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# Limoniinae crane flies (Diptera: Limoniidae) new to Korea II

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Korean species of *Atypophthalmus* Brunetti, 1911 and *Thrypticomyia* Skuse, 1890 crane flies (Diptera: Limoniidae) were taxonomically revised. New findings of *Achyrolimonia* Alexander, 1965, *Helius* Lepeletier and Serville, 1828 (Latreille et al., 1828) and *Limonia* Meigen, 1803 were discussed. Genera *Atypophthalmus* and *Thrypticomyia*, species *Helius* (*Helius*) *flavus* (Walker, 1856) were newly recorded for the Korean Peninsula, and *Achyrolimonia neonebulosa* (Alexander, 1924) and *Limonia juvenca* Alexander, 1935 were new records for North Korea. Male terminalia of *L. episema* Alexander, 1924 were described with detailed photographs. Identification keys, re-descriptions and illustrations of both sexes from all species in Korea were presented.

Keywords: *Achyrolimonia*, *Atypophthalmus*, *Helius*, *Limonia*, North Korea, South Korea, *Thrypticomyia*

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## Introduction

Investigations of Limoniinae (Diptera: Limoniidae) crane flies on the Korean Peninsula were initiated by S. Podenas and H.-W. Byun in 2012. Since then, crane flies have been collected annually in different localities, at different times and using different methods throughout the country. The aim of the study was to document, re-describe, illustrate, and prepare keys for all Korean crane fly species identified to date. This publication is a continuation of our previous work on Limoniinae crane flies in Korea. This study covers the genera *Atypophthalmus* Brunetti, 1911 and *Thrypticomyia* Skuse, 1890, which are new records for the Korean Peninsula. New findings of *Achyrolimonia* Alexander, 1965, *Helius* Lepeletier and Serville, 1828 (Latreille *et al*., 1828) and *Limonia* Meigen, 1803 are discussed.

Despite original and subsequent descriptions of species of the genera *Atypophthalmus* and *Thrypticomyia* species over a long period of time, some species were known only from original descriptions and no illustrations were available. In this article, we provide photographs of both sexes of *Atypophthalmus* (*Atypophthalmus*) *crinitus* (Alexander, 1924), and female specimens of *A.* (*A.*) *stylacanthus* (Alexander, 1971), *A.* (*Microlimonia*) *inelegans* (Alexander, 1924), *A.* (*M.*) *machidai* (Alexander, 1921). A wing and female specimen of *Thrypticomyia unisetosa unisetosa* (Alexander, 1929) are also presented for the first time on record.

## Materials and Methods

Specimens of crane flies used in this study (Table 1) were preserved and deposited in the following repositories:

Specimens collected in 1937-1940 in the northern part of the Korean Peninsula (now North Korea) by A. M. Yankovsky, were deposited in the collections of the United States National Museum (USNM), Smithsonian Institution, Washington DC, USA;

Specimens collected in 1954 in South Korea by Dr. G. W. Byers, were deposited in the Snow Entomological Museum, University of Kansas (SMEK), Lawrence, KS, USA; University of Michigan at Ann Arbor (U-M), MI, USA, and in USNM;

**Table 1.** Collecting sites in Korea.

| Locality | Year | N* | E* | Collector | Method | Collection |
|---|---|---|---|---|---|---|
| N. Korea, Seren Mts. (Hamgyeongbuk-do, Gyeongsung-gun) | 1937<br>1938 | 41.68730 | 129.30918 | A. M. Yankovsky | Net | USNM |
| N. Korea, Kankyo Nando, Puksu Pyaksan (now, Yanggang-do, Pungseo-gun, Mt. Buksubaeksan) | 1939 | 40.69985 | 127.71601 | A. M. Yankovsky | Net | USNM |
| N. Korea, Pontani Paiktusan (Mt. Baekdusan) | 1940 | 42.00670 | 128.10650 | A. M. Yankovsky | Net | USNM |
| N. Korea, Chonsani (Yanggang-do, Daehongdan-gun) | 1940 | 41.99360 | 128.75250 | A. M. Yankovsky | Net | USNM |
| S. Korea, #9, #17, #18, #22, #24, #25, #28, #39, Central National Forest, 18 mi. NE Seoul (Gyeonggi-do, Namyangju-si, Sudong-myeon, Naebang-ri) | 1954 | 37.74813 | 127.29364 | G. W. Byers | Net | SMEK, USNM |
| S. Korea, #12, Hwy. #20, 8 mi. SW Kangnung (Gangwon-do, Gangneung, Seongsan-myeon, Eoheul-ri) | 1954 | 37.70000 | 128.78334 | G. W. Byers | Net | SMEK |
| S. Korea, #20, 2 mi. S. Bupyeong-ri (incorrectly spelled as Pup'yong-ni), 16 mi. NE Seoul | 1954 | 37.74805 | 127.18291 | G. W. Byers | Net | SMEK |
| S. Korea, #35, #36, Cheju-do (Jeju-do), Halla San (volcano) | 1954 | 33.34900 | 126.54100 | G. W. Byers | Net | USNM |
| S. Korea, #37, Hill 1468, 16 mi. NW Chunchon (Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeongmok-ri) | 1954 | 38.00000 | 127.50000 | G. W. Byers | Net | USNM, SMEK |
| S. Korea, #40, 6 mi. E of Seoul (Gyeonggi-do, Namyangju-si, Joan-myeon, Sambong-ri) | 1954 | 37.59600 | 127.33250 | G. W. Byers | Net | U-M |
| S. Korea, Gangwon-do, Pyeongchang-gun, Yongpyeong-myeon, Nodong-ri, Mt. Gyebangsan | 2008 | 37.69777 | 128.47627 | J. D. Yeo *et al.*;<br>H. Y. Seo, K. G. Kim | Malaise trap<br>Net | NIBR |
| S. Korea, Ulju-gun, Sangbuk-myeon, Sanjeon-ri | 2009 | 35.6356111 | 129.0590278 | J. D. Yeo, J. D. Yoon | Malaise trap | NIBR |
| S. Korea, Gyeongsangbuk-do, Cheongdo-gun, Unmun-myeon, Sinwon-ri, Mt. Ulmunsan | 2009 | 35.6532778 | 129.0256111 | K. G. Kim, O. S. Kim | Malaise trap | NIBR |
| S. Korea, Hoedong-ri, Jeongseon-eup, Jeongseon-gun, Gangwon-do, Mt. Gariwangsan | 2009 | 37.4275000 | 128.5319444 | W.Y. Choi *et al.* | Malaise trap | NIBR |
| S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP | 2012 | 37.73920 | 128.59398 | S. Podenas | Net | NIBR |
| S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley | 2013<br>2014<br>2015<br>2016 | 35.26580<br>35.26590<br>35.27177<br>35.27448<br>35.27333<br>35.26586<br>35.27123 | 127.58128<br>127.58096<br>127.57146<br>127.56378<br>127.56924<br>127.58090<br>127.57133 | S. Podenas, V. Podeniene, H. Baek | Net<br>At light | NIBR |
| S. Korea, Gyeongsangnam-do, Geoje-si, Dongbu-myeon, Gabae-ri, Geojedo Island | 2014 | 34.77900 | 128.57968 | S. Podenas | Net | NIBR |
| S. Korea, Gyeongsangnam-do, Geoje-si, Nambu-myeon, Dapo-ri, Geojedo Island | 2014 | 34.75844<br>34.72538<br>34.71542 | 128.61429<br>128.62608<br>128.62286 | S. Podenas | Net | NIBR |
| S. Korea, Jeollabuk-do, Buan, Boan-myeon, Udong-ri, Byeonsanbando NP | 2014 | 35.62896<br>35.62864 | 126.63461<br>126.63441 | S. Podenas | Net | NIBR |

