

Original Article

## Taxonomic Revision of Subfamily Achilinae (Hemiptera: Achilidae) from Korea

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**Abstract** The planthopper subfamily Achilinae (Metcalf, 1938) from Korea is taxonomically revised. Six genera and seven species are recorded among Korean fauna. Among them, one genus, *Phenelia* Kirkaldy, and two species, *Phenelia striatella* (Matsumura, 1914) and *Deferunda qiana* Chen and He (2010) are new to Korea. The male genital structures of all these species are described and illustrated, plus an identification key to the tribe, genus, and species is provided.

**Keywords:** Auchenorrhyncha, Fulgoroidea, New record, Planthopper, Korea

### Introduction

The subfamily Achilinae (Hemiptera: Achilidae) was recognized by Metcalf in 1938 based on the prominence of the cephalic carinae and carriage of the tegmina (Fennah, 1950), and its distribution in tropical and warm temperate areas. Among the subfamilies of Achilidae, only Achilinae has been recorded in Korea, where these fungal feeding fauna are very poorly known. Several species of this subfamily were previously described by Lee (1979), primarily based on their external morphology. Kwon and Huh (2001) then provided a revised checklist for this Korean family, and since then no further work has been done. While descriptions of the male genital structures are important for

identification at species level, this has been essentially omitted from previous studies. Accordingly, this study provides a taxonomic revision for Korean Achilinae, including descriptions of the male genital structures.

Prior to this study only five species under five genera have been recorded in Korea, along with two troiduchid species, *Cixiopsis punctatus* Matsumura and *Catullia vittata* Matsumura, that were mistakenly included in this group (Kwon and Huh, 2001). These two species were subsequently transferred to the Troiduchidae family based on a recent investigation (Rahman et al., 2011).

While sorting and identifying Achilid specimens in the collection of the Systematic Entomology Laboratory at Kyungpook National University, Daegu, Korea (KNU), two unrecorded species, *Phenelia striatella* (Matsumura, 1914) and *Deferunda qiana* (Chen and He, 2010), were found, thereby increasing the number of Achilid taxa in Korea. The previously recorded species, *Rhotala nawae* (Matsumura, 1914), in the checklist of Korean fauna (Kwon and Huh, 2001) was already transferred to the genus *Errada* Walker by Emeljanov (2005). Therefore, this paper presents descriptions of the male genitalia for all recorded and unrecorded species, including illustrations and identification keys to the tribe, genus, and species.

### Materials and Methods

The terminology used in this study follows Che et al. (2007). The genital segments of the examined specimens were observed in glycerin jelly using a stereoscopic microscope (Olympus SZX 12, Olympus, San Diego, CA, USA). The photographs of the specimens were taken using a JUJAK 5.5 (DIXI 3000, DIXI Optics, Daejeon, Korea) digital camera, and the drawings were scanned using an HP Scanjet 4850 (Hewlett-Packard Company, Houston, TX, USA). The image and plate compositions were produced using Helicon Focus 5.1 and Adobe Photoshop CS3

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(Adobe, San Jose, CA, USA), respectively. The spinal formula means the number of apical spines of the hind tibiae and 1<sup>st</sup> and 2<sup>nd</sup> hind tarsomeres.

The specimens examined in the present study are deposited in the collection of the School of Applied Bio-Sciences, Kyungpook National University, Daegu, Republic of Korea (KNU).

## Systematics

### Check list of Subfamily Achilinae Metcalf, 1938 from Korea

**Tribe** Rhotalini Fennah, 1950

**Genus** *Errada* Walker, 1870

*Errada nawae* (Matsumura, 1914)

**Tribe** Plectoderini Fennah, 1950

**Genus** *Akotropis* Matsumura, 1914

*Akotropis fumata* Matsumura, 1914

**Genus** *Deferunda* Distant, 1912

*Deferunda rubrostigma* (Matsumura, 1914)

*Deferunda qiana* Chen and He, 2010 (new record)

**Genus** *Kosalya* Distant, 1906

*Kosalya flavostrigata* Distant, 1906

**Genus** *Phenelia* Kirkaldy, 1906 (new record)

*Phenelia striatella* (Matsumura, 1914) (new record)

**Genus** *Usana* Distant, 1906

*Usana yanonis* Matsumura, 1914

### Subfamily Achilinae Metcalf, 1938

Achilinae Metcalf, 1938: 371; Fennah, 1945: 471; Emeljanov, 1993: 7.

**Diagnosis.** Body depressed; forewing nearly horizontal, overlapping more or less beyond apex of clavus; vertex produced, separated from frons by one or two carinae.

### Key to tribe of Achilinae from Korea

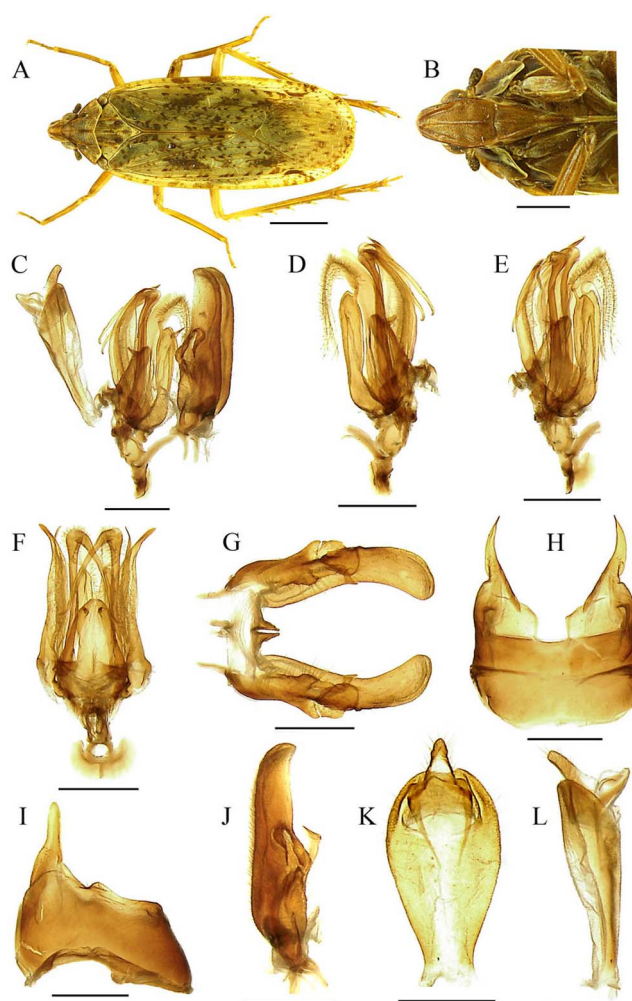
Hind tibia with five to seven lateral teeth; width of vertex less than two-thirds width of pronotum.....Rhotalini

Hind tibia with one spine in basal half; width of vertex at least two-thirds width of pronotum.....Plectoderini

### Tribe Rhotalini Fennah, 1950

Rhotalini Fennah, 1950: 15; Chen et al., 1989: 7; Emeljanov, 1993: 9.

