



Review of the genus *Zelleria* Stainton (Lepidoptera, Yponomeutidae, Yponomeutinae) in East Asia, with description of a new species

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Abstract

Zelleria Stainton, 1849 from the East Asia is reviewed. *Zelleria asiatica* Na, Bae & Ponomarenko, **sp. nov.** is described from Korea and Russia. Three species are redescribed and provided with a key to species, illustrations of adult, male and female genitalia, diagnoses, and descriptions. *Z. japonicella* Moriuti, 1977 is reported from Korea for the first time.

Key words: Korea, Russia, Japan, China, distribution, taxonomy

Introduction

Zelleria Stainton, 1849 is a small genus of the family Yponomeutidae, established by Stainton (1849) for its type species *Zelleria hepariella* Stainton, 1849. *Zelleria* currently comprises 45 described species worldwide, mostly distributed in the Australian Region, the Nearctic Region, and the Neotropical Region (Lewis & Sohn 2015).

In the Palearctic Region, a total of seven species are known until now: *Z. abisella* Chrétien, *Z. oleastrella* Millière, *Z. plumbeella* Staudinger and *Z. wolffi* Klimesch from Europe (Klimesch 1983; Agassiz & Friese 1996); the transpalearctic *Z. hepariella* Stainton distributed from Europe to Japan (Moriuti 1977; Agassiz & Friese 1996; Sinev 2008; Ponomarenko 2016), *Z. japonicella* Moriuti from Japan and China (Moriuti 1977; Sohn *et al.* 2010) and; *Z. silvicolella* Moriuti which is reported from Japan and Russia (Moriuti 1977; Sinev 2008; Ponomarenko 2016).

In the present study, East Asian species of *Zelleria* are reviewed, with the description of a new species *Z. asiatica* **sp. nov.** from Korea and Russia. Additionally, we report *Zelleria* as new to Korea.

Materials and methods

A majority of species examined is based on specimens collected from Korea. The specimens were collected at the lights with a mercury vapor lamp (220V/ 200W, Dongseong Co., Korea) and four UV lamps (20W, FL20SbL/18, Kumho Co., Korea) in Korea and at light with mercury tungsten lamp Osram HWL (220V/ 500W, Osram, Germany) in Russia. Genitalia were dissected and examined under a Leica EZ4 stereo-microscope (Leica microsystems, CMS GmbH, Wetzlar, Germany) and Nikon SMZ 10 stereo-microscope. Images of the adults and genitalia were taken with a Nikon D700 digital camera attached to a Nikon AF-S VR Micro-Nikkor 105mm f/2.8G IF-ED lens (Nikon Co., Japan), and a Leica DM 2500 microscope attached with a Leica ICC50 E (Leica Microsystems, CMS GmbH, Wetzlar, Germany) and Nikon Coolpix 8700 camera. The examined specimens are

deposited in Incheon National University, Incheon, Korea and in Federal Scientific Center of the East Asia Terrestrial Biodiversity, Vladivostok, Russia. Abbreviations for the type depositories are as follows: FSCB—Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of Russian Academy of Sciences, Vladivostok, Russia; INU—Bio-resource and Environmental Center, Department of Life Sciences, Incheon National University, Incheon, Korea; OPU—Environmental Entomology and Zoology, Graduate School of Life and Environmental Sciences, Osaka Prefecture University, Japan. TL—type locality.

Systematic account

Genus *Zelleria* Stainton, 1849

(Figs. 5a, 5b, 6)

Zelleria Stainton, 1849: 22. Type species: *Zelleria hepariella* Stainton, 1849, by subsequent designation by Meyrick, 1915.

Description of adult. Head with rough and erect scales extended to dorsal half of frons, frons otherwise with appressed scales; ocelli absent. Antenna filiform; scape 2 times as long as pedicellus, with pecten. Labial palpus porrect, blunt-tipped (Figs. 5a, 5b). Forewing elongate, narrowed distally, 12-veined, R_1 from before middle, R_2 and R_3 approximate, R_4 and R_5 separate, M_2 and M_3 almost connate or short-stalked, pterostigma developed. Hindwing lanceolate, $Sc+R_1$ reaching costal 1/3, M_1 and M_2 approximate (Fig. 6) (Moriuti 1977).

Male genitalia: Socius narrow, with a thorn at apex, curved outwardly. Tuba analis membranous. Uncus convex or flat. Valva usually ovate with long hair-like setae, a small ridge before 1/4 of dorsal margin; sacculus with stiff setae; tufts of hair-like setae present or absent from basal 1/4 to half on dorsal margin. Tegumen well-developed. Gnathos elongate, drop-shaped. Vinculum V-shaped. Saccus narrow. Aedeagus longer than valva, with cornuti composed usually of 2 rows of small spines.

Female genitalia: Apophysis posterioris about as long as apophysis anterioris. Apophysis anterioris branched. Lamella postvaginalis setose, with posterior rounded lobes. Antrum narrowed funnel-shaped, sclerotized. Ductus bursae tubular, membranous, partially or entirely granulose in proximal half beyond ductus seminalis. Corpus bursae membranous, neither granulose nor denticulate. Signum present or absent.