**Table 1.** Continued.

| Locality | Year | N* | E* | Collector | Method | Collection |
|---|---|---|---|---|---|---|
| S. Korea, Jeollabuk-do, Buan, Byeonsan-myeon, Junggye-ri, Byeonsanbando NP | 2014 | 35.67924 | 126.57083 | S. Podenas | Net | NIBR |
| S. Korea, Jeollabuk-do, Buan, Byeonsan-myeon, Junggye-ri, Byeonsanbando NP, Jigso Pokpo (waterfalls) | 2014 | 35.62675 | 126.57020 | S. Podenas | Net | NIBR |
| S. Korea, Jeollabuk-do, Buan, Jinseo-myeon, Naesosa-ro, Byeonsanbando NP | 2014 | 35.61789 | 126.58573 | S. Podenas | Net | NIBR |
| S. Korea, Gangwon-do, Pyeongchang-gun, Yongpyeong-myeon, Nodong-ri | 2014 | 37.70303<br>37.67212 | 128.48302<br>128.46118 | S. Kim, S. Podenas | Net | NIBR |
| S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Hwaak-ri | 2014 | 37.98402<br>37.99363 | 127.52676<br>127.52102 | S. Kim, S. Podenas | Net | NIBR |
| S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri | 2014<br>2015 | 38.02982<br>37.97627 | 127.44310<br>127.441601 | S. Kim, S. Podenas;<br>Y. J. Bae | Net At light | NIBR<br>KU |
| S. Korea, Gangwon-do, Hongcheon-gun, Nae-myeon, Yuljeon-ri | 2014 | 37.73849 | 128.34566 | S. Kim, S. Podenas | Net | NIBR |
| S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri (Moss valley) | 2014 | 37.47153 | 128.54305 | S. Kim, S. Podenas | Net | NIBR |
| S. Korea, Gyeongsangnam-do, Masanhappo-gu, Gusan-myeon, Yusan-ri | 2014 | 35.12904 | 128.57147 | S. Podenas | Net | NIBR |
| S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri | 2014<br>2015 | 35.11309<br>35.11149 | 128.53067<br>128.53142 | S. Podenas | Net | NIBR |
| S. Korea, Gangwon-do, Hongcheon-gun, Duchon-myeon, Cheonhyeon-ri, near Mt. Garisan | 2015 | 37.84840 | 127.98879 | S. Kim, S. Podenas | Net | NIBR |
| S. Korea, Gangwon-do, Chuncheon-si, Dongsan-myeon, Bongmyeong-ri, KNU Experimental Forest | 2014<br>2015 | 37.77906<br>37.78194 | 127.81564<br>127.81973 | S. Kim, S. Podenas | Net | NIBR |
| S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri, Garim-gyo (Br.), GREC-F | 2015 | 37.94327 | 127.50101 | | Malaise trap | KU |
| S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeomwon-ri, South-MDL | 2015 | 37.93430 | 126.72097 | T.A. Klein, H.C. Kim | Mosquito Magnet | NIBR |
| S. Korea, Gangwon-do, Goseong-gun, Ganseong-eup, Jinbu-ri | 2015 | 38.26678 | 128.35706 | S. Kim, S. Podenas | Net | NIBR |
| S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp | 2015 | 37.95467 | 126.67997 | T.A. Klein, H.C. Kim | Mosquito Magnet | NIBR |
| S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeongja-ri, WB (Warrior Base Training Area) | 2015 | 37.91778 | 126.74158 | T.A. Klein, H.C. Kim | Mosquito Magnet | NIBR |
| S. Korea, Gyeonggi-do, Paju-si, Munsan-eup, Majeong-ri | 2015 | 37.88153 | 126.75692 | T.A. Klein, H.C. Kim | LED trap | NIBR |
| S. Korea, Gangwon-do, Yangyang-gun, Seo-myeon, Osaek-ri, Seoraksan NP | 2015 | 38.08420<br>38.09512 | 128.45026<br>128.41309 | S. Kim, S. Podenas | Net | NIBR |

*Coordinates for old collecting sites are approximate.

Specimens collected in 2008-2016 in South Korea were deposited in the collections of the National Institute of Biological Resources (NIBR), Incheon, South Korea;

Specimens, collected in 2015 in South Korea by entomologists from Korea University were deposited in the collection of the Korea University (KU), Seoul, South Korea.

Adult crane flies were collected by insect net, with Malaise traps, LED light traps, a Mosquito Magnet® trap (Pro Model, Woodstream Corp., Lititz, PA), or at light sources. Some specimens were stored in dry in envelopes in the field and were later mounted at the laboratory on their side on a paper point, with legs generally surrounding the insect pin. Other specimens were preserved in 96 % ethanol (EtOH). Some specimens were slide mounted; genitalia of males and ovipositors of females were cleared overnight in approximately 10% potassium hydroxide (KOH) and preserved in microvials filled with glycerol on the same pin as the dry insect, or on a separate pin, if the crane fly was preserved in EtOH.

Information of examined material is given exactly as it is on the labels regardless of style, measurement units and other information. Additional labels, or additional notes on same label, such as "Metatype" written by Dr. Ch. P. Alexander, were also kept with the specimen.

Specimens were observed using an Olympus SZX10 dissecting microscope. Photographs were taken with a Canon EOS 80D digital camera through a Canon MP-E 65 mm macro lens.

Terminology of adult morphological features generally follows that of McAlpine, 1981.

General distribution of species follows that of Oosterbroek, 2017.

***Achyrolimonia* Alexander, 1965**

(Detailed description and characteristics provided by Podenas and Byun, 2014)

***Achyrolimonia neonebulosa* (Alexander, 1924)**

(Detailed description refers to Podenas and Byun, 2014, identification key for Korean *Achyrolimonia* Podenas, 2016)

Species was previously unknown from North Korea.

Examined material: 1♂ (pinned), North Korea, Seren Mts., alt. 7000 ft., VIII-8, 1938, Yankovsky (USNM); 1♂ (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., VIII-14, 1939, A. Yankovsky (USNM); 1♂ (pinned), N. Korea, Chonsani, alt. 4500 ft., VII-12, 1940, A. Yankovsky (USNM); 1♂ (pinned), N. Korea, Pontani Paiktusan, alt. 5800 ft., VII-19, 1940, A. Yankovsky (USNM).

***Atypophthalmus* Brunetti, 1911**

*Atypophthalmus* Brunetti, 1911: 273; Geiger, 1986: 52; Savchenko, 1985: 60-62; 1989: 288-290.

Type species - *Atypophthalmus holopticus* Brunetti, 1911 (monotypic).

Genus was previously unknown from the Korean Peninsula.

General: Medium-sized crane flies, body length 4.5-7.5 mm.

Head: Eyes large, dorsally nearly reaching each other. Antenna simple, flagellomeres oval, covered with short pubescence.

Wing: Elongate, medium-wide, unpatterned or with indistinct pattern, without macrotrichiae in cells. Humeral vein close to level of arculus. Vein *Sc* long, $Sc_1$ reaching from middle to two-thirds of radial sector (*Rs*), $Sc_2$ at tip of $Sc_1$. Radial sector medium-long, arched at base. Free tip of $R_1$ short, $R_2$ transverse, at tip of $R_1$. Discal cell closed. Basal deflection of $CuA_1$ at or slightly beyond base of discal cell. Anal lobe widely rounded.

Legs: Claw often with one subbasal spine.

Genitalia: Gonocoxite of male genitalia with ventromesal lobe, but in some species could be very complicated. Inner gonostylus usually split into few lobes. Paramere of some species very complicated. Penis large, extending beyond distal margin of gonocoxite, sometimes even reaching middle of gonostylus, tip shallowly bifid. Ninth sternite reduced. Ovipositor comparatively short sclerotized. Cercus distinctly arched, tip pointed upwards.

This genus, divided into two subgenera, contains 51 species. Most species occur in Afrotropics (28 species), Oriental (10), East Palearctic (9) and Australian/Oceanian (8) Regions (Oosterbroek, 2017). No fossil species are known (Evenhuis, 2014).

**Checklist of Korean *Atypophthalmus* crane flies**

*Atypophthalmus* (*Atypophthalmus*) *crinitus* (Alexander, 1924)

*Atypophthalmus* (*Atypophthalmus*) *stylacanthus* (Alexander, 1971)

*Atypophthalmus* (*Microlimonia*) *inelegans* (Alexander, 1924)

*Atypophthalmus* (*Microlimonia*) *machidai* (Alexander, 1921)

**Key to Korean species of the genus *Atypophthalmus***

1. General body coloration brownish-yellow to yellowish-brown. Pleuron yellow with a conspicuous longitudinal brown stripe ····· *Atypophthalmus* (*Atypophthalmus*) 2
– General body coloration dark brown to blackish-brown. Pleuron grayish brown, with or without longitudinal stripe ····· *Atypophthalmus* (*Microlimonia*) 3

2. Brownish spot at base of *Rs*, darkened areas surrounding cord and distal margin of discal cell. Abdominal tergites bicolored, yellow basally, dark brown distally ····· *Atypophthalmus* (*Atypophthalmus*) *crinitus* (Alexander, 1924)
− Wing without darker spots besides stigma. Abdominal tergites dark brown ····· ····· *Atypophthalmus* (*Atypophthalmus*) *stylacanthus* (Alexander, 1971)
3. Pleuron without longitudinal stripe, darker dorsally, paler ventrally. *Sc* nearly reaching level of *Rs* branching point ····· *Atypophthalmus* (*Microlimonia*) *inelegans* (Alexander, 1924)
− Pleuron with distinct longitudinal stripe, dark dorsally, pale ventrally. *Sc* reaching to about one-third of *Rs* length ····· *Atypophthalmus* (*Microlimonia*) *machidai* (Alexander, 1921)

***Atypophthalmus* (*Atypophthalmus*) Brunetti, 1911**

*Atypophthalmus* Brunetti, 1911: 273.
*Atypophthalmus* (*Atypophthalmus*) Geiger, 1986: 53.
Type species - *Atypophthalmus holopticus* Brunetti, 1911 (monotypic).

General: Medium-sized crane flies, body length 4.5-7.5 mm.

Head: Eyes large, nearly reaching each other along dorsal margin. Antenna simple, flagellomeres oval, covered with short pubescence.

Wing: With indistinct darkening along cross-veins and at vein branching points, without macrotrichiae in cells. Stigma distinct. Vein *Sc* long, $Sc_1$ reaching from middle to two-thirds of radial sector (*Rs*), $Sc_2$ at tip of $Sc_1$. Radial sector medium-long, arched or angulated and short-spurred at base. Free tip of $R_1$ indistinct, nearly missing, $R_2$ transverse, at or slightly beyond tip of $R_1$. Discal cell closed, elongate. Basal deflection of $CuA_1$ at or slightly beyond base of discal cell. Anal lobe widely rounded.