**Diagnosis.** Head about half as wide as pronotum; pronotum elongated, three-quarters length of mesonotum; mesonotum disk flat with three carinae; forewings with apical veinlets numerous, parallel; Female with seventh abdominal sternite greatly produced caudad; Male with medioventral process of pygofer paired, free from hind margin.



**Figure 1.** *Errada nawae* (Matsumura). A. Male habitus; B. Frons and clypeus; C. Anal segment, aedeagus and genital styles (left lateral view); D. Aedeagus (right lateral view); E. Ditto (left lateral view); F. Ditto (dorsal view); G. Genital styles (ventral view); H. Pygofer (dorsal view); I. Ditto (lateral view); J. Genital styles (lateral view); K. Anal segment (dorsal view); L. Ditto (lateral view). Scale bars=2.0 mm (A); 1.0 mm (B); 0.5 mm (C-L).

### Genus *Errada* Walker, 1870

*Enada* (sic) Walker, 1870: 82-193.

*Errada* Walker, 1870; Metcalf, 1948: 72-73 (spelling correction); Emeljanov, 2005: 11.

*Siebererella* Schmidt, 1926; Emeljanov and Gnezdilov, 2009: 262-263 (synonymized).

Type species. *Errada funesta* Walker, 1870.

**Diagnosis.** Hind tibia with 5-6 lateral teeth; forewing with posterior branch of CuA running diagonally into posterior margin and fusing with it giving off 2 oblique branches anteriorly, and with numerous and parallel apical veinlets.

### *Errada nawae* (Matsumura, 1914) (Figure 1, A to L)

*Rhotala nawae* Matsumura, 1914a: 279; Esaki, 1932: 1788;

Metcalf, 1948: 74; Emeljanov, 1993: 910; Kwon and Huh, 1995: 41. *Rhotala nawai* (sic): Lee and Kwon, 1981: 151; Kwon et al., 1996: 123; Kwon and Huh, 2001: 322.  
*Errada nawae*: Emeljanov, 2005: 11 (combination).

**Male genitalia.** Anal segment relatively large, ovate, with subapical placement of anal styles, broadest apical half in dorsal view, narrowing to base, longer than wide at widest part (1.84:1) except the length of anal styles, apical margin at middle slightly concave; in lateral view, apical half also wider than the basal half, anal styles, in both view, surpassing the level of anal segment. Pygofer in profile distinctly wider ventrally than dorsally; dorsocaudal angle produced into a long finger-like process and a cluster of setae beneath the processes in lateral view, posterior margin in dorsal view concave strongly to conjugate with anal segment, medioventral process paired, triangularly produced, narrowing apically, elongated and detached from pygofer. Aedeagus complex with phallobase, tubular, with dorsal lobe directing downward having two small processes subapically, convex at apex; lateral lobes dividing into two elongated parts, narrowing apically, ventral lobe rather unique with special appendage in lateral view, basal half cylindrical and then subapically strongly confined into a narrow tube attaching with a long appendage covered with numerous hair-like setae, extending posteriorly then angulately downward. Phallic appendage slender, bent cephalad at midway of phallic appendage, attaining the base of dorsal lobe. Genital styles large and elongated, in ventral view, inner margin at middle concave, outer margin convex, curving median way at apex, in lateral view, lateral margin at middle raising a long process, bent at middle and directing caudodorsally, besides having finger-like triangular process with numerous setae.

**Materials examined.** 1 male, 1 female, Ulleungdo, Gyeongsangbuk-do, Korea, 2.x.1981, YJ Kwon; 1 male, Togyusan, Jeollabuk-do, Korea, 14.viii.1991; 2 males, Hallasan, Jejudo, Korea, 6.viii.1989; 1 female, Seoraksan, Gangweon-do, Korea, 25.vii.1992; 1 female, Is. Windo, Jeollanam-do, Korea, 23.v.2003, all same collector (KNU).

**Host plant.** Unknown.

**Distribution.** Korea (Central, South, Jejudo, Ulleungdo), Japan (whole).

#### Tribe Plectoderini Fennah, 1950

Plectoderini Fennah, 1950: 47; Chen et al., 1989: 7; Emeljanov, 1993: 11.

**Diagnosis.** Vertex at least two-thirds as wide as pronotum, anterior margin convex or angulately produced at middle, forewing shallowly rounded over dorsum when folded, apical margin strongly convex, venation regular, Sc with anterior branch short, sometimes recurved, usually six subapical and eight or nine apical areolets; hind tibia with one lateral tooth in basal half.

#### Key to genera of tribe Plectoderini from Korea

1. Vertex more than 2 times wider at base than long in middle line .....2  
-Vertex less than 2 times wider at base than long in middle line .....3
2. Vertex and pronotum with two and mesonotum with four longitudinal dark brown stripes; vertex with lateroapical areolets present.....*Usana* Distant  
-Vertex, pronotum and mesonotum not as above; mesonotum orange with apical third between lateral carinae black, outside of each lateral carinae with two black spots.....*Kosalya* Distant
3. Forewing with CuA deeply convex distad of claval apex, and with numerous spots along veins.....*Deferunda* Distant  
-Forewing not as above.....4
4. Anterior margin of vertex not carinate; frons relatively narrower at base than widest part (1:1.78).  
.....*Akotropis* Matsumura  
-Anterior margin of vertex carinate and angulately convex; frons relatively narrower at base than widest part (1:1.31)  
.....*Phenelia* Kirkaldy

#### Genus *Akotropis* Matsumura, 1914

*Akotropis* Matsumura, 1914a: 270271; Fennah, 1950: 95; Chen et al., 1989: 12.

*Ballonymus* Jacobi, 1941: 295.

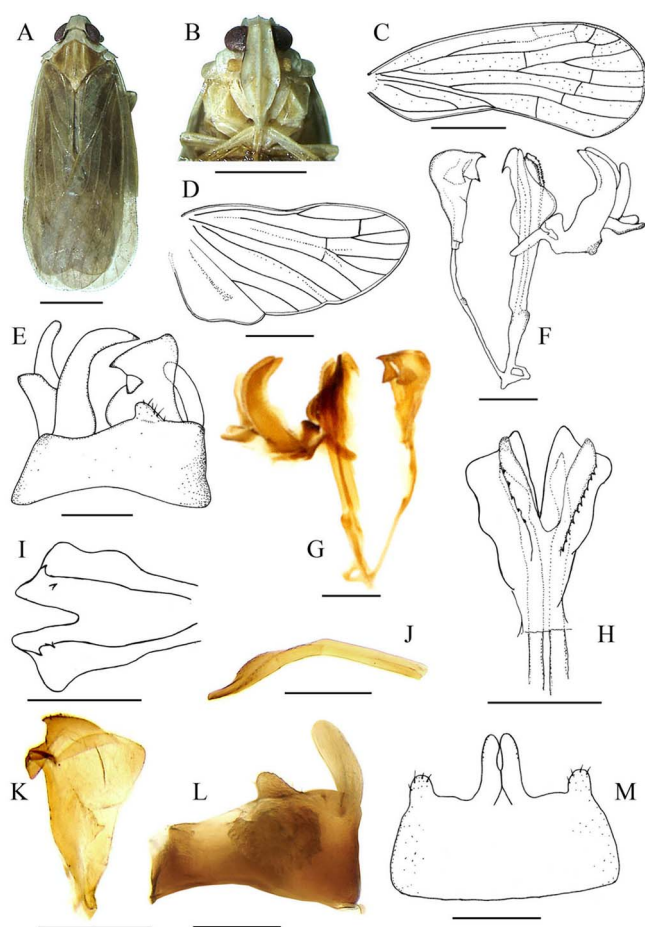
Type species. *Akotropis fumata* Matsumura, 1914.