Key to East Asian *Zelleria* based on male genital characters

(Exclusive of *Z. silvicolella* Moriuti)

- | | | |
|----|--|-------------------------------|
| 1. | Aedeagus about 3 times as long as valva | <i>Z. asiatica</i> sp. nov. |
| -. | Aedeagus about as long as valva. | 2 |
| 2. | Valva elongate-ovate, relation of valva length of its maximal width 2.33 | <i>Z. hepariella</i> Stainton |
| -. | Valva ovate, relation of valva length of its maximal width 1.89. | <i>Z. japonicella</i> Moriuti |

Key to East Asian *Zelleria* based on female genital characters

- | | | |
|----|--|--------------------------------|
| 1. | Signum present in corpus bursae. | 2 |
| -. | Signum absent in corpus bursae | 3 |
| 2. | Signum band-shaped, 1/2 as long as corpus bursae | <i>Z. silvicolella</i> Moriuti |
| -. | Signum elongated ovate, 1/5 as long as corpus bursae | <i>Z. asiatica</i> sp. nov. |
| 3. | Antrum length about 1.5 times as long as diameter of ostium bursae | <i>Z. hepariella</i> Stainton |
| -. | Antrum length about 2 times as long as diameter of ostium bursae | <i>Z. japonicella</i> Moriuti |

Zelleria hepariella Stainton, 1849

(Figs. 1, 7a, 7b, 10)

Zelleria hepariella Stainton, 1849: 22. TL: England.

Zelleria insignipennella Stainton, 1849: 22. TL: England.

Gracillaria taxella Herrich-Schäffer, [1855]: 289. TL: Switzerland, Zurich.

Gracillaria taxi Frey, 1856: 234. Unjustified emendation of *taxella*.

Zelleria phillyrella Millière, 1867: 194. TL: France, Henriette villa.

Zelleria fusca Stainton, 1876: 1. TL: Scotland, Paisley.

Zelleria joannisella Maneval, 1934: 55. TL: France, Haute-Loire, Tence Canton, Chenerailles.

Diagnosis. *Z. hepariella* is characterised by the forewing with a dark purple streak costal line from base to near apex. *Zelleria hepariella* is similar to *Z. japonicella*, but can be separated by the absence of small dark purple spot at dorsal margin of forewing before middle, the narrower elongate-ovate valva, relation of length of valva to its maximal width 2.33 in the male genitalia, and the antrum which is about 1.5 times as long as the diameter of ostium bursae in the female genitalia.

Redescription. Adult (Fig. 1). Wingspan 11–12 mm. Vertex with rough and erect cream white scales extended to dorsal half of frons, frons otherwise with cream white appressed scales, scales around compound eyes brown. Antenna filiform; scape pale yellow brown with brown pecten; flagellum cream white, ringed with dark brown. Labial palpus porrect, blunt-tipped, ochreous inside, dark brown outside, with ochreous tip. Thorax light brown mixed with violet luster; tegula dark purple. Legs light brown mixed with violet luster, faintly irrorate with white scales; hind tibia and tarsus pale gray, with a faintly paler ring at base of each tarsal segment. Abdomen pale shining gray. Forewing elongate, narrowed distally, ground color yellow brown with violet, lustrous crescent patch at basal area, another along costa to apex, violet, lustrous scales suffused from about distal 2/3 to termen, fringe ochreous gray. Hindwing and fringe ochreous gray.

Male genitalia (Figs. 7a, 7b). Socius narrow, with a thorn at apex, curved outwardly. Tuba analis membranous. Uncus convex. Valva elongate-ovate, with a small ridge before 1/4 of dorsal margin; relation of length of valva to its maximal width 2.33. Sacculus with short stiff setae. Gnathos elongate, with drop-shaped median plate. Saccus narrow, slightly shorter than 1/3 length of valva. Aedeagus about 1.25 times as long as valva, cornuti composed of 2 rows of small spines.

Female genitalia (Fig. 10). Papilla analis semiovalate. Apophysis posterioris 0.8 times as long as apophysis anterioris. Apophysis anterioris branched. Lamella postvaginalis setose, with posterior rounded lobes. Antrum narrowed funnel-shaped, sclerotized, about 1.5 times as long as diameter of ostium bursae. Ductus bursae over 2.5 times as long as corpus bursae, tubular, membranous, granulose in proximal half beyond ductus seminalis. Corpus bursae long, narrow, gradually dilated anteriorly. Signum absent.

Material examined: [OPU] 1 ♀, Japan, Honshu, Sinano, Sin-yu near Tatesinayama, 12.VI.1956 (S Moriuti), *Lonicera caerulea* var. *emphylocalyx* (Maxim.) Nakai. [FSCB] 1 ♂, Russia, Primorskii krai, Ussurijskii distr., 20 km SE Ussurijsk, Gornotajezhnoe, 2–14. X. 1994 (M Ponomarenko).

Distribution. Japan (Honshu), Russia (Primorskii krai), Algeria, Austria, Belgium, Corsica, Denmark, England, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Netherlands, Norway, Poland, Romania, Sardinia, Sicily, Slovakia, Spain, Sweden, Switzerland, Turkey, [former] Yugoslavia (Lewis & Sohn 2015).

