.01.2011
48	Miridae	Cylapinae	*Peritropis* sp.3	Cambodia	28.01.2011
49	Pentatomidae		*Eysarcoris lewisi* (Scott)	Korea	21.06.2008
49	Reduviidae		*Polididus perarmatus* (Uhler)	Korea	07.10.2008
50	Nabidae		*Nabis apicalis* Matsumura	Korea	07.10.2008
51	Nabidae		*Nabis stenoferus* Hsiao	Cambodia	18.02.2012

Table. 4. The list of species and sequences with GenBank accession numbers (Downloaded from NCBI)

Family	Subfamily	Tribe	Species	16s	18s	28s	CO1	References
Outgroup								
Pentatomidae	Pentatominae		*Pentatoma Japonica*	GU194579	GU194655	GU194732	GU194810	Jung & Lee, 2012
Microphysidae			*Loricula elegantula*	EU683098	EU683151	AY252557	NA	
Tingidae	Tinginae		*Corythucha* sp.	AY252757	EU683126	AY252530	AY253013	Schuh et al, 2009
			Stephanitis sp.	EF487291	EF487322	EF487313	NA	Schuh et al, 2009
Anthocoridae			*Amphiareus obscriceps*	GQ258358	GQ258393	GQ258429	GQ292179	Jung et al., 2010
			Lasiochilus japonicus	GQ258367	GQ258410	GQ258445	GQ292185	Jung et al. 2010
Ingroup								
Miridae	Isometopinae		*Myiomma* sp._1	AY252885	EU683160	EU683204	EU683240	Schuh et al, 2009
			Myiomma sp._2	EU683102	EU683161	EU683205	AY253124	Schuh et al, 2009
		Isometopini	*Myiomma kukai*	GU194569	GU194645	GU194722	GU194800	Jung&Lee, 2012
	Cylapinae	Cylapini	*Cylapus* sp._1	FJ226440	EU683129	FJ226448	FJ226451	Schuh et al, 2009
			Cylapus sp._2	FJ226441	EU683130	FJ226449	EU683227	Schuh et al, 2009
		Fulvini	*Fulvius* sp.	AY252772	EU683140	AY252544	EU683232	Schuh et al, 2009
	Bryocorinae	Bryocorini	*Monalocoris amami*anus	GU194567	GU194643	GU194720	GU194798	Jung&Lee, 2012
			Monalocoris americanus	AY252713	EU683158	AY252484	AY252978	Schuh et al, 2009
			Bryocoris pteridis	EU683083	EU683115	NA	EU683220	Schuh et al, 2009
		Dicyphini	*Nesidiocoris tenuis*	GU194570	GU194646	GU194723	GU194801	Jung&Lee, 2012
		Monaloniini	*Odoniellina* sp.	EU683103	EU683164	NA	AY253125	Schuh et al, 2009
			Helopeltis sp.	AY252888	EU683144	NA	AY253126	Schuh et al, 2009
	Deraeocorinae	Clivinemini	*Bothynotus pilosus*	GU194540	GU194618	GU194693	GU194771	Jung&Lee, 2012
		Deraecorini	*Alloeotomus simplus*	GU194531	GU194609	GU194684	GU194762	Jung&Lee, 2012