Legs: Claw with subbasal spine.

Genitalia: Gonocoxite of male genitalia usually with small setose lobules, tubercles or densely setose areas in addition to ventro-mesal lobe. Inner gonostylus split into few lobes. Paramere complicated. Penis large, extending beyond distal margin of gonocoxite, sometimes even reaching middle of gonostylus, tip shallowly bifid. Ninth sternite reduced. Ovipositor comparatively short, sclerotized. Cercus distinctly arched, tip pointed upwards.

Larvae and pupae: Described only for *A.* (*A.*) *inustus* (Meigen, 1818) (Krivosheina, Krivosheina, 2011).

Larvae: White, elongate. Spiracular lobes inconspicuous. Spiracular field with one pair (ventral) of fusiform sclerites. Spiracle oblong and oblique. Head capsule oval, depressed dorsoventrally and slightly reduced. Caudal end of head capsule tridentate and internolaterally fused with frontoclypeus. Clypeus consists of two parts: preclypeus and postclypeus. Labrum membranous with groups of hair-like structures on lateral and ventral sides. Posterior end of labrum conical. Mandible large, heavily sclerotized with well-developed three apical teeth. Ventral margin with three smaller teeth. Maxilla well developed, sclerotized at the base and setose at the apex, cardo large with long seta on posterior part and two short setae on anterior part. Hypostomal plate heavily sclerotized with very deep incision. Hypostoma with eleven teeth. Hypopharynx and prementum dentate.

Pupae: Yellowish brown. Cephalic crest and mesonotal spines absent. III-VII abdominal segments with dorsal creeping welts. Abdominal segments IV-VII with ventral creeping welts. Sheaths of legs reaching middle of fifth abdominal segment. Surface of abdominal segments smooth, spineless. Prothoracic horns large, elongate, flattened laterally and widely rounded apically.

Elevation range in Korea: Sea level to nearly 1,100 m.

Bionomics: Larvae and pupae develop in rotten wood of various deciduous trees. Adults attracted to light sources.

Distribution: 46 species belong to this subgenus. Most species occur in Afrotropics (28 species), while fewer occur in the Oriental (8), Australian/Oceanian (8) Regions East Palearctic (4), West Palearctic (3) and Neotropics (1) (Oosterbroek, 2017). One species is likely an introduced species in the Nearctic (J. Gelhaus, pers. comm.).

***Atypophthalmus* (*Atypophthalmus*) *crinitus* (Alexander, 1924)**

*Limonia* crinita Alexander, 1924: 154-155.
*Atypophthalmus* (*Atypophthalmus*) *crinitus* Oosterbroek, 2017.

General: Coloration brownish yellow. Body length of male 4.3-6.1 mm, of female 4.1-7.4 mm.

Head: Light gray. Eyes very narrowly separated dorsally, nearly reaching each other. Antenna (Fig. 1A) brown, 1.3-1.8 mm long in male, 1.3-1.6 mm in female, reaching to about wing base if bent backwards. Scape elongate, slightly widening distally, pedicel 0.8 times as long as scape, pear-shaped. Flagellum 12-segmented, each flagellomere with distinct pale apical pedicels, basal segments oval, distal elongate, apical flagellomere 1.5 times as long as penultimate. Longest verticils 1.2 times as long as respective segments. Rostrum yellowish brown, semi-polished. Palpus brown.

Thorax: Yellow with brown stripes. Pronotum brown, yellowish laterally. Mesonotal prescutum yellow with three brown longitudinal stripes. Medial stripe wide frontally, turning narrow and indistinct at posterior margin of sclerite. Lateral stripe starts at middle of sclerite

and gets wider posteriorly. Lateral margin of prescutum brownish. Scutal lobe brown, area separating lobes pale. Scutellum brown, mediotergite grayish yellow. Pleuron yellow with brown longitudinal stripe.

Wing (Fig. 1B): Length of male 5.6-6.8 mm, of female 4.6-7.1 mm. Brownish, costal and basal areas brighter. Stigma oval, brown. Base of radial sector, cord and distal margin of discal cell surrounded by darker brownish areas. Veins brown, paler at wing base and along frontal wing margin. Venation: *Sc* medium-long, $Sc_1$ reaching to about one third of *Rs* length. $Sc_2$ at tip of $Sc_1$. *Rs* medium-long, arcuate or angulate and short-spurred at base. Free end of $R_1$ short, nearly transverse, light and indistinct. $R_2$ at tip of $R_1$, sometimes also indistinct. $R_3$ and $R_{4+5}$ slightly arched, parallel to each other. Discal cell elongate, 1.75 times as long as wide. Basal deflection of $CuA_1$ at or close to branching point of *M*. Anal lobe widely rounded. Length of halter in both sexes 0.7-1.1 mm. Stem of halter yellow at base, distal part and knob brownish.

Legs: Coxae yellow, frontal face of fore coxa brownish. Trochanters obscure yellow. Femur yellow with conspicuous dark brown ring at apex. Tibiae yellowish brown, tip narrowly dark brown. Distal tarsomeres dark brown. Male femur I: 4.5-5.0 mm long, II: 4.6-5.4 mm, III: 5.1-5.7 mm, tibiae I: 5.3-6.1 mm, II: 5.0-5.7 mm, III: 5.3-6.1 mm, tarsus I: 6.0-6.5 mm, II: 4.8-5.6 mm, III: 4.8-5.5 mm. Female femur I: 3.6-5.2 mm long, II: 4.4-5.6 mm, III: 5.3-5.8 mm, tibiae I: 4.3-6.4 mm, II: 4.5-5.7 mm, III: 5.4-6.0 mm, tarsus I: 4.4-7.1 mm, II: 4.3-5.7 mm, III: 4.6-5.4 mm. Claw with one subbasal spine (Fig. 1C).

Abdomen: Abdominal tergites with yellow base and dark brown distal half. Sternites slightly darker basally, than distally. Ninth tergite shorter than wider, with wide shallow emargination at posterior margin.

Genitalia: Male genitalia (Fig. 1E) yellow. Gonocoxite with three setose tubercles on mesal surface. Outer gonostylus long, narrow, gently curved, blackened, point-apexed. Inner gonostylus small, oval with very powerful, darkened and strongly arched rostral prolongation. Paramere wide at base, distal part rod-shaped, blunt-apexed. Penis long and narrow, nearly reaching middle of gonostylus, apex shallowly bifid. Ovipositor (Fig. 1D) brown. Tenth tergite elongate, yellow. Cercus long, narrow, distal part turned upwards. Hypovalva with black spot at base.

Elevation range in Korea: Sea level to slightly above 600 m.

Period of activity in Korea: Late June through early September.

Bionomics: Slopes of mountainous rivers covered by deciduous forest, abandoned gardens near small streams. Adults attracted to light.

Distribution: Species was known only from Hokkaido Island, Japan.

Examined material: Holotype, (wing and genitalia slide-mounted), Japan, Shimokebo, Hitaka, Hokkaido, August 13, 1923, S. Kuwayama (USNM); 1♂ (in EtOH), S. Korea, Hoedong-ri, Jeongseon-eup, Jeongseon-gun, Gangwon-do, Mt. Gariwangsan, N 37.4275000, E 128.5319444, alt. 609 m, 2009.07.05-09.02, W.Y. Choi *et al,* Malaise trap (NIBR); 11♂♂, 8♀♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2014.08.24, S. Podenas, at light (NIBR); 1♂, 1♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2014.08.29, S. Podenas (NIBR); 1♀ (pinned), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Gusan-myeon, Yusan-ri, N 35.12904, E 128.57147, alt. 58 m, 2014.08.29, S. Podenas (NIBR); 4♀♀ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11309, E 128.53067, alt. 20 m, 2014.08.31 (2), S. Podenas (NIBR); 2♂♂, 1♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.27 (1), S. Podenas (NIBR); 1♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.29 (1), S. Podenas (NIBR); 1♂ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.30 (3), S. Podenas, at light (NIBR); 2♂♂ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27448, E 127.56378, alt. 593 m, 2015.07.01 (1), S. Podenas (NIBR); 7♂♂, 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07.02 (3), S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.07.03 (2), S. Podenas, at light (NIBR); 1♀ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeomwon-ri, South-MDL, N 37°56′3.53″, E 126°43′15.46″, alt. 39 m, 2015.07.03, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR); 1♀ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11149, E 128.53142, alt. 11 m, 2015.07.04, S. Podenas (NIBR); 7♂♂, 1♀ (in EtOH), S. Korea, Gangwon-do, Goseong-gun, Ganseong-eup, Jinbu-ri, N 38.26678, E 128.35706, alt. 497 m, 2015.07.08 (1), S. Kim, S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp, N 37.95467, E 126.67997, alt. 32 m, 2015.07.10, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR); 2♀♀ (in EtOH), S. Korea, Gyeonggi-do, Paju-

