

On the Scientific Name of the Invaded Planthopper (Hemiptera: Fulgoroidea: Ricaniidae) in Korea

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외래침입해충인 갈색날개매미충(노린재목: 꽃매미상과: 큰날개매미충과)의 재동정 결과 보고

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ABSTRACT: Brown ricaniid planthopper (Hemiptera: Fulgoroidea) is one of the invaded pests in Korea. However, this species has been misidentified or not identified yet, caused confusions in taxonomy or agroecosystem. In the present study, we collected the specimens occurring in Korea nationwide and taxonomically reviewed. Consequently, we confirmed its scientific name as *Ricania sublimata*. Herein, a key to the Korean *Ricania* is provided.

Key words: Brown ricaniid planthopper, Invaded pest, *Ricania sublimata*, Ricaniidae, Taxonomy

초 록: 갈색날개매미충(노린재목: 꽃매미상과)은 한반도 침입해충 중 하나이다. 하지만, 그동안 정확한 종 동정이 되지 않아, 분류학적으로 또는 농업적으로 혼선을 야기시키는 문제가 발생하였다. 이번 연구에서는 한반도에서 발생된 표본들의 관찰을 통하여 이 종의 학명을 *Ricania sublimata*로 확인하였다. 또한 한국산 큰날개매미충속에 대한 검색표를 제공한다.

검색어: 갈색날개매미충, 외래침입해충, *Ricania sublimata*, 큰날개매미충과, 분류

The family Ricaniidae (Hemiptera: Auchenorrhyncha) is a relatively small group in the superfamily Fulgoroidea comprising 64 genera and 432 species worldwide (Bourgoin, 2020). It contains significant pests (e.g. *Scolytopa australis* Walker, *Ricania speculum* Walker) on orchards and forest worldwide. This group is also considered as serious pests in agriculture because of its polyphagous habit and ovipositing in young branch with huge population (Luo, 2003; Mazza et al., 2014, 2020; Rossi and Lucchi, 2015 etc.).

Seven species are recorded of the family Ricaniidae in Korea up to date (Lee and Kwon, 1979; Kwon and Huh, 2001; Choi et al., 2011). One species in this group, 'brown ricaniid planthopper' was reported from Korea as an invasive species by Choi et al. (2011), now causing huge damages on agriculture. This species from Korea has been mis-/or-unidentified until now, thus referred as various different scientific names such as *Ricania* sp., *R. shantungensis*, *Pochazia shantungensis*, in many scientific journals and papers (e.g., Choi et al., 2011; Choi et al., 2012; Choi et al., 2016; Choi et al., 2017a, b; Kang et al., 2013; Kim et al., 2015, 2017; Lim et al., 2016; Rahman et al., 2012; Ryu et al., 2016, etc.).

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In this study, this species is taxonomically reviewed based on morphology. Diagnosis, redescription, photographs of habitus, measurements are presented, and photographs of male and female genitalia are first provided with key to the species of genus *Ricania* in Korea.

Material and Methods

Photographs of habitus are taken by a Leica DMC2900 with Leica M165C microscope. Measurements were taken using same camera and LAS Interactive Measurements. All measurements given in millimeters (mm). For genital experiments, male and female genitalia are digested in 10% KOH in room temperature 8–10 hours. Then, genitalia placed in slides with glycerin for dissection. Terminology is mainly based on Yang (1989) and Bourgoin (1993). Depository of the specimens are CNU (Laboratory of Systematic Entomology, Chungnam National University, Daejeon, Korea). Distribution with an asterisk (*) mean a new record. Abbreviations used in the material examined in Korea are as follows: [GG] Gyeonggi-do; [GW] Gangwon-do; [CB] Chungcheongbuk-do; [CN] Chungcheongnam-do; [GB] Gyeongsangbuk-do; [GN] Gyeongsangnam-do; [JB] Jeollabuk-do; [JN] Jeollanam-do.