		Cimidaeorus hasegawai	GU194546	GU194622	GU194699	GU194777	Jung&Lee, 2012
		Deraeocoris ater	GU194548	GU194624	GU194701	GU194779	Jung&Lee, 2012
		Deraeocoris castanea	GU194549	GU194625	GU194702	GU194780	Jung&Lee, 2012
		Deraeocoris claspericapilatus	GU194550	GU194626	GU194703	GU194781	Jung&Lee, 2012
		Deraeocoris mutatus	AY252852	EU683113	AY252578	AY253080	Schuh et al, 2009
		Deraeocoris olivaceus	GU194551	GU194627	GU194704	GU194782	Jung&Lee, 2012
		Deraeocoris pulchellus	GU194552	GU194628	GU194705	GU194783	Jung&Lee, 2012
		Deraeocoris ulmi	GU194554	GU194629	GU194706	GU194784	Jung&Lee, 2012
Mirinae	Mirini	*Adelphocoris suturalis*	GU194529	GU194607	GU194682	GU194760	Jung&Lee, 2012
		Adelphocoris triannulatus	GU194530	GU194608	GU194683	GU194761	Jung&Lee, 2012
		Apolygus hilaris	GU194533	GU194611	GU194686	GU194764	Jung&Lee, 2012
		Apolygus lucorum	GU194534	GU194612	GU194687	GU194765	Jung&Lee, 2012
		Apolygus nigrovirens	GU194535	GU194613	GU194688	GU194766	Jung&Lee, 2012
		Apolygus roseofemoralis	GU194536	GU194614	GU194689	GU194767	Jung&Lee, 2012
		Apolygus spinolae	GU194537	GU194615	GU194690	GU194768	Jung&Lee, 2012
		Apolygus subpulchellus	GU194538	GU194616	GU194691	GU194769	Jung&Lee, 2012
		Arbolygus rubipes	GU194539	GU194617	GU194692	GU194770	Jung&Lee, 2012
		Capsodes gothicus	GU194541	GU194619	GU194694	GU194772	Jung&Lee, 2012
		Capsus ater	AY252712	EU683117	AY252483	AY252977	Schuh et al, 2009
		Capsus wagneri	GU194542	GU194620	GU194695	GU194773	Jung&Lee, 2012
		Castanoopsides kerzhneri	GU194543	NA	GU194696	GU194774	Jung&Lee, 2012
		Castanoopsides potanini	GU194544	NA	GU194697	GU194775	Jung&Lee, 2012
		Charagochilus angusticollis	GU194545	GU194621	GU194698	GU194776	Jung&Lee, 2012
		Eurystylus coelestiolium	GU194558	GU194633	GU194710	GU194788	Jung&Lee, 2012

		Eurystylus luteus	GU194559	GU194634	GU194711	GU194789	Jung&Lee, 2012
		Loristes decoratus	GU194562	GU194637	GU194714	GU194792	Jung&Lee, 2012
		Lygocoris pabulinus	GU194564	GU194639	GU194716	GU194794	Jung&Lee, 2012
		Lygocoris sp.	GU194563	NA	GU194717	GU194795	Jung&Lee, 2012
		Lygus rugulipennis	GU194565	GU194640	GU194718	GU194796	Jung&Lee, 2012
		Phytocoris intricatus	GU194581	GU194657	GU194734	GU194812	Jung&Lee, 2012
		Pinalitus rubeolus	GU194587	NA	GU194740	GU194818	Jung&Lee, 2012
		Polymerus cognatus	GU194592	GU194667	GU194745	GU194823	Jung&Lee, 2012
		Proboscidocoris varicornis	GU194593	GU194668	GU194746	GU194824	Jung&Lee, 2012
		Stenotus rubrovittatus	GU194605	GU194680	GU194758	GU194834	Jung&Lee, 2012
		Taylorilygus apicalis	GU194606	GU194681	GU194759	GU194835	Jung&Lee, 2012
	Stenodemini	*Stenodema calcarata*	GU194602	GU194677	GU194755	GU194831	Jung&Lee, 2012
		Stenodema rubrinerve	GU194603	GU194678	GU194756	GU194832	Jung&Lee, 2012
		Stenodema sibirica	GU194604	GU194679	GU194757	GU194833	Jung&Lee, 2012
	Restheneini	*Oncerometopus* sp.	AY252787	EU683165	AY252553	AY253036	Schuh et al, 2009
		Mecistoscelini sp.	EU683099	EU683154	AY252495	EU683237	Schuh et al, 2009
	Herdoniini	*Cyphopelta modesta*	AY252863	EU683132	AY252605	AY253089	Schuh et al, 2009
		Ectopiocerus anthracinus	AY252830	EU683138	AY252599	EU683230	Schuh et al, 2009
Orthotylinae	Halticini	*Halticus comitans*	GU194560	GU194635	GU194712	GU194790	Jung&Lee, 2012
		Orthocephalus funestus	GU194571	GU194647	GU194724	GU194802	Jung&Lee, 2012
		Orthocephalus sp	EU683104	EU683169	AY252482	AY252976	Schuh et al, 2009
		Coridromius sp.	EU683088	EU683125	EU683190	EU683225	Schuh et al, 2009
		Compositocoris senecionus	EU683087	EU683124	EU683189	NA	Schuh et al, 2009
	Orthotylini	*Dryophilocoris miyamotoi*	GU194555	GU194630	GU194707	GU194785	Jung&Lee, 2012
		Othotylus flavosparsus	GU194572	GU194648	GU194725	GU194803	Jung&Lee, 2012