**Diagnosis.** Head with eyes distinctly narrower than pronotum. Vertex produced before eyes about half of its length, anterior margin angulate, diverging posteriorly, median carina distinctly elevated. Frons narrow at base and wide near apex beneath antennae, thence incised to suture, median carina distinctly elevated from base of frons to end of postclypeus. Ocelli present, detached from eyes. Antennae subglobose. Apex of rostrum attaining post-coxae. Pronotum moderately short, disc depressed slightly, median carina distinct. Forewing with ScR forking at level of CuA fork, vein M forking basal of level of node, with 3-branches. Hind wing longer than widest part about 2:1. Post-tibiae with lateral spine at basal half. Spinal formula of hind leg 8-7-5.

#### *Akotropis fumata* Matsumura, 1914 (Figure 2, A to M)

*Akotropis fumata* Matsumura, 1914a: 270272; Schumacher, 1915: 118; Metcalf, 1948: 14; Fennah, 1950: 96; Zool. Soc. Kor., 1968: 35; Lee and Kwon, 1977: 97; Chen et al., 1989: 13; Kwon et al., 1994: 93; Kwon et al., 1996: 123; Kwon and Huh, 2001: 319-320.

**Male genitalia.** Anal segment large, gradually narrowing apically, strongly bent at apex in lateral view, basal margin twice longer than apical, angulately concave deeply at middle, lateral margin slightly convex in dorsal view, anal styles placed approximately at middle, attaining apical margin. Pygofer ventral and dorsal



**Figure 2.** *Akotropis fumata* Matsumura, male structures. A. Male habitus; B. Frons and clypeus; C. Forewing; D. Hind wing; E. Male genital block; F-G. Anal segment, aedeagus and genital styles (left and right lateral view); H. Aedeagus (dorsal view); I. Phallobase (ventral view); J. Phallic appendage; K. Genital styles; L. Pygofer (lateral view); M. Ditto (ventral view). Scale bars=1.0 mm (AB); 0.25 mm (E-M).

margins subequivalent, ventral margin slightly clinched caudal, hind margin with a triangular process located slightly ventrad than middle, medioventral processes paired, elongate, rod-shaped, slightly converging apically. Phallobase tubular, ventral lobe broadly extending lateral, with apical margin deeply cleft at middle, with two spines at each apex beside the incision. Phallic appendages with right one thicker than left one, with series of spines lateral apically. Genital styles strongly extending apically, dorsal margin with two processes, one near apex, triangular and raising dorsal, the other broad and extending lateral.

**Materials examined.** 2 males, Daegu city, Korea, 13.ix.1983, YJ Kwon; 1 male, same locality, 6.ix.1981, YJ Kwon; 1 male, Tongdosa, Gyeongsangnam-do, Korea, 9.x.1979, YJ Kwon; 1 male, Dansan myeon, Gyeongsangbuk-do, Korea, 13.vii.1983, YJ Kwon; 1 male, same locality, 2.x.1982, YJ Kwon; 1 male, 1 female, Uido, Jeollanam-do, Korea, 17.viii.1998, YJ Kwon; 1 female, Mt. Songdu, Daejeonciry, Chungcheongnam-do, Korea, 3.ix.1993, SL An; 1

female, Jungmun, Jejudo, Korea, 11.viii.1984, YJ Kwon; 1 female, Paegunsan, Jeollanam-do, Korea, 13.viii.1999, YJ Kwon (KNU).

**Host plant.** Unknown.

**Distribution.** Korea (Central, South, Jejudo), Japan (Kyushu, Shikoku), Taiwan.

#### Genus *Deferunda* Distant, 1912

*Majella* Kirkaldy, 1906: 421 preoccupied by *Majella* Ortmann, 1893.

*Deferunda* Distant, 1912: 186; Fennah, 1950: 104; Chen *et al.*, 1989: 57; Wang *et al.*, 2008: 775; Chen and He, 2010: 60.

*Okatropis* Matsumura, 1914: 272, synonymised by Fennah, 1950: 104.

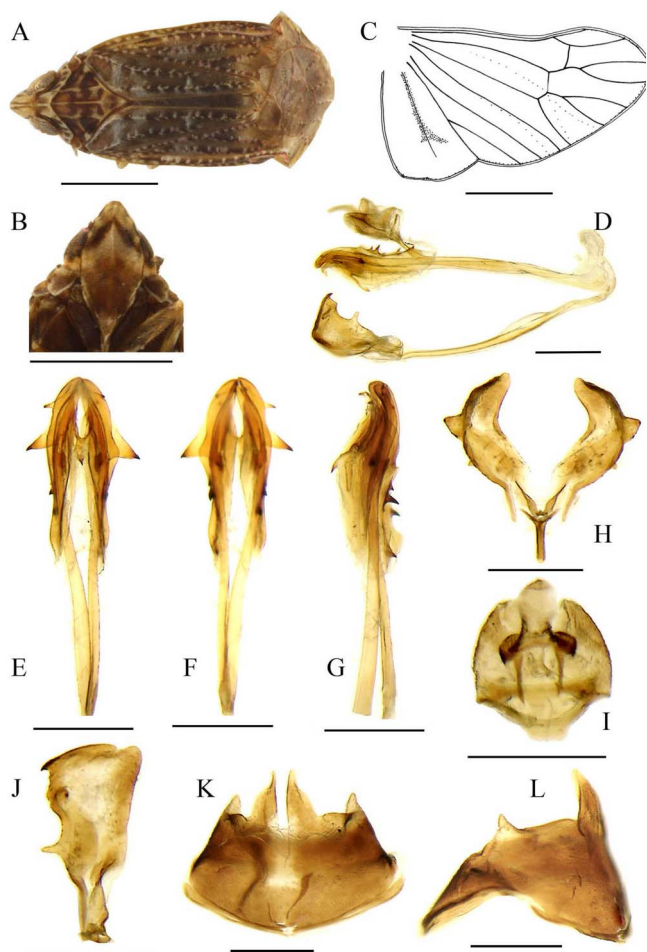
*Majellana* Metcalf, 1948: 63, nom.nov. for *Majella* Kirkaldy, synonymised by Fennah, 1950: 104.