Host plants. Caprifoliaceae: *Lonicera caerulea* var. *emphylocalyx* (Maxim.) Nakai (first record); Oleaceae: *Fraxinus excelsior* L., *Fraxinus* sp., *Ligustrum tschonskii* Decne, *Phillyrea angustifolia* L. (Friese 1960; Gershenson & Ulenberg 1998; Moriuti 1977).

***Zelleria japonicella* Moriuti, 1977**

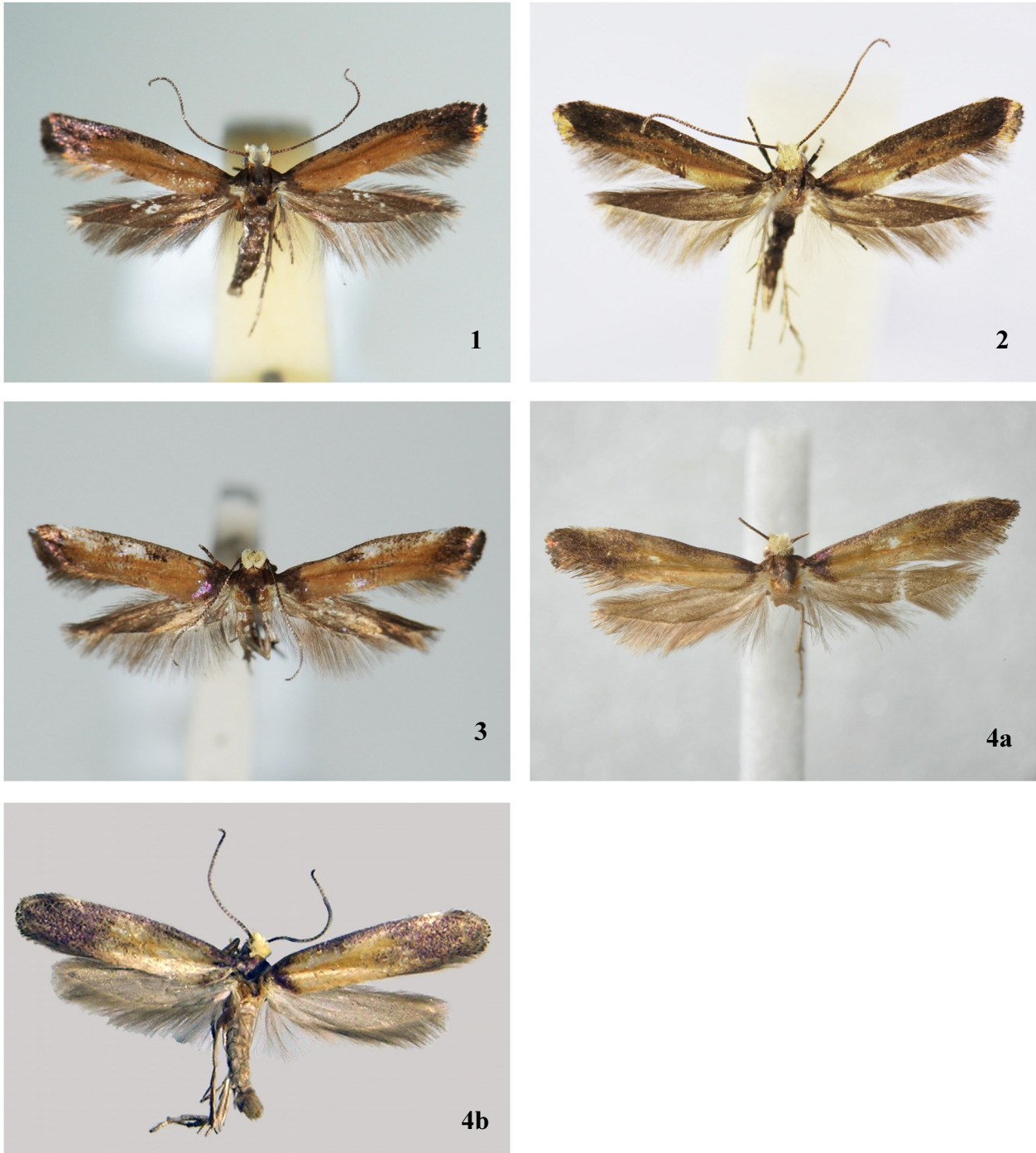
(Figs. 2, 8a, 8b, 11)

Zelleria japonicella Moriuti, 1977: 221; Sohn *et al.*, 2010: 2810; Yamauchi & Hirowatari, 2013: 161. TL: Japan, Hokkaido.

Diagnosis. *Z. japonicella* is characterized by the dark purple spots suffused before middle of dorsum. This species is externally similar to *Z. hepariella* Stainton, but can be distinguished by the ovate valva, its maximal width 1.89 times as in the male genitalia, and the antrum about 2 times as long as the diameter of ostium bursae in the female genitalia.