Taxonomic Accounts

Superfamily Fulgoroidea Latreille 1807 꽃매미상과

Family Ricaniidae Amyot and Audinet-Serville 1843 큰날개매미충과

Genus *Ricania* Germar 1818 큰날개매미충속

Richania Spinola, 1839: 395 (wrong spelling, corrected in Metcalf, 1955: 196)

Rhycania Agassiz, 1848: 941 (wrong spelling, corrected in Metcalf, 1955: 42)

Bicania Kato, 1933b: 11 (wrong spelling, corrected in Metcalf, 1955: 191)

Rycania Schulze et al., 1936: 3081 (wrong spelling, corrected in Metcalf, 1955: 41)

Ricahia Li, 1940: 254 (wrong spelling, corrected in Metcalf, 1955: 195)

Diagnosis. Recognized by coloration of body brownish to

fuscous generally with whitish spot on anterior margins of tegmina; veins of precostal area on tegmina forming densely, margins one thirds part convex; tegmina shaped rounded apical margin to posterior margin distinctly, not angled; clypeus with one median carinae (Figs. 1A–E) (Metcalf, 1955; Bu and Liang, 2011).

Key to the species of *Ricania* in Korea

- 1 Body size relatively small, less than 10 mm; paraproct surpassing posterior margin
 *Ricania taeniata* Stål, 1870 남쪽날개매미충
- Body size big, over than 10 mm; paraproct not reaching posterior margin 2
- 2 Patterns of tegmina spotted, contrasted with background distinctly; male anal tube expanded laterally, aedeagus curved irregularly, branched twice
 *Ricania speculum* (Walker, 1851) 팔점날개매미충
- Patterns of tegmina not developed, whitish markings in precostal area; male anal tube oval, aedeagus curved laterally, not branched
 *Ricania sublimata* Jacobi, 1916 갈색날개매미충

Ricania sublimata Jacobi, 1916 갈색날개매미충

(Figs. 1A–E, 2A–N)

Pochazia sublimata Schumacher, 1915: 137; Esaki, 1932: 1801.

Ricania sublimata Jacobi, 1916: 303.

Ricania (Ricanula) sublimata Melichar, 1923: 130.

Ricania sublimbata Kato, 1933a: 7 (wrong spelling).

Ricanula sublimata Metcalf, 1955: 101; Yang, 1989: 195.

Diagnosis. Recognized by fuscous body generally, tegmina with whitish markings on middle of precostal area distinctly, apical margins round uniformly (Fig. 1A–B, E); male anal tube round and oval (Fig. 2B); phallic complex with two spinosus processes; aedeagus not branched, curved laterally (Fig. 2D–F); female anterior margin of pregenital sternite with two triangular bumps (Fig. 2N).

Note. This species is distinguished from *Pochazia shantungensis* (Chou and Lu, 1977) (new combination by Rahman et al., 2012), by tegmina relatively more quadrate and expanded, apical margin not narrowing apex to basal distinctly. See Chou and Lu (1977: 320) and Chou et al. (1985: 83) for comparative

illustrations with *Ricania sublimata*.

Redescription. Male. COLORATION: General coloration of body fuscous, vertex and pronotum concolorous with background. Frons fuscous, lateral margins slightly lighter than background. Tegmina fuscous, veins darker than background, costal margin with whitish marking in upper-middle. Femora and tibiae brown (Fig. 1A–B, E). SURFACE AND VESTITURE: Tegmina and body generally covered with thin whitish to brown wax layer, variations between population (Fig. 1A–B). **Head.** Head with compound eyes slightly more than widest part of mesonotum. Vertex narrower than pronotum, all margins carinated; disc of vertex without median carina, anterior to posterior margins curved. Frons widest in middle, upper margin flat; lateral margins arcuate, curved to frontoclypeal suture; one median

carinae developed frons to clypeus. Frontoclypeal suture arcuate. Compound eyes oval, ocelli present (Fig. 1A, E). **Thorax.** Pronotum longer than vertex in midline; disc of pronotum with median carina, anterior and posterior margins arcuate. Mesonotum about 7.2 times longer than cumulative length of vertex and pronotum in midline; median carina reaching posterior margin; lateral carinae not connected basally, almost reaching posterior margins; anterolateral carinae fused with lateral carinae, surpassing the lateral angles of mesonotum. Tegmina membranous, elongately-triangular; costal margin slightly arcuate, anterior angle broadly rounded, posterior margin almost straight. Precostal area with veins forming densely, a little wider than costal cell and a little widened apically; basal cell small, widely rounded; veins Sc, R, M and Cu leaving basal cell separated. Sc vein curved after