Type species. *Deferunda stigmatica* Distant, 1912 (Bengal)

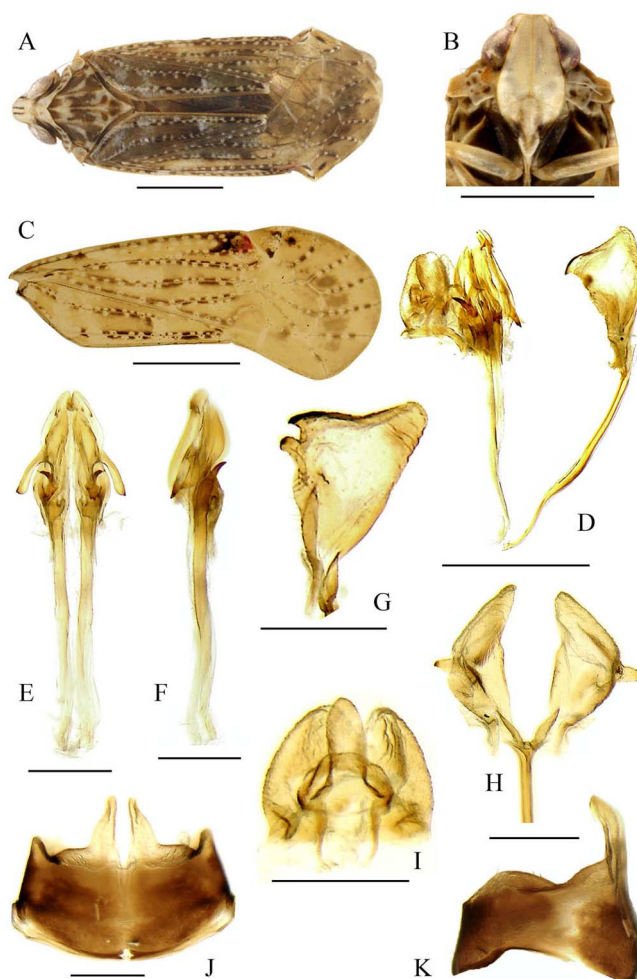
**Diagnosis.** Head with eyes distinctly narrower than pronotum about 0.7-0.8:1. Vertex produced before eyes two-third of its length, disc strongly depressed, wider between basal angles than long in middle line about 0.88-1.3:1, posterior margin subtruncate or slightly concave, anterior half of median carina obsolete, basal half prominent, lateral margin highly elevated, diverging posteriorly. Frons longer in middle line than widest part about 1.16-1.36:1, basal margin roundly convex, widest part subapically, median carina distinct. Ocelli present, detached from the eyes. Antennae subovate. Rostrum relatively short, reaching median trochanters. Median and lateral carinae strongly prominent, subparallel. Forewing costal margin slightly convex, longer than wide, ScR forked in basal third of forewing, M forked level with node, CuA strongly convex distal of claval apex, almost reaching M, hence slightly detached, apical part behind apex of clavus dropping and covering apex of abdomen. Spinal formula of hind leg 8-7(8)-6(5).

#### Key to species of *Deferunda* from Korea

1. Vertex with median carina bordered with longitudinal dark stripes from apex to base; frons with inverse V-shaped dark marking, genital styles in lateral view with three processes, one subapically and other two on lateral margin near middle and at apex; aedeagus without two large forked processes arising from near middle of lateral margin  
.....*D. rubrostigma* (Matsumura)
- Vertex with median carina bordered with longitudinal dark stripes at apex; frons without any dark marking, genital styles in lateral view with two processes on outer margin apically and subapically; aedeagus with two large forked processes arising from near middle of lateral margin, inner branch having three teeth at apex, outer branch with apex acute



**Figure 3.** *Deferunda rubrostigma* (Matsumura), male structures. A. Male habitus; B. Frons and clypeus; C. Hind wing; D. Anal segment, aedeagus and genital styles (right lateral view); E-G. Aedeagus (ventral, dorsal and lateral view); H. Genital styles (ventral view); I. Anal segment (dorsal view); J. Genital styles (dorsal view); K. Pygofer (ventral view); M. Ditto (lateral view). Scale bars=1.0 mm (AC); 0.25 mm (D-L).



**Figure 4.** *Deferunda qiana* Chen et He, male structures. A. Male habitus; B. Frons and clypeus; C. Forewing; D. Anal segment, aedeagus and genital styles (left lateral view); E-F. Aedeagus (ventral and lateral view); G. Genital styles (dorso-lateral view); H. Ditto (ventral view); I. Anal segment (dorsal view); J. Pygofer (ventral view); K. Ditto (lateral view). Scale bars=1.0 mm (AC); 0.50 mm (D); 0.25 (E-K).

.....*D. qiana* Chen and He

***Deferunda rubrostigma* (Matsumura, 1914) (Figure 3, A to L)**

*Okatropis rubrostigma* Matsumura, 1914a: 273-274.

*Deferunda rubrostigma*: Fennah, 1950: 104; Kwon and Lee, 1979: 66; Morimoto, 1989: 88; Chen et al., 1989: 57-59; Kwon et al., 1994: 93; Kwon et al., 1996: 123; Kwon and Huh, 2001: 321.

**Male genitalia.** Anal segment small, with round apex, in dorsal view pear-shaped, approximately as long as wide, deeply concave apically, with about median placement of anal style, half surpassing over posterior margin. Pygofer round, apparently wider ventrally than dorsally, anterior margin converging posteriorly about 1.48:1, produced caudad in an acute process at middle, medioventral process deeply cleft medially, triangular, acute at each apex. Aedeagus with phallobase not quite bilaterally symmetrical, tubular, dividing into four lobes at apex, dorsal lobe

reduced, with four spines, lateral lobes elongate, ventral lobe cleft at apex, with a spine at middle line, each side produced into two or three spines laterally. Phallic appendages apex flattened, with a spine produced apically. Genital styles narrow basally, and expanding distally, in lateral view, with three processes, one subapically and other two on lateral margin near middle and at apex.

**Materials examined.** 1 male, Toumsan, Gyeongsangbuk-do, Korea, 17.viii.1997, YJ Kwon; 1 male, Hwanghaksan, Gyeongsangbuk-do, Korea, 27.viii.1985; 1 female, same locality, 14.ix.1991; 1 male, Hakilsan, Gyeongsangbuk-do, Korea, 13.viii.1997; 1 male, Palgongsan, Gyeongsangbuk-do, Korea, 23.ix.1984; 1 male, Uido, Jeollanam-do, Korea, 15.viii.1998; 1 female, same locality, 17.viii.1998; 1 male, Sonuisan, Gyeongsangbuk-do, Korea, 21.ix.1997; 1 male, Bukhansan, Gyeonggido, Korea, 21.viii.2001; 1 female,

Dansan Myeon, Gyeongsangbuk-do, Korea, 13.viii.1983; 1 female, Chonhwangsan, Jeollabuk-do, Korea, 12.ix.1999; 2 females, Gajisan, Gyeongsangnam-do, Korea, 1.x.1984, all same collector (KNU).

**Host plant.** Unknown.

**Distribution.** Korea (central, south), Japan (Honshu, Shikoku, Yaku-shima), Taiwan.

***Deferunda qiana* Chen and He, 2010 (Figure 4, A to K)**

*Deferunda qiana* Chen and He, 2010: 64-65.

**Description.** Body length (including forewing): male 4.0-4.2 mm (N=22), female 4.8-5.2 mm (N=13); Forewing length: male 3.0-3.2 (N=22), female 3.9-4.2 mm (N=13).