Redescription. Adult (Fig. 2). Wingspan 12–13 mm. Vertex with rough and erect cream white scales, extended to dorsal half of frons, frons otherwise with cream white, appressed scales, scales around compound eyes light brown. Antenna filiform; scape pale yellow brown with brown pecten; flagellum cream white, ringed with

dark brown. Labial palpus porrect, blunt-tipped, ochreous inside, light brown outside, with ochreous tip. Thorax yellow brown mixed with violet luster; tegula dark purple. Fore- and midlegs from femur to tibia dark brown, mixed with ochreous, tarsus pale ochreous, ringed with dark brown; hindleg from femur to tibia dark brown, mixed with ochreous, tarsus ochreous. Abdomen pale shining gray. Forewing elongate, narrowed distally, ground color brown, with violet, lustrous, crescent-shaped patch at basal area, black brown streak from base to apex, mixed with violet luster along costa, distal 2/3 of wing length suffused with black brown scales; pale ochreous dorsal streak from basal 1/6 to 2/6, dark purple spots at middle of dorsum; fringe formed of black brown and purple, lustrous scales on termen, ochreous gray on basal 1/3 to termen. Hindwing and fringe ochreous gray.



FIGURES 1–4. Adults of *Zelleria* spp.: 1. *Z. hepariella* Stainton, female, Honshu, Japan; 2. *Z. japonicella* Moriuti, female, Gangwon Province, Korea; 3. *Z. silvicolella* Moriuti, female, Honshu, Japan (Holotype from OPU); 4a. *Zelleria asiatica* Na, Bae & Ponomarenko, **sp. nov.**, male, Gangwon Province, Korea (Holotype from INU); 4b. *ditto*, male, Primorskii krai, Russia (Paratype from FSCB).

Male genitalia (Figs. 8a, 8b). Socius narrow, with a thorn at apex and curved outwardly. Tuba analis membranous. Uncus convex. Valva ovate, relation of length of valva to its maximal width 1.89; with a small ridge before about 1/4 of dorsal margin; sacculus with short stiff setae. Gnathos elongate, with drop-shaped median plate. Saccus narrow, about 1/3 length of valva. Aedeagus about 1.4 times as long as valva, cornuti composed of 2 rows of short spines.



FIGURES 5. Head of *Zelleria*: 5a. Lateral aspect; 5b. Frontal aspect (Paratype from INU).

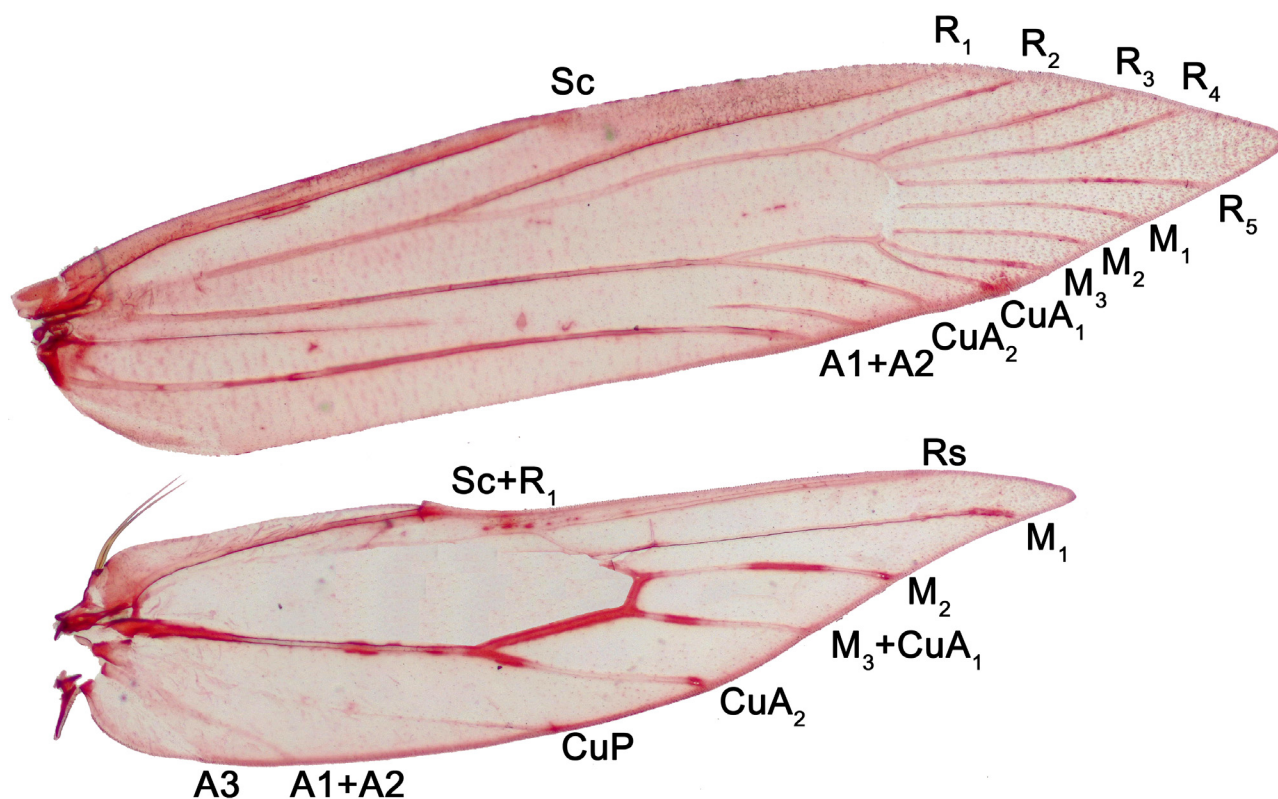


FIGURE 6. Wing venation of *Zelleria*, female, Gangwon Province, Korea (Paratype from INU).