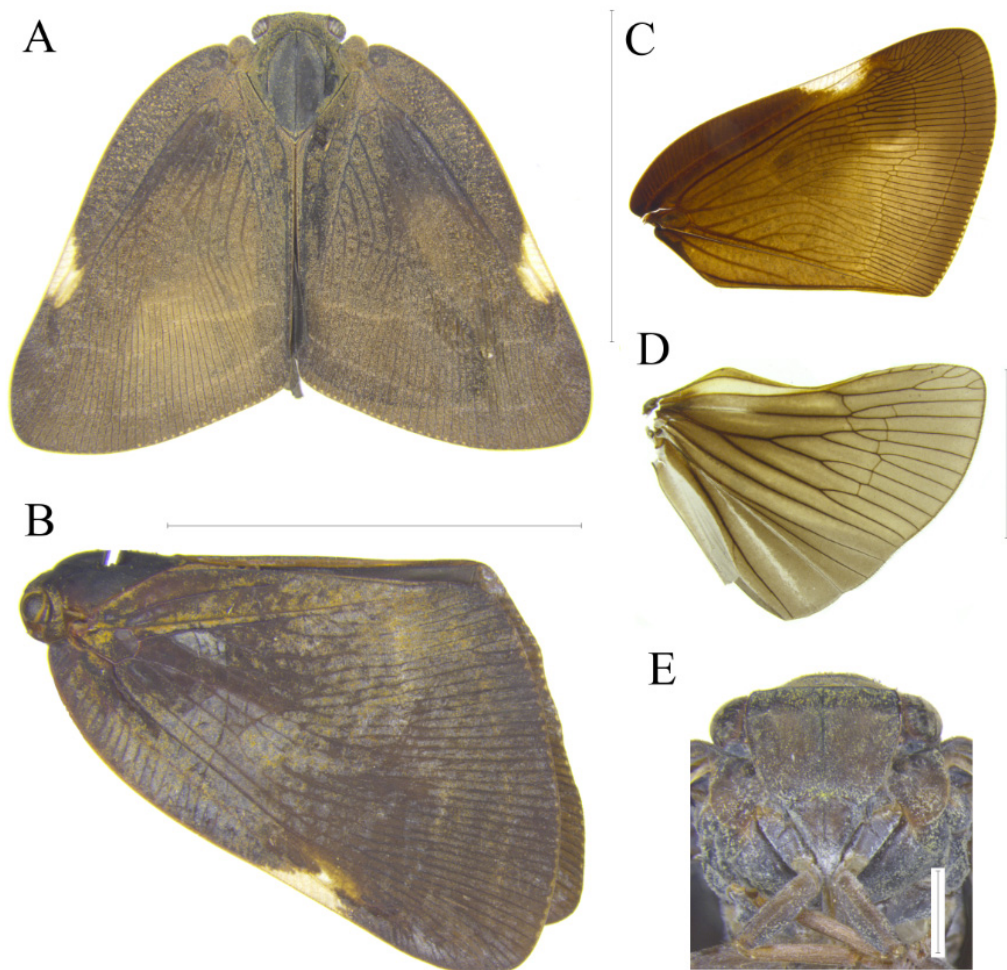


Fig. 1. Photographs of habitus of *Ricania sublimata*: A. dorsal habitus; B. left-lateral habitus; C. right tegmina, dorsal view; D. right wing, dorsal view; E. frons, ventral view. scale bar: A–C: 10.0 mm, D: 5.0 mm, E: 1.0 mm.

leaving basal cell, M dividing near basally, Cu branched five times to middle (Fig. 1A-B). **Abdomen.** GENITALIA: Anal tube, posterior margin concave, basal margin slightly straight, lateral margins arcuate, anus placed in middle, paraproct not reaching the posterior margin (Fig. 2B). Pygofer, in lateral

view, higher than wide distinctly; dorsally narrower than ventrally, posterior margin almost straight; posterior-dorsal angle without process, caudo-dorsal angle angulate (Fig. 2C). Genital styles thick, in lateral view longer than wide distinctly, with a spine-like process at the end of dorsal margin; upper margin convex