**Coloration.** General color yellowish white to brown. Vertex yellowish white with two longitudinal stripes along middle line from apical two-thirds to apex, fuscous, lateral carinae yellowish brown. Frons yellowish white, lateral margins with three fuscous spots. Clypeus with apical half brown to fuscous. Rostrum yellowish with except apex fuscous. Genae yellowish white, with three transverse fuscous stripes before eyes, area beneath antenna with a fuscous marking. Eyes reddish brown, ocelli yellowish brown, tinged with reddish margin at base. Antennae yellowish brown, with apex brown dorsally. Pronotum yellowish brown, lateral areas with five spots, brown. Mesonotum yellowish brown, with irregular brown markings. Forewings yellowish brown, distributing irregular brown to fuscous markings, along veins, with narrow brown stripes, many white spots scattered, most of them near veins, callus dark brown, infused with reddish orange markings. Hind wing pale brown, veins brown, with a brown marking at anal region. Thorax with ventral areas anterior to middle legs fuscous, region posterior to middle legs yellowish brown. Legs yellowish white to yellowish brown, apex of tibiae with brown spots. Abdomen fuscous, except lateral margin and posterior margin of each segment, yellowish white to yellowish brown. Genital segment yellowish brown to brown.

**Head and thorax.** Head with eyes distinctly narrower than pronotum (0.77:1). Vertex not declivous, produced before eyes about two-thirds of its length, disc strongly depressed, wider between basal angles than long in middle line about 1.3:1, posterior margin sinuate, angularly concave medially, median carina distinct, lateral carinae distinctly foliate and elevated, diverging posteriorly. Frons longer in middle line than widest part about 1.21:1, widest at apical one-fourth, basal margin slightly rounded, apical margin concave medially, disc depressed, median carina distinct from base to apex, lateral margin strongly foliate basally, then diverging forward up to beneath antennae, thence converging to suture. Frontoclypeal suture obliquely angulate.

Post-clypeus shorter than frons in middle line about 1: 1.21. Pronotum shorter than vertex in middle line about 0.76:1, slightly depressed between median and lateral carina, anterior margin almost roundly convex, lateral carinae diverging posteriorly, each lateral lobe with four obsolete ridges. Mesonotum triangular, larger than vertex and pronotum combinedly in middle line (2.46:1), about as wide as long at widest part and provided with three subparallel distinct carinae. Forewings longer than widest part about 2.44:1, ScR forked in basal third of forewing, M forked level with node, CuA strongly convex distad of claval apex, almost reaching M, hence slightly detached, apical part behind apex of clavus dropping and covering apex of abdomen. Spinal formula of hind leg 8-7-6.

**Male genitalia.** Anal segment in dorsal view rounded with apical margin concave as like as 'V' medially, anal style relatively long, extending out apical margin of anal segment. Pygofer in profile distinctly shorter dorsally than ventrally, anterior margin broadly concave, posterior margin roundly convex caudad at middle, pygofer in ventral view, medioventral processes stout, relatively long, sub-triangular, apex slightly rounded, two processes separate basally, median cleft broad and deep. Aedeagus with phallobase bilaterally symmetrical, tubular, dividing into four lobes at apex, in ventral view, ventral lobe slightly cleft at apex medially, each with four or five spines at ventral side subapically, two large forked processes arising from near middle of lateral margin, inner branch having three teeth at apex, outer branch with apex acute, curving ventral apically, lateral lobes elongate, dorsal lobe reduced. Phallic appendages reaching to middle of phallobase, slightly widening apically, each apex with a stout spine-like process, curving laterally. Genital styles narrow at base, and widening apically, in lateral view, with two processes, one in outer margin apically and other finger-like tooth subapically.

**Materials examined.** 4 males, Dansan Myeon, Gyeongsangbuk-do, Korea, 13.viii.1983, YJ Kwon; 4 males, Chunji, Gyeongsangbuk-do, Korea, 31.vii.2010; 3 males, 2 females, same locality, 4.viii.2010; 11 males, 11 females, same locality, 3.vi.2010, all same collector (KNU).

**Host plant.** Unknown.

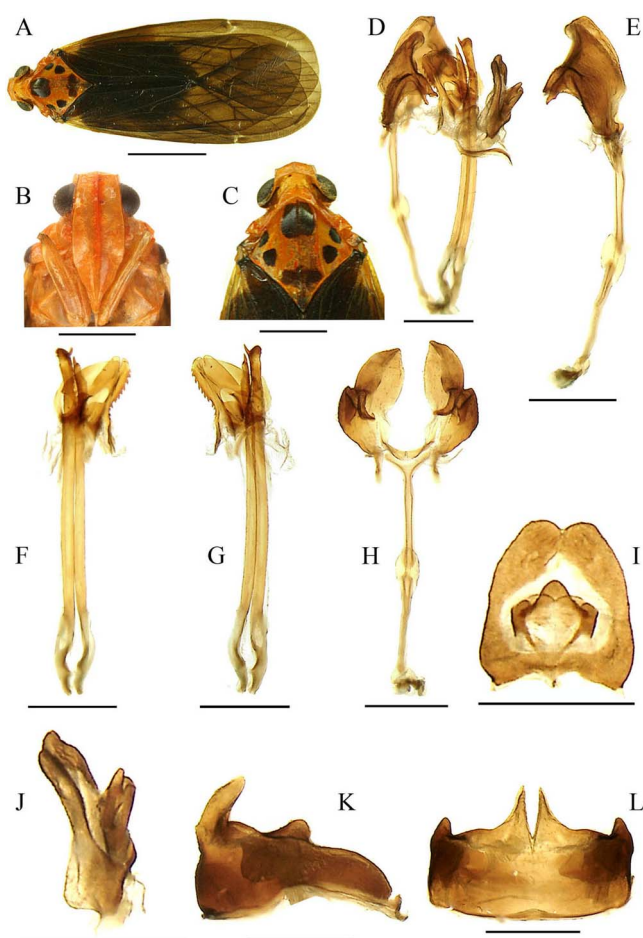
**Distribution.** Korea (new record: south), China (Guizhou and Yunnan).

**Genus *Kosalya* Distant, 1906**

*Kosalya* Distant, 1906: 292-293; Fennah, 1950: 72; Anufriev and Emeljanov, 1988: 480; Chen et al., 1989: 19-20.

Type species. *Kosalya flavostrigata* Distant, 1906 (Myanmar)

**Diagnosis.** Head with eyes distinctly narrower than pronotum.



**Figure 5.** *Kosalya flavostrigata* Distant, male structures. A. Male habitus; B. Frons and clypeus; C. Head and thorax; D. Anal segment, aedeagus and genital styles (right lateral view); E. Genital styles (lateral view); F-G. Aedeagus (left and right lateral view); H. Genital styles (ventral view); I. Anal segment (dorsal view); J. Ditto (lateral view); K. Pygofer (lateral view); L. Ditto (ventral view). Scale bars=2.0 mm (A); 1.0 mm (B-C); 0.50 (D-L).