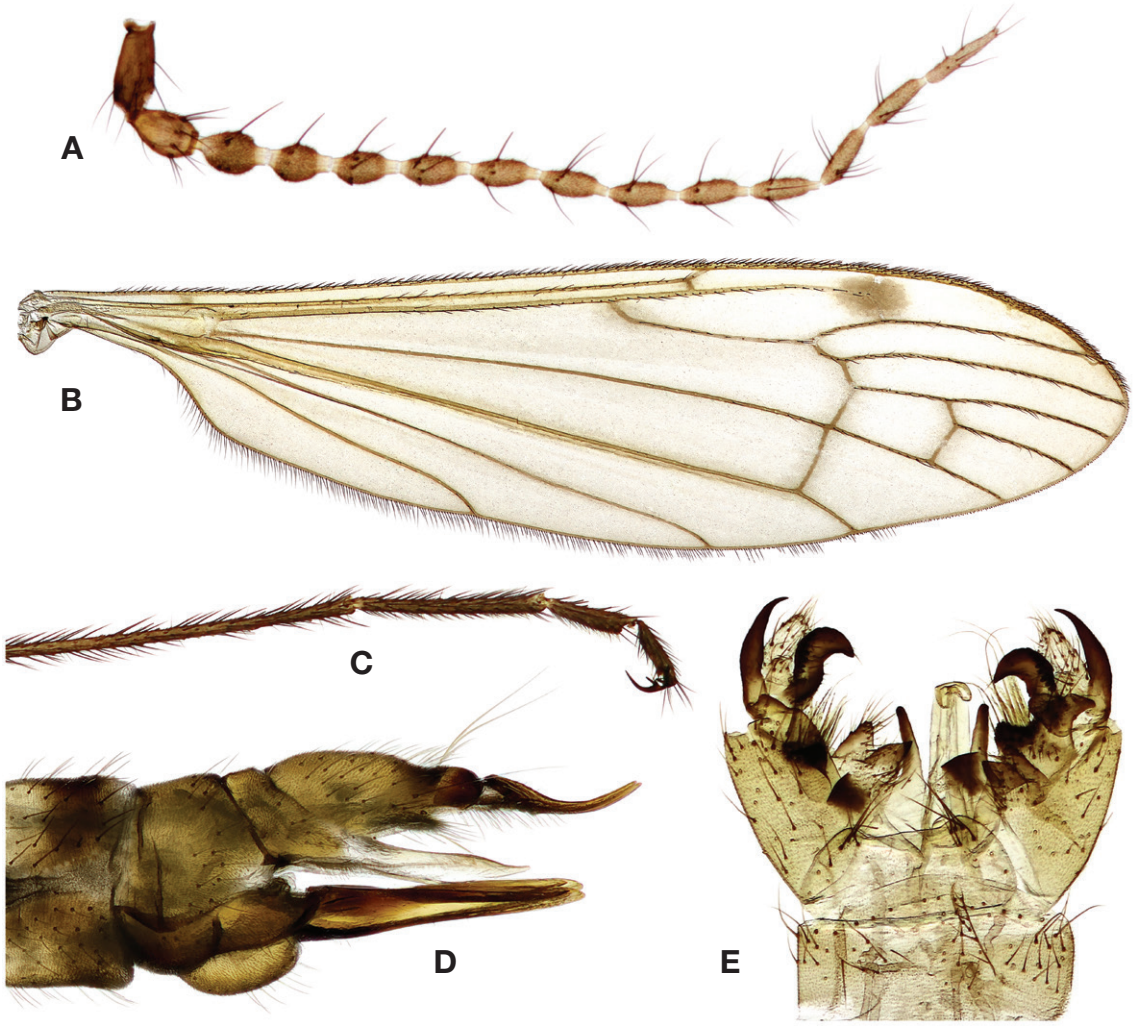


**Fig. 1.** *Atypophthalmus* (*Atypophthalmus*) *crinitus*. A. antenna. B. wing. C. last tarsomeres. D. ovipositor, lateral view. E. male genitalia, dorsal view.

si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp, N 37.95467, E 126.67997, alt. 32 m, 2015.09.04, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR); 1♀ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeongja-ri, WB (Warrior Base Training Area), N 37°55′3.96″, E 126°44′29.74″, alt. 19 m, 2015.09.04, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR).

***Atypophthalmus* (*Atypophthalmus*) *stylacanthus* (Alexander, 1971)**

*Limonia* (*Atypophthalmus*) *stylacantha* Alexander, 1971: 10.

*Atypophthalmus* (*Atypophthalmus*) *stylacanthus* Oosterbroek, 2017.

General: Coloration yellowish-grayish brown. Body length: of male 3.3-4.7 mm, of female 3.6-6.9 mm.

Head: Dark grayish brown color. Eyes narrowly separated dorsally. Antenna (Fig. 2A) dark brown, 1.1-1.6 mm long in male, 1.1-1.8 mm in female, reaching to about wing base if bent backwards. Scape dark brown, elongate, slightly widened distally; pedicel dark brown, subglobular, 1.2 times as short as scape. Flagellum brown, 12-segmented, basal flagellomeres oval, distal elongate, with pale apical pedicels, basal segments rounded, distal segments more elongate, apical flagellomere 1.5 times as long as penultimate. Verticils shorter than respective segments. Rostrum and palpus brown.

Thorax: Grayish yellow. Pronotum light brown. Mesonotal prescutum with wide light brown median area, yellow laterally, postero-lateral margin narrowly darkened. Scutal lobe light yellow. Scutellum brown. Mediotergite light yellow. Pleuron yellow with a conspicuous

longitudinal brown stripe extending from cervical sclerites to base of abdomen.

Wing (Fig. 2B): Length of male 4.0-4.8 mm, of female 4.2-7.1 mm. Subhyaline, veins broadly seamed with pale brown in holotype, but not surrounded by darker areas in specimens from Korea. Stigma oval, pale brownish. Veins brown. Venation: *Sc* medium-long, $Sc_1$ reaching to middle of *Rs*. $Sc_2$ at tip of $Sc_1$. *Rs* medium-long, slightly arched, sometimes angulate and short-spurred at base. Free end of $R_1$ indistinct. $R_2$ nearly transverse. $R_3$ and $R_{4+5}$ slightly arched, parallel to each other. Discal cell elongate, 1.8 times as long as wide, rarely discal cell open due to reduction of basal part of $M_3$ (Fig. 2C). Basal deflection of $CuA_1$ at base of discal cell. Anal lobe low, medium-wide. Length of male halter 0.6-0.8 mm, of female 0.6-1.0 mm. Halter with yellow stem and brown knob.

Legs: Legs light brown. Coxae and trochanters light yellow. Femur and tibiae brown. Male femur III: 3.8-4.2 mm long, tibiae III: 3.7-4.3 mm, tarsus III: 3.1-3.7 mm. Female femur I: 3.4 mm long, II: 3.2-4.8 mm, III: 3.7-5.8 mm, tibiae I: 4.1-4.8 mm, II: 3.3-4.7 mm, III: 3.9-5.4 mm, tarsus I: 4.0-5.2 mm, II: 3.3-5.3 mm, III: 3.1-5.0 mm. Claw with subbasal spine (Fig. 2D).

Abdomen: Abdominal tergites dark brown. Basal sternites bicolorous, basal part brownish yellow, distal brown. Remaining sternites uniformly brown.

Genitalia: Male genitalia (Fig. 2F) dark brown. Ninth tergite of male genitalia widely rounded at posterior margin. Gonocoxite short and wide with low rounded ventro-mesal lobe. Single pair of apical gonostyles. Gonostylus complicated, bilobed. Outer lobe with small subbasal tubercle on mesal surface, armed with two strong apical spines. Inner lobe with long, claw shaped lobe starting from the middle. Paramere widened distally. Penis elongate, reaching slightly beyond distal margin of gonocoxite, apex shallowly bifid. Ovipositor yellowish brown (Fig. 2E). Tenth tergite elongate. Cercus long, distal part raised upwards. Hypovalva shiny black at base.

Elevation range in Korea: Sea level to nearly 1,100 m.

Period of activity in Korea: Beginning of June through August.

Bionomics: Slopes of mountainous rivers covered by deciduous forest, settlements on mountainous streams surrounded by deciduous shrubs, trees and small farms. Actively flies to light.

Distribution: Species was recorded from the continental part of the Far East of Russia and Honshu Island, Japan.

Examined material: Holotype, male (wing, legs, antenna and genitalia slide-mounted), Japan, Echigo, Kurokawa, July 2, 1955, K. Baba (USNM); 2♀♀ (pinned), North Korea, Seren Mts., alt. 3500 ft., VII-3, 1938, A, Yankovsky (USNM); 1♂, 2♀♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2014.08.24, S. Podenas, with net and at light (NIBR); 1♂ (in EtOH, wing and genitalia slide-mounted), S. Korea, Jeollabuk-do, Buan, Byeonsan-myeon, Junggye-ri, Byeonsanbando NP, Jigso Pokpo (waterfalls), N 35.62675, E 126.57020, alt. 141 m, 2014.08.27 (1), S. Podenas (NIBR); 2♂♂ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (1), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.29 (1), S. Podenas (NIBR); 1♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.30 (1), S. Podenas (NIBR); 2♀♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27448, E 127.56378, alt. 593 m, 2015.07.01 (1), S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07.03 (1), S. Podenas (NIBR); 1♂, 1♀ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11149, E 128.53142, alt. 11 m, 2015.07.04, S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27333, E 127.56924, alt. 546 m, 2016.06.03 (3), S. Podenas (NIBR).