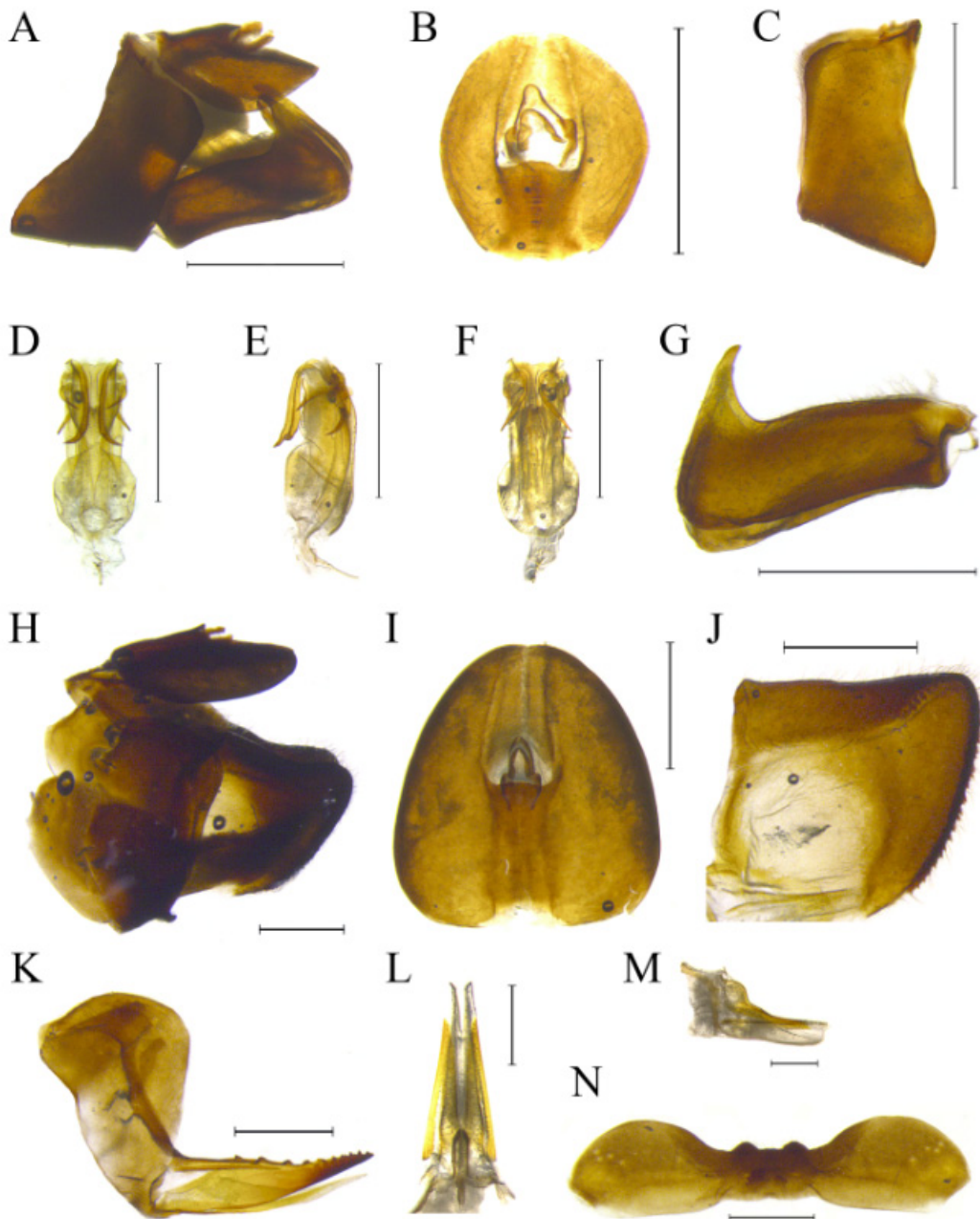


Fig. 2. Photographs of male and female genitalia of *Ricania sublimata*: A. male genitalia, lateral view; B. male anal segment, caudal view; C. male pygofer, lateral view; D. phallic complex, ventral view; E. phallic complex, lateral view; F. phallic complex, dorsal view; G. styles, lateral view; H. female genitalia, lateral view; I. female anal segment, caudal view; J. gonoplac, lateral view; K. gonapophysis VIII and process, lateral view; L. gonapophysis IX, dorsal view; M. gonapophysis IX, lateral view; N. pregenital sternite, flattened. scale bar: A-K, N: 1.0 mm, L-M: 0.5 mm.