Anterior margin of vertex marked by obtuse-angulate carina parallel to posterior margin, median carina distinct. Frons longer in middle line than widest part about 1.45:1, widest part broader than at base about 1.3:1, disc depressed between median and lateral carinae, median carina distinct. Antennae subovate. Eyes broadly rounded in lateral view, concave beneath. Pronotum moderately short, posterior margin angulately concave, median and lateral carinae distinct. Mesonotum much longer than vertex and pronotum combined in middle line about 3.2, tricarinate. Forewing longer than widest part about 2.8, ScR forking slightly distal of CuA fork. Hind wing slightly shorter than tegmina, twice as long as wide. Post-tibia with a single lateral spine at basal half.

***Kosalya flavostrigata* Distant, 1906 (Figure 5, A to L)**

*Kosalya flavostrigata* Distant, 1906: 293; Lee and Kwon, 1977: 97; Anufriev and Emeljanov, 1988: 481; Kwon et al., 1994: 93; Kwon et al., 1996: 123; Kwon and Huh, 2001: 321.

**Male genitalia.** Anal segment moderately large, gradually narrowing apically in lateral view, in dorsal view pear-shaped, with apex incised in middle, basal margin concave beside middle line, anal style placed approximately in middle, short, cone-shaped, apex rounded. Pygofer ring like, in profile prominently wider ventrally than dorsally, posterior margin with two processes produced caudad, medioventral processes paired. Genital style spoon-shaped, in ventral view, dorsolateral margin incised at middle with a process, in lateral view, narrow at base and then diverging subapically, a process at middle, subapically concave, apex narrow, outer margin convex. Aedeagus asymmetrical, phallobase submembranous, in lateral view, right lateral lobe incised and left lateral lobe with saw blade structure. Phallic appendages long, at level of phallobase apex, left one cone-shaped with a spine at apex, right one rod-shaped and swelling apically, with a spine subapically.

**Materials examined.** 1 male, Palgongsan, Gyeongsangbuk-do, Korea, 10.viii.1999, 1 male, Mt. Kaya, Gyeongsangnam-do, Korea, 12.viii.1996; 1 male, Togyusan, Jeollabuk-do, Korea, 18.viii.1999; 1 male, same locality, 18.viii.1991; 1 male, Taeamsan, Chungcheongnam-do, Korea, 18.viii.1989; 1 female, Unjangsan, Jeollabuk-do, Korea, 28.viii.1998; 1 female, Tonggosan, Gyeongsangbuk-do, Korea, 13.viii.1992; 1 female, Palgongsan, Gyeongsangbuk-do, Korea, 24.viii.1980; 1 female, Hwanghaksan, 3.x.1991; 1 female, Tonggosan, Gyeongsangbuk-do, Korea, 21.viii.2001, all same collector (KNU).

**Host plant.** Unknown.

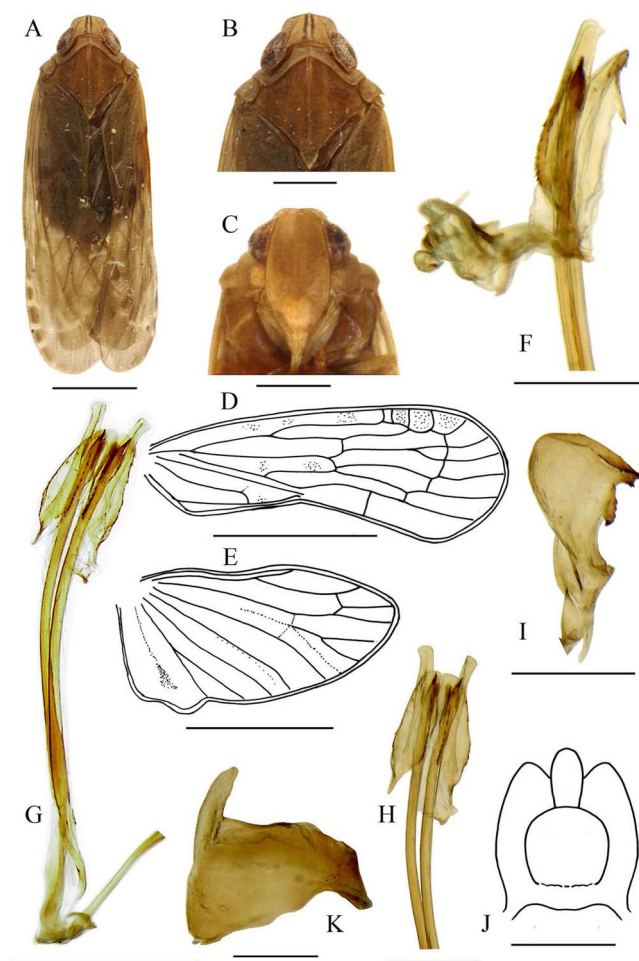
**Distribution.** Korea (central, south), Taiwan, Russia (Maritime Territory), India, Myanmar.

**Genus *Phenelia* Kirkaldy, 1906**

*Phenelia* Kirkaldy, 1906: 417, 421; Fennah, 1950: 139.

Type species. *Phenelia elidipeteroides* Kirkaldy, 1906 (Queensland).

**Diagnosis.** Head with eyes slightly narrower than pronotum. Vertex wider at base than long in middle line, produced before eyes about a third of its length, median carina prominent, disc slightly depressed, anterior margin carinate, a distinct triangular areolet at each latero-apical angle of head, lateral margins carinate, diverging basal, posterior margin broadly concave. Frons slightly convex in profile, longer in middle line than broad, basal margin slightly concave, median carina distinct, lateral margins carinate, very slightly foliate distally. Postclypeus shorter than frons. Antennae subglobose. Eyes slightly overlapping pronotum, ocelli separated from eyes. Pronotum shorter than vertex at middle line, anterior margin of disc convex-truncate, posterior margin angulately concave, median carina distinct. Mesonotum longer than vertex and pronotum combined, tricarinate. Forewing less



**Figure 6.** *Phenelia striatella* (Matsumura), male structures. A. Male habitus; B. Head and thorax; C. Frons and clypeus; D. Forewing; E. Hind wing; F. Anal segment and aedeagus (left lateral view); G. Aedeagus (lateral view); H. Ditto (ventral view); I. Genital styles; J. Anal segment (dorsal view); K. Pygofer (lateral view). Scale bars=2.0 mm (D, E); 1.0 mm (A); 0.5 mm (B, C, G); 0.25 mm (F, H, I, K); 0.2 mm (J).

than three times as long as wide at widest part, costal margin slightly convex, ScR fork slightly distal of or about level with CuA fork. Hind wing slightly shorter than forewing. Post-tibia with a single lateral spine at basal half.

***Phenelia striatella* (Matsumura, 1914) (Figure 6, A to K)**

*Akotropis striatella* Matsumura, 1914a: 272; Schumacher, 1915: 118.

*Phenelia striatella*: Chen *et al.*, 1989: 26-28.

**Description.** Body length (including forewing): male 4.1-4.5 mm (N=06), female 4.1-4.7 mm (N=03); Forewing length: male 3.5-3.8 (N=06), female 3.6-3.9 mm (N=03).