### *Atypophthalmus* (*Microlimonia*) Savchenko, 1976

*Dicranomyia* (*Microlimonia*) Savchenko, Krivolutskaya, 1976: 147-148; Savchenko, 1983: 138; 1985: 125-126; 1989: 311-312.

*Atypophthalmus* (*Microlimonia*) Geiger, 1986: 53.

Type species - *Limonia inelegans* Alexander, 1924 (original designation).

General: Medium-sized crane flies, body length 4.5-7.0 mm. Body coloration varies from brownish-yellow to brown or brownish gray.

Head: Antennal flagellomeres oval with apical pedicel.

Wing: Elongate, medium-wide, unpatterned, without macrotrichiae in cells. Vein *Sc* long, $Sc_1$ reaching at least middle of *Rs*, $Sc_2$ at tip of $Sc_1$. Radial sector medium-long, arched at base. Free tip of $R_1$ short, $R_2$ transverse, slightly beyond tip of $R_1$. Discal cell closed. Basal deflection of $CuA_1$ close to base of discal cell. Anal lobe widely rounded.

Genitalia: Male genitalia approximately as wide as remaining abdominal segments. Ninth tergite wider than longer. Gonocoxite with simple or bifid ventro-mesal lobe. One pair of gonostyles. Gonostylus often divided

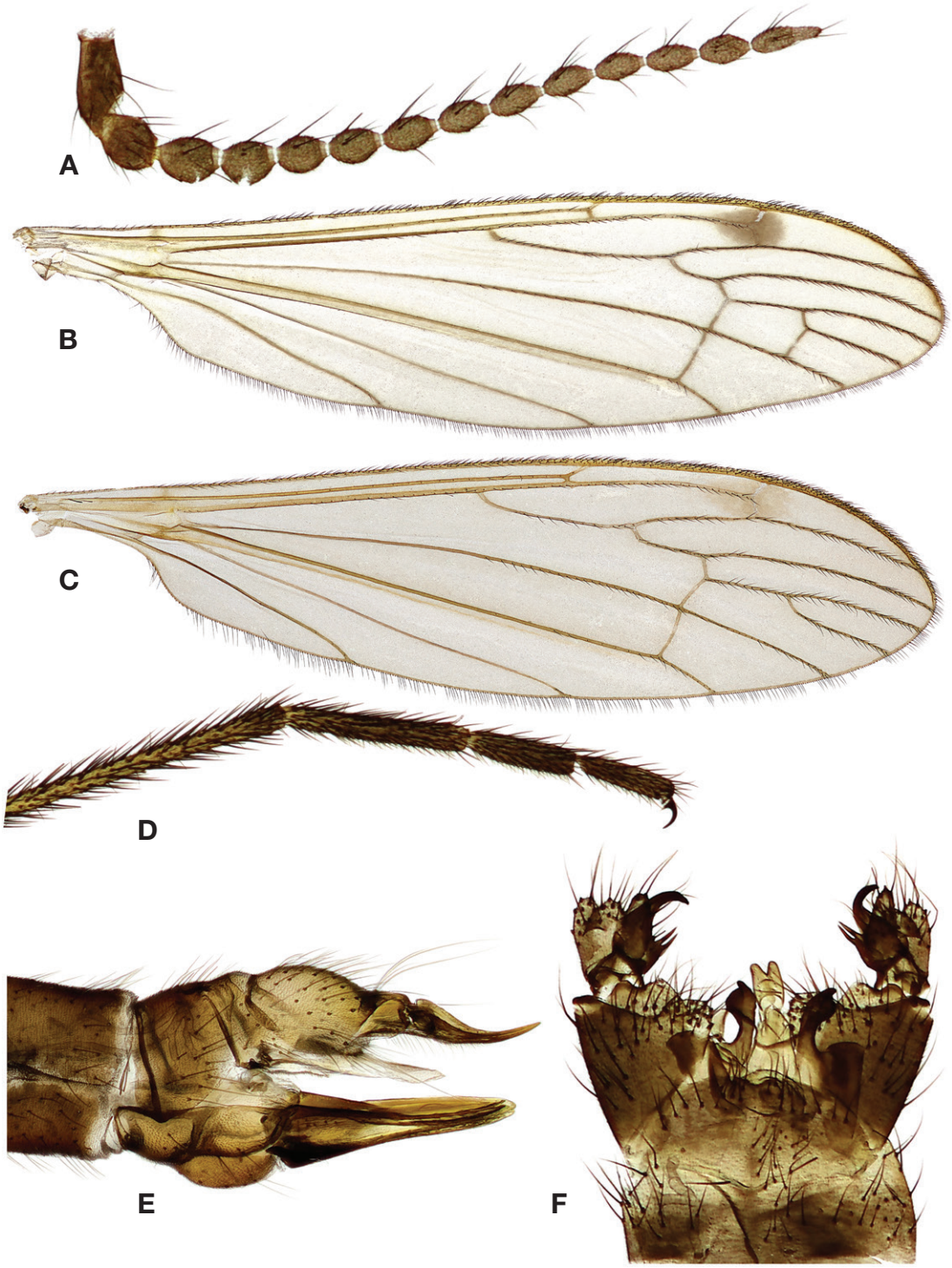


**Fig. 2.** *Atypophthalmus* (*Atypophthalmus*) *stylacanthus*. A. antenna. B. wing. C. wing, variation. D. last tarsomeres. E. ovipositor, lateral view. F. male genitalia, dorsal view.

into two or three lobes. Rostral prolongation long, slender, arched and spineless. Penis wide, shallowly bifid at tip. Ovipositor with distinctly arched cercus and straight, long, basally blackened hypovalva.

Larvae and Pupae: Described only for *A.* (*M.*) *machidai* (Alexander, 1921) (Krivosheina, 2010). Larval body yellowish, densely covered with long, up to one-fifth to one-fourth of segment's length, setae. Abdominal seg-

ments II-VII with ventral creeping welts. Spiracular field surrounded by five lobes covered with dark sclerites. Spiracles irregularly oval. Head hemicephalic, heavily sclerotised. Frons less sclerotised than the rest of head, short, widened anteriorly and narrowed posteriorly, anterior part with sensory structures, fused with clypeus. Distinct border between frontoclypeus and labrum absent. Antenna long, three times as long as wide. Mandible heavily sclerotised with three apical teeth, that are different in length. Maxillae consisting of well-developed cardo, stipes, and galea. Labium formed by short plate bounded by rods and bearing group of sensilla on anterior part and long thickened setae over entire surface. Hypopharynx with numerous sclerotised ctenoid plates. Hypostomal plate with five large obtuse teeth.

Pupa unknown.

Bionomics: Larvae develop in rotten logs within wet fibers of the bast of deciduous and coniferous trees.

Distribution: Five extant species belong to this subgenus and are only known from the East Palearctic; *A.* (*M.*) *inelegans* (Alexander, 1924) reaches as far south as Taiwan, and *A.* (*M.*) *machidai* (Alexander, 1921) is common throughout the Europe (Oosterbroek, 2017).

***Atypophthalmus* (*Microlimonia*) *inelegans* (Alexander, 1924)**

*Limonia inelegans* Alexander, 1924: 156.

*Dicranomyia* (*Microlimonia*) *inelegans* Savchenko, Krivolutskaya, 1976: 148-149; Savchenko, 1983: 139; 1989: 312.

*Atypophthalmus* (*Microlimonia*) *inelegans* Oosterbroek, 2017.

General: Coloration blackish brown. Body length of male 4.1-5.7 mm, of female 3.9-6.6 mm.

Head: Dark brown to black dusted with gray. Eyes narrowly separated dorsally. Antenna (Fig. 3A) black at base, turning dark brown towards apex, 1.1-1.6 mm long in male, 1.2-1.6 mm in female, reaching wing base if bent backwards. Scape elongate, slightly widened distally, pedicel egg-shaped, approximately two thirds as long as scape. Flagellum 12-segmented, flagellomeres with distinct apical pedicels, basal segments rounded, distal segments more elongate, apical flagellomere 1.5 times as long as penultimate. Longest verticils as long as respective segments. Rostrum and palpus brown.

Thorax: Brown to dark brown. Pronotum grayish brown. Mesonotal prescutum grayish brown, stripes missing or very indistinct. Scutellum and mediotergite same color as prescutum, scutellum with narrow blackish margins. Pleuron grayish brown, paler ventrally.

Wing (Fig. 3B): Length of male 4.1-6.7 mm, of female 4.4-5.7 mm. Uniformly brownish, subhyaline with light brown, indistinct, elongate stigma. Veins brown. Venation: *Sc* long, $Sc_1$ reaching to branching point of *Rs*. $Sc_2$ at tip of $Sc_1$. *Rs* medium-long, arched. Free end of $R_1$ short, transverse, very light and indistinct. $R_2$ slightly beyond tip of $R_1$. $R_3$ and $R_{4+5}$ arched, parallel to each other. Discal cell small, just slightly longer than wider. Basal deflection of $CuA_1$ at base of discal cell. Anal lobe wide. Length of male halter 0.7-0.9 mm, of female 0.7-0.8 mm. Halter pale, knob slightly infuscated.