		Othotylus interpositus	GU194573	GU194649	GU194726	GU194804	Jung&Lee, 2012
		Othotylus pallens	GU194574	GU194650	GU194727	GU194805	Jung&Lee, 2012
		Othotylus riparius	GU194575	GU194651	GU194728	GU194806	Jung&Lee, 2012
		Othotylus sp.	GU194576	GU194652	GU194729	GU194807	Jung&Lee, 2012
		Pseudoloxops takaii	GU194600	GU194675	GU194753	NA	Jung&Lee, 2012
		Slaterocoris sp.	AY252768	EU683181	AY252541	AY252955	Schuh et al, 2009
		Austromiris sp.	EU683082	EU683112	EU683186	AY252936	Schuh et al, 2009
		Lopidea bullata	EU683097	EU683150	AY252582	NA	Schuh et al, 2009
		Ceratocapsus sp.	AY252876	EU683119	AY252617	EU683222	Schuh et al, 2009
		Cremnocephalus albolineatus	EU683089	EU683127	EU683191	EU683226	Schuh et al, 2009
Phylinae	Phylini	*Comsidolon salicellum*	GU194547	GU194623	GU194700	GU194778	Jung&Lee, 2012
		Harpocera orientalis	GU194561	GU194636	GU194713	GU194791	Jung&Lee, 2012
		Phylus coryloides	GU194580	GU194656	GU194733	GU194811	Jung&Lee, 2012
		Europiella artemisiae	GU194556	GU194631	GU194708	GU194786	Jung&Lee, 2012
		Europiella kiritshenkoi	GU194557	GU194632	GU194709	GU194787	Jung&Lee, 2012
		Moissonia sp.	GU194566	GU194642	GU194719	GU194797	Jung&Lee, 2012
		Monosynamma bohemanni	GU194568	GU194644	GU194721	GU194799	Jung&Lee, 2012
		Parapsallus vitellinus	GU194577	GU194653	GU194730	GU194808	Jung&Lee, 2012
		Plagiognathus amurensis	GU194588	GU194663	GU194741	GU194819	Jung&Lee, 2012
		Plagiognathus chrysanthemi	GU194589	GU194664	GU194742	GU194820	Jung&Lee, 2012
		Plagiognathus collaris	GU194590	GU194665	GU194743	GU194821	Jung&Lee, 2012
		Plagiognathus yomogi	GU194591	GU194666	GU194744	GU194822	Jung&Lee, 2012
		Psallus castanea	GU194594	GU194669	GU194747	GU194825	Jung&Lee, 2012
		Psallus cinnabarinus	GU194596	GU194670	GU194748	GU194826	Jung&Lee, 2012
		Psallus clarus	GU194597	GU194671	GU194749	GU194827	Jung&Lee, 2012

	Psallus roseoguttatus	GU194605	GU194672	GU194750	GU194828	Jung&Lee, 2012
	Psallus sp1	GU194599	GU194673	GU194751	GU194829	Jung&Lee, 2012
	Psallus sp2	GU194595	GU194674	GU194752	GU194830	Jung&Lee, 2012
	Pseudophylus stundjuki	GU194601	GU194676	GU194754	NA	Jung&Lee, 2012
	Semium hirtum	AY252658	EU683180	EU683210	AY252921	Schuh et al, 2009
	Megalopsallus froeschneri	AY252788	EU683155	NA	AY253041	Schuh et al, 2009
Pronotocrepini	*Teleorhinus* sp.	AY252832	EU683182	EU683211	AY253079	Schuh et al, 2009
Pilohorini	*Pilophorus clavatus*	GU194582	GU194658	GU194735	GU194813	Jung&Lee, 2012
	Pilophorus discretus	GU194583	GU194659	GU194736	GU194814	Jung&Lee, 2012
	Pilophorus erraticus	GU194584	GU194660	GU194737	GU194815	Jung&Lee, 2012
	Pilophorus lucidus	GU194585	GU194661	GU194738	GU194816	Jung&Lee, 2012
	Pilophorus typicus	GU194586	GU194662	GU194739	GU194817	Jung&Lee, 2012
	Hypseloecus sp.	AY252897	EU683146	AY252639	AY253134	Schuh et al, 2009
Hallodapini	*Hallodapus* sp.	AY252887	EU683142	NA	NA	Schuh et al, 2009