Female genitalia (Fig. 11). Papilla analis semiovate. Apophysis posterioris as long as apophysis anterioris. Apophysis anterioris branched. Lamella postvaginalis setose, with posterior rounded lobes. Antrum cylindrical,

sclerotized, about 2 times as long as the diameter of ostium bursae. Ductus bursae over 2 times as long as corpus bursae, tubular, membranous, granulose in proximal half beyond ductus seminalis. Corpus bursae long, narrow, gradually dilated anteriorly. Signum absent.

Material examined. [INU] 1 ♀, Korea, Gwangwon Province, Yangyang-gun, Seo-myeon, Osaekyaksu, 2.X.2005 (YS Bae), genitalia slide no. INU-4659. 12 ♂, 13 ♀, Korea, Gangwon Province, Mt. Gyeong, 4–5.V.1997 (YS Bae), reared 20–25.V.1997, *Lonicera sachalinensis* Nakai, genitalia slide no. INU-4727, -4728.

Distribution. China (Heilongjiang), Japan (Hokkaido, Honshu), Korea.

Host plants. Caprifoliaceae: *Lonicera sachalinensis* Nakai (first record); Oleaceae: *Ligustrum tschonoskii* var. *glabrescens* Koidzumi, *Syringa persica* L. (Moriuti 1977; Sohn *et al.* 2010).

Remark. First record from Korea.

***Zelleria silvicolella* Moriuti, 1977**

(Figs. 3, 12a, 12b)

Zelleria silvicolella Moriuti, 1977: 222; Yamauchi & Hirowatari, 2013: 162. TL: Japan, Honshu.

Diagnosis. *Z. silvicolella* is characterized by the forewing having a white streak or spot along costa from basal 1/3 almost to apex. The female genitalia are otherwise similar to those of *Z. asiatica* **sp. nov.**, but can be separated by the following characters: ductus bursae less than 2.5 times as long as the corpus bursae, the signum band-shaped with denticles, extending about half the length of the corpus bursae in *Z. silvicolella*.

Redescription. Adult (Fig. 3). Wingspan 12–13 mm. Vertex with rough and erect cream white scales extended to dorsal half of frons, frons otherwise with pale ochreous, appressed scales, scales around compound eyes pale brown. Antenna filiform; scape pale gray with brown pecten; flagellum cream white, ringed with dark brown. Labial palpus porrect, blunt-tipped; ochreous inside, orange yellow outside, with ochreous tip. Thorax yellow brown, mixed with violet luster; tegula yellow brown with violet luster. Fore-, and midlegs light brown with violet luster, faintly irrorated with white scales; hindleg dark gray mixed with white scales, each segment of tarsus dark brown, irrorated with white scales. Abdomen pale shining gray. Forewing elongate, narrowed distally, ground color light brown; violet, lustrous patch at basal area, black brown costal streak extended from basal patch to basal 1/4; violet, lustrous scales at basal 1/3, white streak almost from basal 1/3 almost to apex, irrorated with dark brown scales, white spot at apex, distal area suffused with violet luster, white and dark brown scales scattered in median area; fringe ochreous gray. Hindwing and fringe ochreous gray.

Female genitalia (Figs. 12a, 12b). Papilla analis arrow-shaped. Apophysis posterioris 0.9 times as long as apophysis anterioris. Apophysis anterioris branched. Lamella postvaginalis setose, with posterior wide rounded lobes. Antrum cylindrical, sclerotized. Ductus bursae over 2 times as long as corpus bursae, tubular, membranous, granulose in proximal half beyond ductus seminalis. Corpus bursae ovate; signum band-shaped, 1/2 length of corpus bursae with denticles.

Material examined. [OPU] 1 ♀, (Holotype), Japan, Honshu, Iwateken, Gando, 22.VI.1965 (T Oku).

Distribution. Japan (Hokkaido, Honshu).

Host plant. Oleaceae: *Syringa reticulata* Blume (Moriuti 1977).

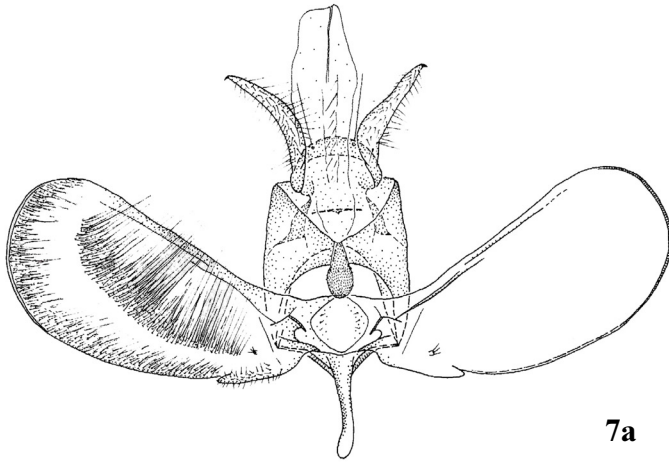
Remarks. The species is reported from the Russian Far East by Gershenson (1986), but illustrated specimens are certainly not conspecific with *Z. silvicolella* Moriuti, having differences in the length of antrum and the shape of the signum in the female genitalia. This record, followed by (Sinev 2008; Ponomarenko 2016) is thus erroneous.