Legs: Coxae brown at base, getting pale distally, darkening more intense on fore coxae. Trochanters pale with narrowly blackish distal margin. Femur grayish yellow with pale base, apical darkening indistinct. Tibiae and basal tarsomere grayish yellow, remaining tarsomeres brown to dark brown. Male femur I: 3.8-4.7 mm long, II: 4.0-6.1 mm, III: 4.1-5.5 mm, tibiae I: 4.4-5.6 mm, II: 4.0-5.9 mm, III: 4.1-5.5 mm, tarsus I: 5.4-6.1 mm, II: 4.4-5.1 mm, III: 3.7-4.6 mm. Female femur I: 3.8-4.6 mm long, II: 4.0-5.3 mm, III: 3.9-5.5 mm, tibiae I: 4.4-5.2 mm, II: 4.2-5.2 mm, III: 4.5-5.6 mm, tarsus I: 4.3-5.1 mm, II: 3.5-5.5 mm, III: 3.0-4.4 mm. Claw with small subbasal spine (Fig. 3C).

Abdomen: Abdominal tergites dark brown, posterior margins slightly paler, second and third tergite indistinctly yellowish laterally. Four basal sternites bicolorous, basal part widely dark brown, distal yellow. Remaining sternites dark brown.

Genitalia: Male terminalia same color as distal abdominal segments (Fig. 3D). Ninth tergite with shallow emargination at middle of posterior margin. Gonocoxite slightly elongate with wide rounded ventro-mesal lobe. Gonostylus bilobed, rounded at base, with long arched beak-shaped rostrum and small subbasal extension. Paramere getting narrow towards distal end. Penis long and narrow, reaching to about one-third of gonostylus length, apex shallowly bifid. Ovipositor yellowish brown (Fig. 3E). Tenth tergite elongate, grayish brown. Cercus narrow, distal part turned upwards. Hypovalva shiny black at base.

Elevation range in Korea: sea level to 800 m.

Period of activity in Korea: Beginning of May through August.

Bionomics: Edges of mountainous rivers covered by deciduous forest, abandoned farm lands, villages near mountainous streams surrounded by shrubs and trees. Species is attracted to light.

Distribution: Species was recorded from the Far East of Russia, Japan and China.

Examined material: Holotype, female, (wing slide-mounted), Japan, Chuzenji, Shimotsuke-no-kuni, alt. 5000 ft., VII-22, 1923, Teiso Esaki (USNM); 1♀ (pinned), S. Korea, #18, Central National Forest, 18 mi NE Seoul, alt. 350-500 ft., 6 July, 1954, G. W. Byers (SMEK); 2♂♂ (pinned), S. Korea, #24, Central National Forest, 18 mi NE Seoul, alt. 400-500 ft., 27 July, 1954, G. W. Byers

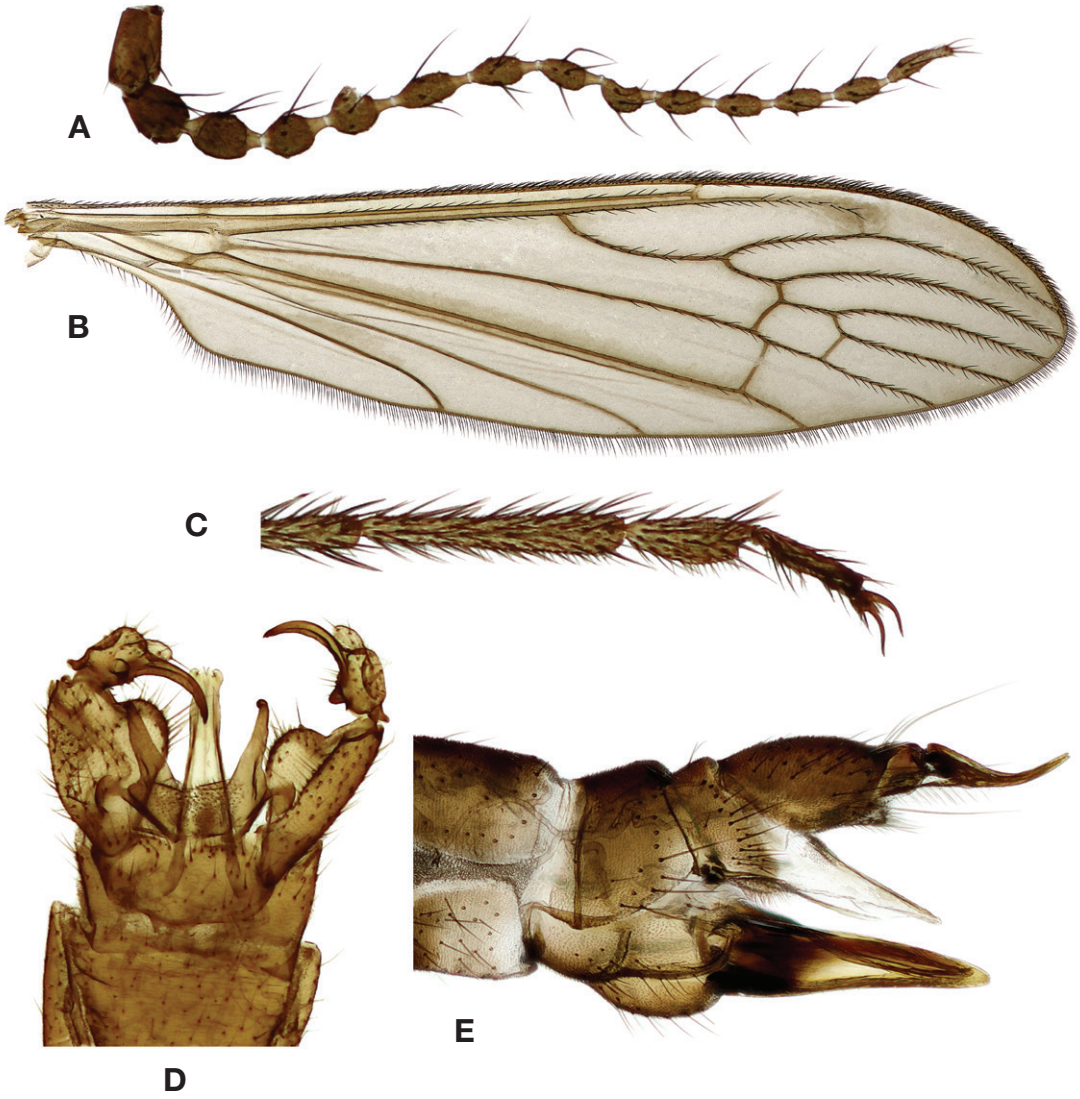


**Fig. 3.** *Atypophthalmus* (*Microlimonia*) *inelegans*. A. antenna. B. wing. C. last tarsomeres. D. male genitalia, dorsal view. E. ovipositor, lateral view.

(SMEK); 1♂ (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Yongpyeong-myeon, Nodong-ri, Mt. Gyebangsan, 2008.05.15-07.19, J. D. Yeo *et al,* Malaise trap (NIBR); 1 specimen, sex unknown (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Yongpyeong-myeon, Nodong-ri, Mt. Gyebangsan, 2008.07.19-08.12, H. Y. Seo, K. G. Kim, Malaise trap (NIBR); 1♀ (in EtOH), S. Korea, Ulju-gun, Sangbuk-myeon, Sanjeon-ri, N 35.6356111, E 129.0590278, alt. 377 m, 2009.06.04-07.09, J. D. Yeo, J. D. Yoon, Malaise trap (NIBR); 1♂ (in EtOH, wing and antenna slide-mounted), S. Korea, Gyeongsangbuk-do, Cheongdo-gun, Unmun-myeon, Sinwon-ri, Mt. Ulmunsan, N35.6532778, E129.0256111, alt. 439 m, 2009.07.09-08.05, K. G. Kim, O. S. Kim, Malaise trap (NIBR); 1♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26580, E 127.58128, alt. 378 m, 2013.05.10, S. Podenas (NIBR); 1♂ (in EtOH, wing, antenna and genitalia slide-mounted), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Hwaak-ri, N 37.98402, E 127.52676, alt. 579 m, 2014.08.20 (2), S. Kim, S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Yongpyeong-myeon, Nodong-ri (auto camping area), N 37.70303, E 128.48302, alt. 802 m, 2014.08.21 (4), S. Kim, S. Podenas (NIBR); 4♂♂, 10♀♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2014.08.24, S. Podenas, with net and at light (NIBR); 3♂♂, 1♀ (in EtOH), S. Korea, Jeollabuk-do, Buan, Jinseo-myeon, Naesosa-ro, Byeonsanbando NP,