**Coloration.** General color yellow brown to brown. Frons, clypeus, genae and antennae brown. Vertex with two longitudinal dark brown stripes beside median carina. Ocelli red. Forewing

semiopaque, pale brown, around apical cell and costal margin with infusate marks, apical veins pale. Hind wing semihyaline with pale brown veins. Abdominal segments brown to dark brown. Genital segment brown.

**Head and thorax.** Head with eyes narrower than pronotum about 1:1.17. Vertex wider at base than long in middle line about 1.7:1, produced before eyes about a third of its length, median carina prominent, disc slightly depressed, anterior margin carinate, a distinct triangular areolet at each latero-apical angle of head, lateral margins carinate, slightly foliate, diverging basad, posterior margin broadly concave. Frons longer in middle line than widest part about 2.26:1, lateral margins convexed laterad, especially level of antennae thence incurved into suture, median carina prominent, wider at widest part than at base about 1.53:1, median carina distinct. Postclypeus about 0.65 times length of frons, medially and laterally carinate. Antennae subglobose, not sunk in a depression. Eyes slightly overlapping pronotum, ocelli separated from eyes. Pronotum shorter than vertex at middle line about 1:2.85, anterior margin of disc convex-truncate, posterior margin angulately concave, median carina distinct, lateral carinae diverging basad, attaining hind margin. Mesonotum longer than vertex and pronotum combined about 2.48:1, tricarinate. Forewing 2.92 times as long as wide at widest part, costal margin slightly convex, ScR fork slightly distad of or about level with CuA fork. Hind wing slightly shorter than forewing, 2.5 times as long as wide. Post-tibia with a single lateral spine at basal half, spinal formula of hind leg 8-7-6.

**Male genitalia.** Anal segment in lateral view slender, relatively short, concave distally, in dorsal view, anal styles placed approximately in middle, half surpassing posterior margin, posterior margin strongly concave. Pygofer prominently shorter dorsally than ventrally, medioventral processes rod-shaped, elongate, detached from each other widely. Genital styles large, anterodorsal margin raising upward, a large triangular process produced laterally at the middle. Phallobase tubular, in dorsal view, not quite symmetric, in ventral view lateral margins with spines, apex round, a distinct tooth at middle. Phallic appendages subequal, sharp and pointed at apex.

**Materials examined.** 4 males, 2 females, Gajisan, Gyeongsangnam-do, Korea, 1.x.1984, YJ Kwon; 1 male, Hwanghaksan, Gyeongsangbuk-do, Korea, 3.x.1991, 1 male, same locality, 14.ix.1991; 1 male, 1 female, same locality, 29.vi.2010; 1 female, Daegucity, Gyeongsangbuk-do, Korea, 6.x.1984, all same collector (KNU).

**Host plant.** Unknown.

**Distribution.** Korea (new record: south), Taiwan.



**Genus *Usana* Distant, 1906**

*Usana* Distant, 1906: 293; Fennah, 1950: 132; Chen et al., 1989: 23-24.

Type species. *Usana lineolatis* Distant, 1906 (Tenasserim)

**Diagnosis.** Head with eyes slightly narrower than pronotum. Vertex not declivous, broader at base than long in middle line, produced before eyes for about a third of its length, median carina distinct, anterior margin carinate, obtusely subangulately convex, a distinct triangular areolet at each latero-apical angle of head, lateral margins carinate, straight, slightly diverging basal, posterior margin broadly concave. Frons longer in middle line than widest part, basal margin truncate, median carina distinct, lateral margins carinate, straight, diverging to below level of antennae thence gradually incurved to suture. Postclypeus shorter than frons, medially and laterally carinate. Rostrum with subapical segment shorter than apex. Antennae subglobose, not sunk in a depression. Ocelli present. Pronotum moderately long, anterior margin of disc broadly convex, posterior margin angulately excavate, median carina distinct, lateral carina straight, diverging posteriorly, attaining hind margin. Mesonotum longer than vertex and pronotum combined, tricarinate. Forewing 2.8 times as long as broad, costal margin slightly convex, three or four cells in Sc at margin distal of stigmal cell, M fork slightly basal of node, Clavus terminating about at middle of forewing. Hind wing M 2-branched, CuA 3-branched. Post-tibia with a single spine laterally at basal half.

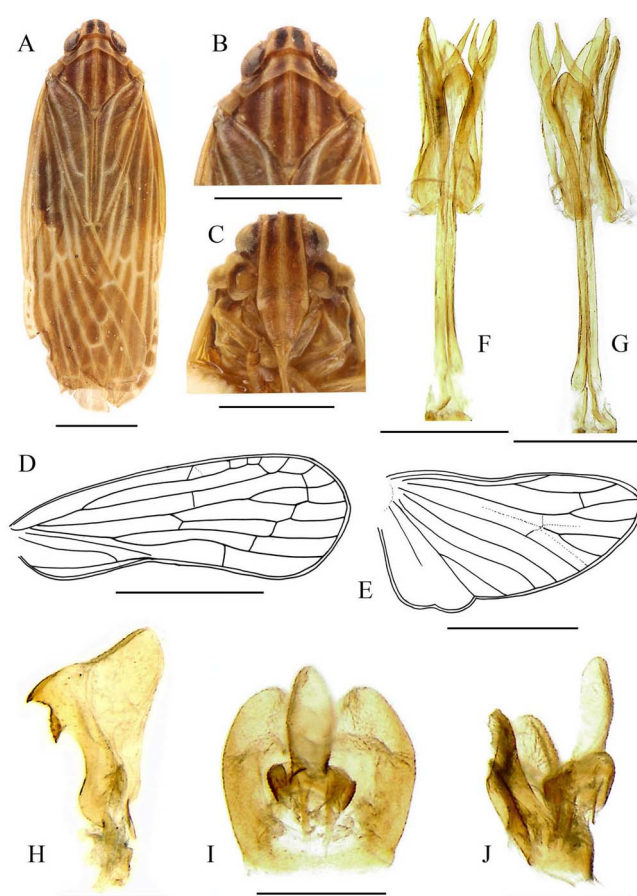
***Usana yanonis* Matsumura, 1914 (Figure 7, A to J)**

*Usana yanonis* Matsumura, 1914a: 276; Schumacher, 1915: 118; Esaki, 1932: 1787; Matsumura, 1940: 34; Chen et al., 1989: 24-25.

**Male genitalia.** Anal segment in lateral view slender, relatively short, concave distally, in dorsal view, anal styles placed near base, half surpassing posterior margin, posterior margin strongly concave as like as 'V'. Pygofer prominently shorter dorsally than ventrally, medioventral processes rod-shaped, elongate, detached from each other widely. Genital styles large, anterodorsal margin raising upward, a large triangular process produced laterally at the middle. Phallobase tubular, in dorsal view, not quite symmetric, in ventral view lateral processes longer than ventral process, convex apically. Phallic appendages approximate equal level at posterior end, subapically curved, apex pointed.

**Materials examined.** 1 male, 1 female, Dansan Myeon, Gyeongsangbuk-do, Korea, 13.viii.1983, YJ Kwon; 1 female, Daegu city, Korea, 5.ix.1981; 1 female, Tongdosa, Gyeongsangnam-do, Korea, 9.x.1979, all same collector (KNU).