Table 6. Taxon sampling and Gene bank accession numbers for NCBI data

Family	Subfamily	Tribe	Species	16s	18s	28s	CO1	H2A	H3A	Locality	References
Outgroup											
Miridae	Bryocorinae	Bryocorini	*Monalocoris amamianus* Yasunaga, 2000	GU194567	GU194643	GU194720	GU194798				Jung & Lee, 2012
		Dicyphini	*Nesidiocoris tenuis* (Reuter, 1895)	GU194570	GU194646	GU194723	GU194801			Cambodia	Jung & Lee, 2012
	Cylapinae	Cylapini	*Peritropis* sp1							Cambodia	
		Fulvini	*Fulvius* sp								
	Deraeocorinae	Deraeocorini	*Deraeocoris ulmi* Josifov, 1983	GU194554	GU194629	GU194706	GU194784				Jung & Lee, 2012
			Fingulus sp							Cambodia	
	Isometopinae	Myiommini	*Myiomma kukai* Yasunaga and Hayashi, 2002	GU194569	GU194645	GU194722	GU194800				Jung & Lee, 2012
	Mirinae	Mirini	*Apolygus lucorum* (Meyer-Dur, 1843)	GU194534	GU194612	GU194687	GU194765				Jung & Lee, 2012
		Stenodemini	*Stenodema calcarata* (Fallen, 1807)	GU194602	GU194677	GU194755	GU194831				Jung & Lee, 2012
	Orthotylinae	Halticini	*Orthocephalus funestus* Jakovlev, 1881	GU194571	GU194647	GU194724	GU194802				Jung & Lee, 2012
		Orthotylini	*Cyrtorhinus lividipennis* Reuter, 1885							Taiwan	
Ingroup											
Miridae	Phylinae	Auricillocorini	*Cleotomiris schneirlai* Schuh, 1984							Cambodia	
			Cleotomiris sp. nov.							Cambodia	
			Wygomiris indochinensis Schuh, 1984							Cambodia	
		Hallodapini	*Acrorrhinium inexpectatum* (Josifov, 1978)							Korea	
			Acrorrhinium rhinoceros (Distant, 1909)							Cambodia	
			Alloeomimus muiri Schuh, 1984_a							Cambodia	
			Alloeomimus muiri Schuh, 1984_b							Cambodia	
			Hallodapus albofasciatus (Motschulsky, 1863)							Cambodia	

	Hallodapus brunneus (Poppius, 1915)					Cambodia	
	Hallodapus fasciatus (Poppius, 1909)					Cambodia	
	Hallodapus pseudosimilis Schuh, 1974					Cambodia	
	Hallodapus ravenar (Kirkaldy, 1902)					Cambodia	
Leucophoropterini	*Papuamimus* sp. nov.					Cambodia	
phylini	*Atomoscelis asiatica (*Josifov, 1979)					China	
	Campylomma annulicornis (V.Signoret, 1865)					China	
	Campylomma lividicornis Reuter, 1912					Taiwan	
	Campylomma chinensis Schuh, 1984					Korea	
	Compsidolon salicellum (Herrich-Schaeffer, 1841)	GU194547	GU194623	GU194700	GU194778		Jung & Lee, 2012
	Decomia sp						
	Europiella artemisiae (Becker, 1864)	GU194556	GU194631	GU194708	GU194786		Jung & Lee, 2012
	Europiella kiritshenkoi (Kulik, 1975)	GU194557	GU194632	GU194709	GU194787		Jung & Lee, 2012
	Europiella puspae Duwal et al.					Nepal	
	Harpocera orientalis Kerzhner, 1979	GU194561	GU194636	GU194713	GU194791		Jung & Lee, 2012
	*Kasumiphylus kyushuensis (*Linnavuori, 1961)					Korea	
	Lasiolabops sp.					Cambodia	
	Moissonia sp.	GU194566	GU194642	GU194719	GU194797		Jung & Lee, 2012
	Monosynamma bohemanni (Fallen, 1829)	GU194568	GU194644	GU194721	GU194799		Jung & Lee, 2012
	Parapsallus vitellinus (Schotz, 1847)	GU194577	GU194653	GU194730	GU194808		Jung & Lee, 2012
	Phylus coryloides Josifov and Kerzhner, 1972	GU194580	GU194656	GU194733	GU194811		Jung&Lee, 2012
	Plagiognathus amurensis Reuter, 1883	GU194588	GU194663	GU194741	GU194819		Jung & Lee, 2012