N 35.61789, E 126.58573, alt. 67 m, 2014.08.26 (2), S. Podenas (NIBR); 3♂♂, 2♀♀ (in EtOH), S. Korea, Jeollabuk-do, Buan, Byeonsan-myeon, Junggye-ri, Byeonsanbando NP, N 35.67924, E 126.57083, alt. 24 m, 2014.08.26 (3), S. Podenas (NIBR); 5♂♂, 10♀♀ (in EtOH and pinned), S. Korea, Jeollabuk-do, Buan, Boan-myeon, Udong-ri, Byeonsanbando NP, N 35.62864, E 126.63441, alt. 52 m-N 35.62896, E 126.63461, alt. 105 m, 2014.08.27 (2), S. Podenas (NIBR); 2♂♂, 2♀♀ (in EtOH and pinned), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Gusan-myeon, Yusan-ri, N 35.12904, E 128.57147, alt. 58 m, 2014.08.29, S. Podenas (NIBR); 1♂, 2♀♀ (in EtOH and pinned), S. Korea, Gyeongsangnam-do, Geoje-si, Nambu-myeon, Dapo-ri, Geojedo Island, N 34.71542, E 128.62286, alt. 63 m, 2014.08.30 (1), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Gyeongsangnam-do, Geoje-si, Nambu-myeon, Dapo-ri, Geojedo Island, N 34.72538, E 128.62608, alt. 52 m, 2014.08.30 (2), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Gyeongsangnam-do, Geoje-si, Nambu-myeon, Dapo-ri, Geojedo Island, N 34.75844, E 128.61429, alt. 191 m, 2014.08.30 (3), S. Podenas (NIBR); 6♂♂, 4♀♀ (in EtOH and pinned), S. Korea, Gyeongsangnam-do, Geoje-si, Dongbu-myeon, Gabae-ri, Geojedo Island, N 34.77900, E 128.57968, alt. 50 m, 2014.08.30 (4), S. Podenas (NIBR); 5♂♂, 9♀♀ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11149, E 128.53142, alt. 11 m, 2014.08.31 (1), S. Podenas (NIBR); 2♂♂, 4♀♀ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11309, E 128.53067, alt. 20 m, 2014.08.31 (2), S. Podenas (NIBR); 5♂♂, 1♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.27 (1), S. Podenas (NIBR); 14♂♂, 6♀♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (1), S. Podenas, V. Podeniene (NIBR); 2♂♂, 1♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (2), S. Podenas (NIBR); 5♂♂, 4♀♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.29 (1), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.29 (3), S. Podenas, at light (NIBR); 1♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.30 (3), S. Podenas, at light (NIBR); 7♂♂, 2♀♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27448, E 127.56378, alt. 593 m, 2015.07.01 (1), S. Podenas, V. Podeniene (NIBR); 1♂, 2♀♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07.02 (2), S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27448, E 127.56378, alt. 593 m, 2015.07.02 (3), S. Podenas (NIBR); 1♂, 3♀♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07.03 (1), S. Podenas (NIBR); 4♂♂, 9♀♀ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11149, E 128.53142, alt. 11 m, 2015.07.04, S. Podenas (NIBR); 1♂, 1♀ (in EtOH), S. Korea, Gangwon-do, Hongcheon-gun, Duchon-myeon, Cheonhyeon-ri, near Mt. Garisan, N 37.84840, E 127.98879, alt. 304 m, 2015.07.08 (3), S. Kim, S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Gangwon-do, Chuncheon-si, Dongsan-myeon, Bongmyeong-ri, KNU Experimental Forest, N 37.78194, E 127.81973, alt. 197 m, 2015.07.09, S. Kim, S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri, Garim-gyo (Br.), GREC-F, 2015-VII-23-29, Malaise trap (KU); 1♂ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeomwon-ri, South-MDL, N 37.93430, E 126.72097, alt. 39 m, 2015.07.31, T.A. Klein, H.C. Kim (NIBR); 2♂♂ (in EtOH), S. Korea, Geonggi-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri, Garimgyo (Br.), GREC-F, 2015.IX.6-12, Malaise trap (KU).

***Atypophthalmus* (*Microlimonia*) *machidai* (Alexander, 1921)**

*Dicranomyia machidai* Alexander, 1921: 113.

*Dicranomyia* (*Microlimonia*) Savchenko, Krivolutskaya, 1976: 149-150; Savchenko, 1983: 139-140; 1985: 126-127; 1989: 312.

*Atypophthalmus* (*Microlimonia*) *machidai* Starý, 1981: 116; Geiger, 1986: 53-54.

General: Coloration grayish-brown to dark brown. Body length of male 3.8-6.4 mm, of female 5.1-6.9 mm.

Head: Blackish brown, dusted with gray. Eyes nearly reaching each other dorsally. Antenna (Fig. 4A) entirely dark brown, 1.1-1.6 mm long in male, 1.2-1.6 mm in female, reaching base of wing in male and middle of prescutum in female if bent backwards. Scape narrow, nearly cylindrical, pedicel pear-shaped, nearly as long as scape. Flagellum 12-segmented, basal segments oval, distal segments more elongate, apical flagellomere 1.5 times as long as penultimate, distinctly narrowed beyond middle. Flagellomeres with distinct apical pedicels. Longest verticils as long as respective segments. Rostrum and palpus dark brown.

Thorax: Grayish-brown dorsally, pale ventrally. Cervi-

cal sclerites blackish. Pronotum grayish brown, margins narrowly blackened. Mesonotal prescutum brownish yellow, with grayish brown median stripe, that widens posteriorly. Lateral stripes missing, but lateral margins of sclerite and pseudosutural fovea darkened. Scutal lobe grayish brown, postero-lateral angle yellow. Area between lobes yellow. Scutellum and mediotergite grayish brown. Pleuron grayish-brown dorsally, with distinct dark brown longitudinal stripe extending from cervical sclerite to base of abdomen, pale ventrally. Ventral part of katepisternum slightly darkened.

Wing (Fig. 4B): Length of male 4.8-7.1 mm, of female 5.7-7.5 mm. Uniformly brownish, subhyaline with light brown oval stigma. Veins dark brown. Venation: *Sc* long, $Sc_1$ nearly reaching to middle of *Rs*. $Sc_2$ at tip of $Sc_1$. *Rs* medium-long, arched at base. Free end of $R_1$ short, transverse. $R_2$ slightly beyond tip of $R_1$. $R_3$ and $R_{4+5}$ slightly arched, parallel to each other. Discal cell 1.5 times as long as wide. Basal deflection of $CuA_1$ slightly before base of discal cell. Anal lobe widely rounded. Length of male halter 0.7-1.1 mm, of female 0.8-1.1 mm. Halter grayish-brown, base of stem pale-yellow. Fore coxa dorsally dark brown, ventrally yellow, middle and posterior coxae pale-yellow. Trochanters pale-yellow. Leg grayish brown with narrowly yellowish base of femur and dark brown three distal tarsomeres. Male femur I: 3.8-4.3 mm long, II: 3.9-5.5 mm, III: 4.2-5.2 mm, tibiae I: 4.7-5.6 mm, II: 4.0-5.2 mm, III: 4.6-6.1 mm, tarsus I: 4.9-5.8 mm, II: 4.4-5.1 mm, III: 3.8-5.6 mm. Female femur I: 4.1-5.2 mm long, II: 5.0-6.9 mm, III: 4.2-5.1 mm, tibiae I: 4.7-6.6 mm, II: 4.6-5.3 mm, III: 4.6-5.5 mm, tarsus I: 5.1-5.7 mm, II: 4.4-5.1 mm, III: 4.1-4.3 mm. Claw with long spine near middle (Fig. 4C).

Abdomen: Dark brown, ventrally with three large grayish-yellow spots at basal parts of three basal sternites. Yellowish spot at base of fourth sternite small or indistinct.

Genitalia: Male terminalia same color as distal abdominal segments, but penis grayish-yellow (Fig. 4E). Ninth tergite widened distally, with small emargination at posterior margin. Gonocoxite elongate with rounded subapical ventro-mesal lobe. Gonostylus wide and rounded at base, distal part long and narrow, distinctly arched, spineless. Paramere with long narrow distal part, that bears small subapical tubercle. Penis long and narrow, reaching to about middle of gonostylus, apex shallowly bifid. Ovipositor yellowish brown (Fig. 4D). Tenth tergite slightly elongate. Cercus long, narrow, distal part raised upwards. Hypovalva long and straight getting narrower towards distal end, reaching to about middle of cercus, blackened at base.

Elevation range in Korea: Sea level to $>1{,}300$ m.

Period of activity in Korea: Beginning of May through September. Species is attracted to light.

Bionomics: Larvae found on slopes of mountainous rivers covered by deciduous forest, settlements on mountainous streams surrounded by deciduous shrubs, trees and small farms. Larvae develop in dead trees and fungi (Savchenko, 1985). Adults are attracted to light sources.

Distribution: Species is widely distributed throughout the Palearctic.