***Zelleria asiatica* Na, Bae & Ponomarenko, sp. nov.**

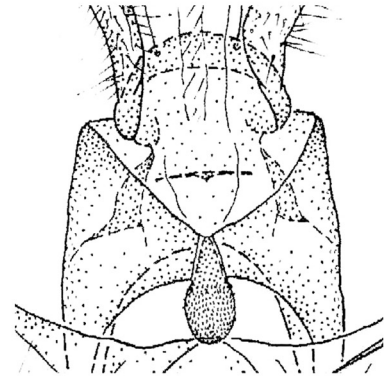
(Figs. 4a, 4b, 9a, 9b, 13a, 13b)

Zelleria silvicolella auct. nec Moriuti, 1977: 222; Gershenson, 1986: 70; Sinev, 2008: 46; Ponomarenko, 2016: 63.

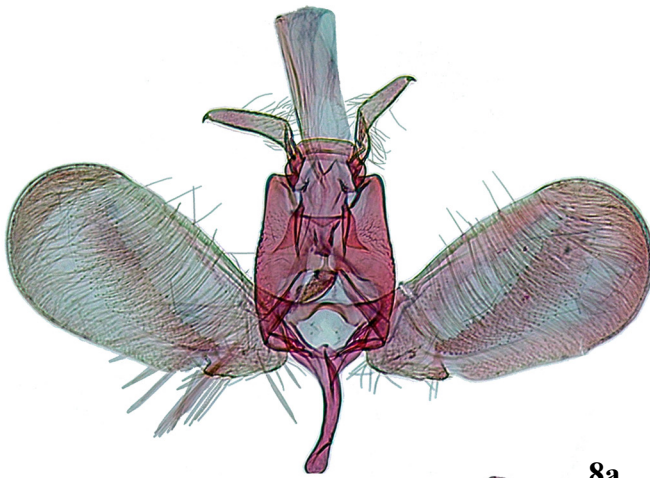
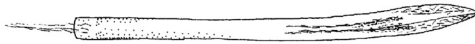
Holotype: [INU] 1 ♂, Korea, Gangwon Province, Hongcheon-gun, Gachilbong, 27–30.V.2002 (YS Bae), genitalia slide no. INU-4658; **Paratypes:** [INU] 2 ♂, 5 ♀, Korea, Gangwon Province, Taebaek-si, Changjuk-dong, Geomryongso (37°13'43.01"N, 128°55'30.73"E), 3.VII.2013 (YD Ju, BS Park & SM Na), genitalia slide no.