slightly, lower margin mostly straight; ventral margin in caudo-dorsal angle widely rounded and surpassing the posterior margin of process (Fig. 2C). Phallic complex, in lateral view, long, slightly narrow at middle; Periandrium with lateral shorter than the half of length. Basal part of periandrium rounded without any additional structures, apical part with two spinosus process dorsally, slightly bent to dorsally, upper median lateral fold of periandrium convex. Aedeagus shorter than periandrium, with pair sclerotized, each process with a single apex. Processes long, a slightly shorter than periandrium, curved to horizontally (Figs. 2D–F). **Female.** Same as male in general features; **Abdomen.** GENITALIA: Pregenital sternite with lateral lobes well developed, median portion narrow; anterior margin with two triangular bumps distinctly; posterior margin straight with slightly concave median portion (Fig. 2N). Anal tube lateral margins convex, basal margin slightly wider than upper, posterior margin concave, anus placed after midlength, paraproct not surpassing the posterior margin of anal tube (Fig. 2I). Gonoplac triangular, posterior margin bearing with blunt and short teeth, posterior ventral part partly membranous (Fig. 2J). Gonapophysis VIII partly flattened laterally, tapering apicad; dorsal margin convex, with sharp apex and well visible teeth at posterodorsal margin; endogonocoxal process narrower and slightly shorter than gonapophysis VIII, membranous (Fig. 2K). Gonapophysis IX with posterior connective lamina sclerotized, gonospiculum bridge flat, slightly blunt ventrodorsally (Figs. 2L–M). See Jacobi (1916) for original description and Yang (1989) for illustrations also.

Measurements (in mm). Male (n=10)/Female (n=10). Body length (mm): 10.08–12.41/11.58–14.01.

Material examined. [GG] 1♂ 2♀. 8.VIII.2017. Ssangji-ri, Gosam-myeon, Anseong-si. J.K. Park, sweeping; 10♂ 10♀. 3.VIII.2018. Gyeongseo-dong, Seo-gu, Incheon. J.K. Park & E.J. Kim, sweeping; 10♂ 10♀. 13.VIII.2018. Jikdong-ri, Soheul-eup, Pocheon-si; 10♂ 10♀. 23.VII.2019. Dongchon-ri, Seoun-myeon, Anseong-si. G.H. Kim, yellow sticky trap; 1♂ 3♀. 23.VIII.2019. Songsan-myeon, Hwaseong-si. J.K. Park, J.H. Kim & J.M. Bae, sweeping.

[GW] 6♀. 14.IX.2017. Bangjeol-ri, Yeongwol-eup, Yeongwol-gun. J.K. Park, E.J. Kim & H.K. Ji, sweeping; 4♀. 14.IX.2017.

Mapyeong-dong, Samcheok-si; Hoenggye-ri, Doam-myeon, Pyeongchang-gun. J.K. Park, E.J. Kim & H.K. Ji, sweeping; 1♂ 1♀. 14.VIII.2018. Jindong-ri, Girin-myeon, Inje-gun. J.K. Park, M.J. Kang & E.J. Kim, sweeping; 10♂ 10♀. 4.IX.2019. Daean-ri, Heungeop-myeon, Wonju-si. G.H. Kim, yellow sticky trap; 10♂ 10♀. 4.IX.2019. Nampyeong-ri, Bukpyeong-myeon, Jeongseon-gun. G.H. Kim, yellow sticky trap; 1♂ 2♀. 24.X.2019. Gacheon-ri, Anheung-myeon, Hoengseong-gun. J.K. Park & J.M. Bae, sweeping.

[CB] 3♂ 1♀. 18.VII.2018. Deokchon-ri, Daegang-myeon, Danyang-gun. J.K. Park, sweeping; 2♀. 25.X.2018. Yullyang-dong, Sangdang-gu, Cheongju-si. J.K. Park, sweeping; 7 nymph. 24.VI.2019. Jichon-ri, Yanggang-myeon, Yeongdong-gun. J.K. Park, sweeping; 10♂ 10♀. 24.IX.2019. Goejeong-ri, Ochang-eup, Cheongwon-gun. G.H. Kim, yellow sticky trap.

[CN] 10♂ 10♀. 1.IX.2018. Gung-dong, Yuseong-gu, Daejeon. J.K. Park, light trap; 10♂ 10♀. 4.VII.2019. Seongyeon-ri, Cheongso-myeon, Boryeong-si. J.K. Park, J.H. Kim & M.J. Kang, sweeping; 10♂ 10♀. 6.VIII.2019. Dong-ri, Mokcheon-eup, Dongnam-gu, Cheonan-si. J.K. Park & E.J. Kim, light trap; 10♂ 10♀. 16.VIII.2019. Jiryang-ri, Boksu-myeon, Geumsan-gun. J.K. Park, light trap; 10♂ 10♀. 16.IX.2019. Wanpo-ri, Hwayang-myeon, Seocheon-gun. G.H. Kim, yellow sticky trap; 10♂ 10♀. 16.IX.2019. Sinnong-ri, Munsan-myeon, Seocheon-gun. G.H. Kim, yellow sticky trap.