	Plagiognathus chrysanthemi (Wolff, 1804)	GU194589	GU194664	GU194742	GU194820		Jung & Lee, 2012
	Plagiognathus collaris (Matsumura, 1911)	GU194590	GU194665	GU194743	GU194821		Jung & Lee, 2012
	Plagiognathus yomogi Miyamoto, 1969	GU194591	GU194666	GU194744	GU194822		Jung & Lee, 2012
	Psallus atratus Josifov, 1983						
	Psallus castaneae Josifov, 1983	GU194594	GU194669	GU194747	GU194825	Korea	Jung & Lee, 2012
	Psallus cinnabarinus Kerzhner, 1979	GU194596	GU194670	GU194748	GU194826		Jung & Lee, 2012
	Psallus clarus Kerzhner, 1988	GU194597	GU194671	GU194749	GU194827		Jung & Lee, 2012
	Psallus roseoguttatus Yasunaga and Vinokurov, 2000	GU194605	GU194672	GU194750	GU194828		Jung & Lee, 2012
	Pseudophylus stundjuki (Kulik, 1973)	GU194601	GU194676	GU194754	NA		Jung & Lee, 2012
	*Tytthus chinensis (*Stal, 1859)_a					Cambodia	
	*Tytthus chinensis (*Stal, 1859)_b					Taiwan	
Pilophorini	*Hypseloecus* sp.	AY252897	EU683146	AY252639	AY253134		Schuh et al, 2009
	Pherolepis amplus Kulik, 1968					Korea	
	Pilophorus clavatus (Linnaeus, 1767)	GU194582	GU194658	GU194735	GU194813		Jung & Lee, 2012
	Pilophorus discretus Van Duzee, 1918	GU194583	GU194659	GU194736	GU194814		Jung & Lee, 2012
	Pilophorus erraticus Linnavuori, 1962	GU194584	GU194660	GU194737	GU194815		Jung & Lee, 2012
	Pilophorus lucidus Linnavuori, 1962	GU194585	GU194661	GU194738	GU194816		Jung & Lee, 2012
	Pilophorus typicus (Distant, 1909)	GU194586	GU194662	GU194739	GU194817		Jung & Lee, 2012
	Pilophorus pilosus Odhiambo, 1959					Cambodia	
	Pilophorus sp. nov.1					Cambodia	
	Pilophorus sp. nov.2					Cambodia	
	Pilophorus sp. nov3					Cambodia	
	Pilophorus pleiku (Schuh, 1984)					Cambodia	

	Sthenaridea piceonigra (Motschulsky, 1863)					Cambodia	
	Sthenaridea sp					Cambodia	
	Sthenaridea rufescens (Poppius, 1915)					Cambodia	
Pronotocrepini	*Teleorhinus* sp.	AY252832	EU683182	EU683211	AY253079		Schuh et al, 2009

국문초록

본 연구는 한반도산 애장님노린재아과 (노린재목: 장님노린재과)의 계통분류학적 연구로서, 두 가지 주요 주제로 구성되어 있다. 1. 한반도에 서식하는 애장님노린재류의 분류학적 검토; 2. 장님노린재과의 계통분류학적 연구에서, (i) 장님노린재과에서의 아과수준에서 계통연구, (ii) 애장님노린재아과내 족수준의 계통관계 연구이다.

첫째로, 국내 서식하는 애장님노린재류의 분류학적 연구와 생물학적 정보구축를 중심으로 구성하였다. 전체 85 종 중, 신종을 포함한 총 20 종이 국내에 새롭게 기록되었다. 또한, 2 개의 속을 비롯한 6 종의 동의어, 그리고 속의 재조합이 제안 되었다.

두번재로, 장님노린재과의 계통학적 연구는, 내집단(ingroup)인 장님노린재과에 속하는 7 개 아과의 149 종 및 회집단(outgroup)인 6 과 10 종을 포함한 총 159 종에 대한 분석과 애장님노린재아과에 속하는 57 종의 애장님노린재류의 대하여 mitochondrial protein (COI) and ribosomal (16S), and nuclear protein (H2A, H3A) and ribosomal (18S, 28SD3) DNA 를 이용하여 계통수를 제작하였으며, 이들의 계통학적 관계를 학인하기 위하여, maximum likelihood, Bayesian 그리고 parsimony 를 이용하여 계통분석을 수행하였다. 분자계통학적 연구 결과로, 다음의 장님노린재과과 애장님노린재아과내 계통유연관계을 확인하있다: (1) 장님노린재과의 단계통; (2) Bryocorinae 및 Orthotylinae 제외하고 다른 모든 대표 아과의 단계통; (3) 이전 연구와 다르게 애장님노린재아과 가장 최근에 분화; (4) 애장님노린재아과내에서의 Auricillocorini 의 원시성 및 꼬마장님노린재족와 근연관계; (5) 애장님노린재족류 단계통. 이상의 결과를 바탕으로 장님노린재류의 계통분류학적인 결과와 이들의 유연관계에 대하여 새로운 의견을 도출하였다.

주요어: 계통분류, 장님노린재과, 애장님노린재아과, 신속, 신종, 한반도, 분류학

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