7a



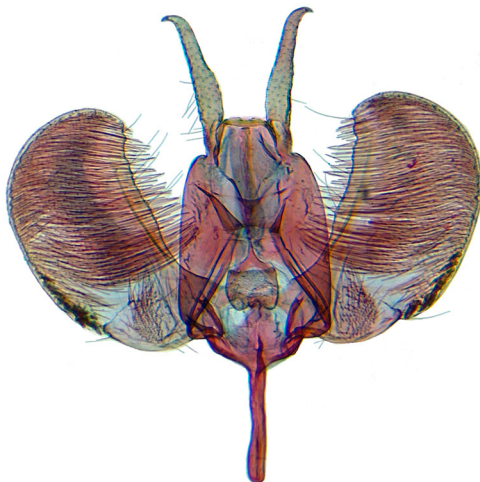
7b



8a



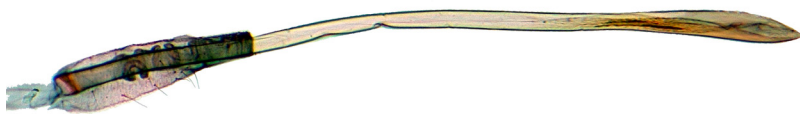
8b



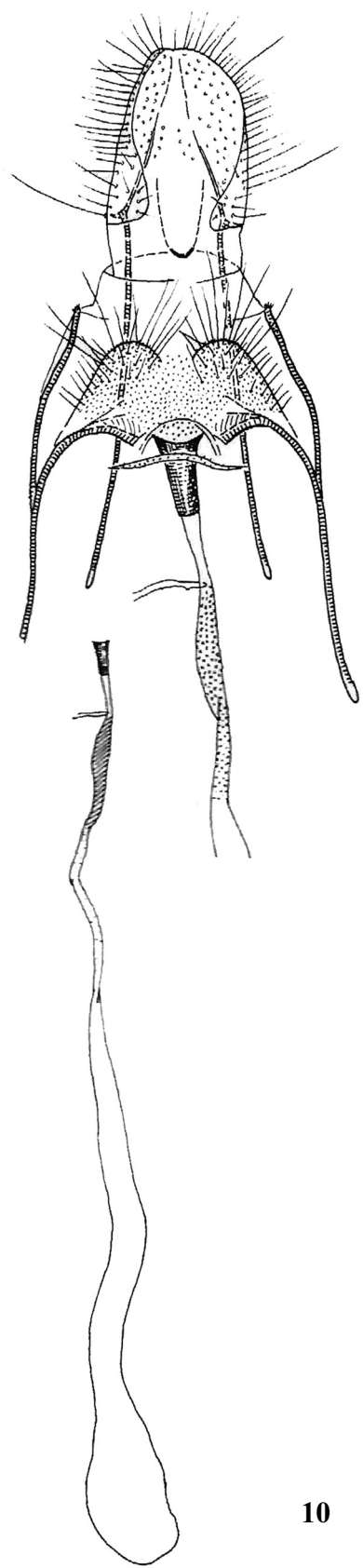
9a



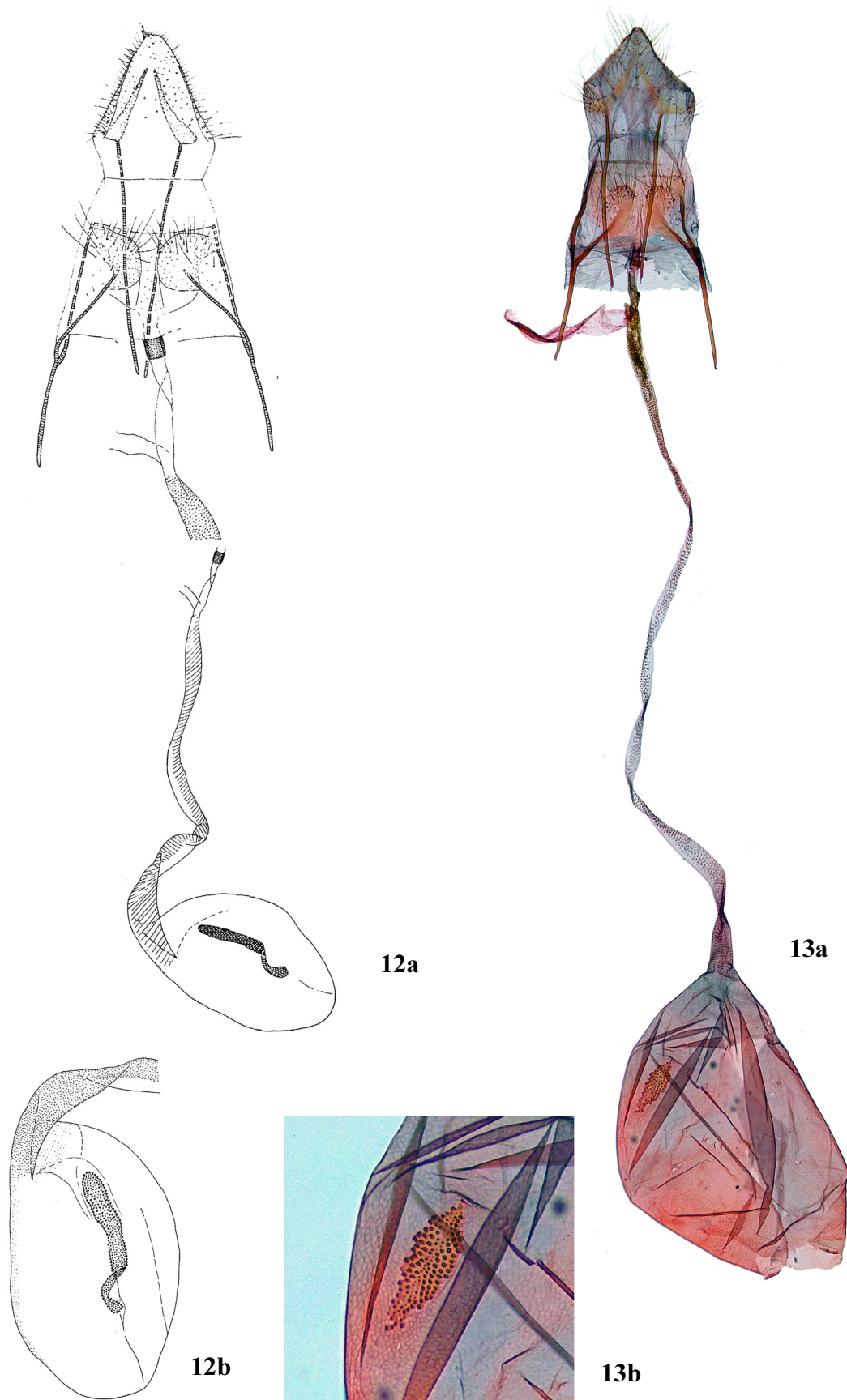
9b



FIGURES 7–9. Male genitalia of *Zelleria* spp.: 7a–b. *Z. hepariella* Stainton (Redrawing from Moriuti, 1977); 8a–b. *Z. japonicella* Moriuti, genitalia slide no. INU-4727; 9a–b. *Z. asiatica* Na, Bae & Ponomarenko, **sp. nov.**, genitalia slide no. INU-4650.



FIGURES 10–11. Female genitalia of *Zelleria* spp.: 10. *Z. hepariella* Stainton (Redrawing from Moriuti, 1977); 11. *Z. japonicella* Moriuti, genitalia slide no. INU-4728.