[GB] 1♂. 1.VIII.2018. Osin-ri, Bomun-myeon, Yecheon-gun. J.K. Park, sweeping; 3♂ 5♀. 2.VIII.2018. Sineum-ri, Gaepo-myeon, Yecheon-gun. J.K. Park & Y.J. Kim, sweeping; 3 nymph. 2.VIII.2018. Ocheon-ri, Homyeong-myeon, Yecheon-gun. J.K. Park & Y.J. Kim, sweeping; 2 nymph. 2.VIII.2018. Gyeong-sangbuk-do; Gopyeong-ri, Yecheon-eup, Yecheon-gun. J.K. Park & Y.J. Kim, sweeping; 10♂ 10♀. 4.IX.2019. Odong-ri, Hamchang-eup, Sangju-si. G.H. Kim, yellow sticky trap.

[GN] 2♀. 1.VIII.2019. Sodong-ri, Irun-myeon, Geoje-si. J.K. Park, E.J. Kim & S.B. Choi, sweeping; 10♂ 5♀. 31.VIII.2019. Bukbu-dong, Jinhae-gu, Changwon-si. J.K. Park, E.J. Kim & S.B. Choi, sweeping; 10♂ 10♀. 23.VIII.2019. Doksan-ri, Naedong-myeon, Jinju-si. G.H. Kim, yellow sticky trap; 10♂ 10♀. 23.VIII.2019. Yongsan-ri, Myeongseok-myeon, Jinju-si. G.H. Kim, yellow sticky trap.

[JB] 3 nymph. 21.VI.2018. Hyoja-dong, Wansan-gu, Jeonju-si. J.K. Park & E.J. Kim, sweeping; 10♂ 10♀. 16.VII.2019.

Woljeon-ri, Geumgu-myeon, Gimje-si. J.K. Park, M.J. Kang & J.M. Bae, sweeping; 10♂ 10♀. 23.VIII.2019. Junggil-ri, Seongsu-myeon, Jinan-gun. G.H. Kim, yellow sticky trap; 10♂ 10♀. 23.VIII.2019. Uiam-ri, Sanggwon-myeon, Wanju-gun. G.H. Kim, yellow sticky trap.

[JN] 10♂ 10♀. 17.IX.2017. Yongbong-dong, Buk-gu, Gwangju. M. Roca-Cusachs; 10♂ 10♀. 24.IX.2019. Bongnim-ri, Jangpyeong-myeon, Jangheung-gun. G.H. Kim, yellow sticky trap; 10♂ 10♀. 24.IX.2019. Jeopjeong-ri, Yongsan-myeon, Jangheung-gun. G.H. Kim, yellow sticky trap; 10♂ 10♀. 24.IX.2019. Usan-ri, Jangpyeong-myeon, Jangheung-gun. G.H. Kim, yellow sticky trap.

Distributions. South Korea (excluding Jeju Is.)*, China (South, East, Northeast, Southeast), Japan, Taiwan.

Hosts. See Choi et al., 2017a.

Remarks. *Ricania sublimata* has numerous taxonomic changes after first description of Jacobi (1916). First, Jacobi (1916) established this species in *Ricania*, Schumacher (1915) replaced it to *Pochazia* (ref. the Schumacher paper was published after Jacobi (1916)). Melichar (1923) put this species in subgenus *Ricanula* of the genus *Ricania*. Metcalf (1955) and Yang (1989) placed this species in the separate genus *Ricanula*. Recently, Ren et al. (2016), mentioned *R. sublimata* should belong to the genus *Ricania* based on morphology. Given the taxonomic histories mentioned in the above sentences, the genus of this species is controversial so far, which needs a phylogenetic study for this group in the future. Nonetheless, we temporarily put this species in the genus *Ricania* based on morphological characters (forewing precostal area with dense transverse veinlets, costal margin distinctly convex near base) (Bu and Liang, 2011) and agreement with arguments by the latest relevant paper (Ren et al., 2016).

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모든 저자는 원고를 읽고 투고에 동의하였음.

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