**Host plant.** Unknown.



**Figure 7.** *Usana yanonis* Matsumura, male structures. A. Male habitus; B. Head and thorax; C. Frons and clypeus; D. Forewing; E. Hind wing; F-G. Aedeagus (dorsal and ventral view); H. Genital styles (dorso-lateral view); I. Anal segment (dorsal view); J. Ditto (lateral view). Scale bars=2.0 mm (D, E); 0.50 mm (FG); 0.25 mm (H-J).

**Distribution.** Korea (South), Japan (Honshu, Kyushu, Shikoku), Taiwan.

**References**

- Anufriev GA, Emeljanov AF (1988) Volume II: Homoptera and Heteroptera. In: PA Lehr (ed.) *Keys to the insects of the far East of the USSR in Six Volumes*, Nauka Publishing House, Leningrad, Moscow. (English translation), pp. 317-496.
- Che YL, Zhang YL, Wang YL (2007) Seven new species and one new record of *Gergithus* Stål (Hemiptera: Fulgoroidea: Issidae). *Proc Entomol Soc Wash* 109: 611-627.
- Chen CL, Yang CT, Wilson MR (1989) Achilidae of Taiwan (Homoptera: Fulgoroidea). *Natl Taiwan Mus Spec Publ Ser* 8: 57-61.
- Chen XS, He TT (2010) Two new species of genus *Deferunda* Distant (Hemiptera: Fulgoromorpha: Achilidae) from southwest China. *Zootaxa* 2335: 59-68.
- Distant WL (1906) *The fauna of British India, including Ceylon and Burma*. Rhynchota 3 (HeteropteraHomoptera). London: Taylor & Francis, p. 503.
- Distant WL (1912) Descriptions of new genera and species of Oriental

- Homoptera. *Ann Mag Nat Hist* 9: 181-194.
- Emeljanov AF (1993) Description of tribes of the subfamily Achilinae (Homoptera, Achilidae) and revision of their composition. *Entomol Rev* 72: 7-27.
- Emeljanov AF (2005) New genera and new species of the family Achilidae (Homoptera). *Entomol Obozr* 84: 10-45.
- Emeljanov AF, Gnezdilov VM. (2009) On the taxonomic position of the genus *Sieberella* (Homoptera: Fulgoroidea: Achilidae). *Zoosyst Rossica* 18: 262-263.
- Esaki T (1932) *Nippon Konchu Zukan. Iconographia insectorum Japonicorum*, p. 2241.
- Fennah RG (1945) The Fulgoroidea, or Lanternflies, of Trinidad and adjacent parts of South America. *Proc U S Nat Mus* 95: 411-509.
- Fennah RG (1950) A generic revision of Achilidae (Homoptera: Fulgoroidea) with descriptions of new species. *Bull Brit Mus Nat Hist Entomol* 1: 1-170.
- Jacobi A (1941) Die Zikadenfauna der Kleinen Sundainseln. Nach der Expeditionsausbeute von B. Rensch. *Zoologische Jahrbücher. Abteilung für Systematik, Ökologie und Geographie der Tiere*. Jena 74: 277-322.
- Kirkaldy GW (1906) Leafhoppers and their natural enemies. (Pt. IX. Leafhoppers. Hemiptera). *Bulletin of Hawaiian Sugar Planters' Association. Division of Entomology* 1: 271-479.
- Kwon YJ, Huh EY (1995) A check list of the Auchenorrhyncha from Chejudo (Homoptera). *Ins Kor Suppl* 5: 19-54.
- Kwon YJ, Huh EY (2001) Suborder Auchenorrhyncha. *Economic Insects of Korea*, 19, *Ins Kor Suppl* 26: 302-391.
- Kwon YJ, Lee CE (1979) Notes on some planthoppers from Korea (Homoptera: Fulgoroidea). *Nat Life* 9 : 63-68.
- Kwon YJ, Lee JH, Suh SJ, An SL, Huh EY, Lu LS (1996) III. Invertebrate 2 (Insect & spiders): 93-292. In: *List of biological species from Korea. The Korean National Council for Conservation of Nature*, Seoul, p. 504.
- Kwon YJ, Park JK, Huh EY (1994) V. Insect fauna: 225-286. In: *Report on the ecosystem survey to P'algongsan Natural Park, Taegu*, (in Korean), p. 363.
- Lee CE (1979) *Illustrated Flora and Fauna of Korea, Vol. 23 (Insecta VII)*, Ministry of Education, Seoul, p. 1070.
- Lee CE, Kwon YJ (1977) Studies on the spittlebugs, leafhoppers and planthoppers (Auchenorrhyncha, Homoptera, Hemiptera). *Nat Life* 7: 55-111.
- Lee CE, Kwon YJ (1979) A check list of Auchenorrhyncha from Korea (Homoptera). In: Lee, C.E. III. *Flora and Fauna of Korea*, 23, *Ins (VII)*, pp. 799-1018.
- Lee CE, Kwon YJ (1981) On the insect fauna of Ulreung Is. and Dogdo Is. in Korea. *Rep Kor Ass Cons Nat* 19: 139-182.
- Matsumura S (1914) Die Cixiinen Japans. *Annot Zool Jap* 8 : 39-434.
- Matsumura S (1914a) Beitrag zur Kenntnis der Fulgorisen Japans. *Annl hist-nat Mus Natn Hung* 12: 261-305.
- Matsumura S (1940) New species of Dictyophoridae (Homoptera) from Manchoukuo and the neighbouring countries. *Insecta Matsumurana* 15: 14-20.
- Metcalf ZP (1938) The Fulgorina of Barro Colorado and other parts of Panama. *Bull Mus Comp Zool* 82: 277-423.
- Metcalf ZP (1948) *General catalogue of the Hemiptera. Fascicule IV Fulgoroidea. Part 10 Achilidae*. North Carolina State College, Raleigh, NC. pp. 1-85.
- Morimoto K (1989) 21. Hemiptera, (a) Homoptera. In: Hirashima, Y. et al. (eds), *A checklist of Japanese insects 1. Kyushu University, Fukuoka*. (in Japanese), pp. 82-151.
- Rahman MA, Kwon YJ, Suh SJ (2011) Taxonomic revision of family Tropiduchidae (Hemiptera: Fulgoromorpha) from Korea. *Entomol Res* 41: 247-256.
- Schumacher F (1915) Der gegenwärtige stand unserer kenntnis von der homopteren-Fauna der Insel Formosa unter besonder er berücksichtigung von sauter'schem material. *Mitt Zool Mus Berl* 8: 73-134.
- Walker F (1870) *Catalogue of the Homopterous insects collected in the Indian Archipelago by Mr. A. R. Wallace, with descriptions of new species*. *Zool J Linn Soc* 10: 82-193.
- Wang YL, Peng LF, Liu HW (2008) A taxonomic study on the genus *Deferunda* Distant from China (Hemiptera, Achilidae). *Acta Zootaxonomica Sinica* 33: 775-779.
- Zool Soc Kor (1968) *Nomina Animalium Koreanorum 2 (Insecta)*. Hyangmoon Publ. Co., Seoul, (in Korean), p. 334.