FIGURES 12–13. Female genitalia of *Zelleria* spp.: 12a. *Z. silvicolella* Moriuti (Redrawing from Moriuti, 1977); 12b. Enlarged signum of *Z. silvicolella* Moriuti; 13a. *Z. asiatica* Na, Bae & Ponomarenko, **sp. nov.** (Paratype); 13b. Enlarged signum of *Z. asiatica* Na, Bae et Ponomarenko, **sp. nov.**, genitalia slide no. INU-4657.

INU-4647, -4648, -4651, & -4653; 3 ♂, same locality, 3.VII.2015 (SM Na, DJ Lee, YK Lee & HK Kim), genitalia slide no. INU-4650, -4654, & -4655; 1 ♀, Inje-gun, Buk-myeon, Mt. Daeam, 27.VI.2013 (YS Bae), genitalia slide no. INU-4656; 1 ♀, Gangwon Province, Inje-gun, Girin-myeon, Jindong Valley, 24.VI.2010 (NH Ahn), genitalia slide no. INU-4657. 1 ♀, Jeollanam Province, Is. Wan, 20.IX.2014 (Bae *et al.*). [FSCB] 2 ♂, Russia, Jewish Autonomous Region, “Bastak” reserve, 27 km N of Birobidzhan, upper Ikura river, 1–3.VII.2004 (M Ponomarenko); 1 ♂, Jewish Autonomous Region, “Bastak” reserve, 21 km N of Birobidzhan, Ikura river, 4.VII.004 (M Ponomarenko). 2 ♂, Primorskii krai, Nadezhdinskii distr., 7 km NE Razdolnoe, Olenevod, 10–13.VI.1976 (Ermolaev). 11 ♂, 10 ♀, Primorskii krai, Ussurijskii distr., 20 km SE Ussurijsk, Gornotajezhnoe, 27.VI, 2–14.VII, 26–28.VII. 1994 (M Ponomarenko); 3 ♂, Primorskii krai, Terneiskii distr., 50 km W Masimovka, upper Maximovka river at the mouth of Bolshaya Lugovaya river, 5–7.VII. 1998 (E Beljaev); 2 ♂, Primorskii krai, 18 km SE Spassk Dalnii, “Kalinovka” recreation center, 8.VII.2018 (M Ponomarenko).

Diagnosis. *Z. asiatica* is very similar to *Z. silvicolella* Moriuti but can externally be separated by the absence of dark subcostal stroke before middle on the forewing, and elongated ovate signum, as long as 1/5 of corpus bursae in the female genitalia; *Z. silvicolella* has a distinct subcostal stroke before middle on the forewing and signum equal to half of corpus bursae in length. *Z. asiatica* is also externally similar to *Z. japonicella* Moriuti, but can be distinguished by the absence of violet, lustrous spots at middle of dorsum. Male genitalia are similar to those of *Z. silvicolella*.

Description. Adult (Figs. 4a, 4b). Wingspan 10–12 mm. Vertex with rough and erect cream white scales extended to dorsal half of frons, frons otherwise with cream white appressed scales, yellow ochreous around compound eyes. Antenna filiform; scape black brown mixed with ochreous, with black brown pecten; flagellum cream white ringed with dark brown. Labial palpus porrect, blunt-tipped; first segment pale yellow brown with dark brown scales densely irrorate, second and third segment black brown and pale yellow brown scales mixed outside and pale yellow brown inside. Thorax brown, mixed with violet luster; tegula dark purple. Fore- and midlegs, from femur to tibia black brown, mixed with ochreous, tarsus pale ochreous, ringed with dark brown; hindleg from femur to tibia dark brown, mixed with pale yellow brown, tarsus pale yellow brown. Abdomen pale shining gray. Forewing elongate, narrowed distally, ground color yellow brown, crescent violet lustrous patch at basal area, continue to 2/3 costa, white streak from 2/3 costa to near apex, violet lustrous scales suffused from about basal 2/3 to termen, purple lustrous scales on termen, fringe black brown, ochreous gray scales on base 1/3 to termen. Hindwing and fringe ochreous gray.

Male genitalia (Figs. 9a, 9b). Socius narrow, curved outwardly, with a thorn at apex. Tuba analis membranous. Uncus with flat posterior margin. Valva elongate-ovate, with slightly sickle curved apex, a small ridge before 1/4 of dorsal margin; sacculus without distinct hair tufts at basal 1/4 to half on dorsal margin, dorsal margin of valva with strong thorns from basal 1/4 to the middle. Gnathos elongate, widened as drop-shaped median plate. Saccus narrow, length 1/2 of valva. Aedeagus about 3 times as long as valva, cornuti composed of 2 thorns and 2 rows of short spines.

Female genitalia (Figs. 13a, 13b). Papilla analis arrow-shaped. Apophysis posterioris 0.8 times as long as apophysis anterioris. Apophysis anterioris branched. Lamella postvaginalis setose, with rounded posterior lobes. Antrum cylindrical, sclerotized. Ductus bursae over 2.5 times as long as corpus bursae, tubular, membranous, granulose from ductus seminalis to corpus bursae. Corpus bursae ovate; signum elongated ovate with denticles, 0.2 times as long as corpus bursae.

Distribution. Korea, Russia (Far East).

Host plant. Unknown.

Remark. This species was misidentified as *Zelleria silvicolella* Moriuti by Gershenson (1986).

Etymology. This species is named after the region “Asia” where it was collected from Korea and Russia Far East.

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