Examined material: Holotype, male, (wing and genitalia slide-mounted), Japan, Nakana, May 28, 1920, H. Machida (USNM); 1♀ (pinned), North Korea, Seren Mts., alt. 4000 ft., VIII-4, 1938, Yankovsky (USNM); 1♂ (pinned) S. Korea, #9, Central National Forest, 18 mi. NE Seoul, alt. 400-500 ft., 29 May 1954, G. W. Byers (SMEK); 1♂ (pinned), S. Korea, #12, Hwy. #20, 8 mi. SW Kangnung, 128°47′E, 37°42′N, 8 June 1954, alt. 1925 ft., G. W. Byers (SMEK); 2♂♂, 1♀ (pinned) S. Korea, #17, Central National Forest, 18 mi. NE Seoul, alt. 350-500 ft., 20 June 1954, G. W. Byers (SMEK); 1♀ (pinned), S. Korea, #22, Central National Forest, 18 mi. NE Seoul, alt. 400-500 ft., 11 July 1954, G. W. Byers (SMEK); 1♂, 2♀♀ (pinned) S. Korea, #24, Central National Forest, 18 mi. NE Seoul, alt. 400-500 ft., 27 July 1954, G. W. Byers (SMEK); 3♀♀ (pinned), S. Korea, #25, Central National Forest, 18 mi. NE Seoul, alt. 400-500 ft., 14 August 1954, G. W. Byers (SMEK); 1♀ (pinned), S. Korea, #28, Central National Forest, 18 mi. NE Seoul, alt. 350-500 ft., 22 August 1954, G. W. Byers (SMEK); 1♂ (pinned) S. Korea, #35, Cheju [Jeju] Island, 9 September, 1954, G. W. Byers (USNM); 2♂♂ (pinned) S. Korea, #36, Cheju-do, Halla San (volcano), alt. 1500 ft., 10 September, 1954, G. W. Byers (USNM); 1♂, 1♀ (pinned) S. Korea, #37, Hill 1468, 16 mi. NW Chunchon, 127°30′E, 38°00′N, alt. 4300 ft., 16 September, 1954, G. W. Byers (USNM, SMEK); 1♂ (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.73920, E 128.59398, alt. 794 m, 2012.06.22 (1), S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Hwaak-ri, N 37.99363, E 127.52102, alt. 810 m, 2014. 08.20 (1), S. Kim, S. Podenas (NIBR); 2♂♂ (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Hwaak-ri, N 37.98402, E 127.52676, alt. 579 m, 2014. 08.20 (2), S. Kim, S. Podenas (NIBR); 2♂♂, 4♀♀ (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Bukmyeon, Jeokmok-ri, N 38.02982, E 127.44310, alt. 560 m, 2014.08.20 (3), S. Kim, S. Podenas (NIBR); 2♀♀ (in EtOH), S. Korea, Gangwon-do, Hongcheon-gun, Naemyeon, Yuljeon-ri, N 37.73849, E 128.34566, alt. 798 m, 2014.08.21 (1), S. Kim, S. Podenas (NIBR); 2♀♀ (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Yongpyeong-myeon, Nodong-ri, N 37.67212, E 128.46118, alt. 733 m, 2014.08.21 (3), S. Kim, S. Podenas (NIBR); 5♂♂, 2♀♀ (in EtOH), S. Korea, Gangwon-do, Pyeong-

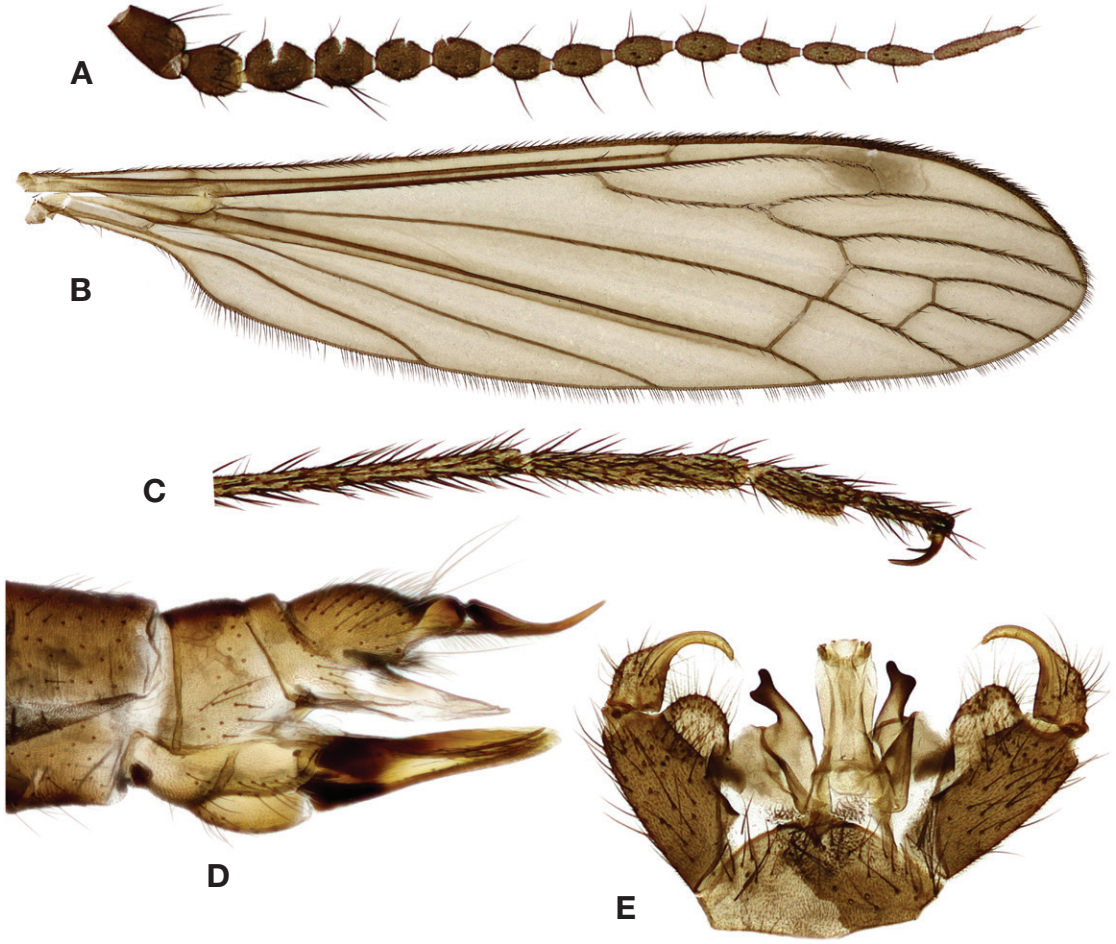


**Fig. 4.** *Atypophthalmus* (*Microlimonia*) *machidai*. A. antenna. B. wing. C. last tarsomeres. D. ovipositor, lateral view. E. male genitalia, dorsal view.

chang-gun, Yongpyeong-myeon, Nodong-ri (auto camping area), N 37.70303, E 128.48302, alt. 802 m, 2014.08.21 (4), S. Kim, S. Podenas (NIBR); 2♂ (in EtOH and pinned), S. Korea, Gangwon-do, Chuncheon-si, Dongsan-myeon, Bongmyeong-ri, KNU experimental forest, N 37.77906, E 127.81564, alt. 233 m, 2014.08.22 (1), S. Kim, S. Podenas (NIBR); 9♂♂, 3♀♀ (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri, (Moss valley), N 37.47153, E 128.54305, alt. 769 m, 2014.08.22 (2), S. Kim, S. Podenas (NIBR); 60♂♂, 37♀♀ (pinned and in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2014.08.24, S. Podenas, with net and at light (NIBR); 1♂, 3♀♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2014.08.25, S. Podenas (NIBR); 5♂♂, 1♀ (in EtOH), S. Korea, Jeollabuk-do, Buan, Jinseo-myeon, Naesosaro, Byeonsanbando NP, N 35.61789, E 126.58573, alt. 67 m, 2014.08.26 (2), S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Jeollabuk-do, Buan, Byeonsan-myeon, Junggye-ri, Byeonsanbando NP, Jigso Pokpo (waterfalls), N 35.62675, E 126.57020, alt. 141 m, 2014.08.27 (1), S. Podenas (NIBR); 7♂♂, 13♀♀ (in EtOH and pinned), S. Korea, Jeollabuk-do, Buan, Boan-myeon, Udong-ri, Byeonsanbando NP, N 35.62864, E 126.63441, alt. 52 m-N 35.62896, E 126.63461, alt. 105 m, 2014.08.27 (2), S. Podenas (NIBR); 1♀ (pinned), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Gusan-myeon, Yusan-ri, N 35.12904, E 128.57147, alt. 58 m, 2014.08.29, S. Podenas (NIBR); 2♂♂, 2♀♀, 1 specimen with unknown sex (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11149, E 128.53142, alt. 11 m, 2014.08.31 (1), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.05.01 (3), S. Podenas, at light (NIBR); 1♂, 1♀ (in EtOH), S. Korea, Jeollanam-

do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.05.02 (4), S. Podenas, at light (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.05.03 (3), S. Podenas, at light (NIBR); 1♂ (in EtOH, wing slide-mounted), S. Korea, Gyeonggi-do, Paju-si, Munsan-eup, Majeong-ri, N 37°52′53.52″, E 126°45′24.89″, alt. 32 m, 2015.05.25, T.A. Klein, H.C. Kim, LED trap (NIBR); 1♀ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Munsan-eup, Majeong-ri, N 37°52′53.52″, E 126°45′ 24.89″, alt. 32 m, 2015.05.29, T.A. Klein, H.C. Kim, LED trap (NIBR); 2♂♂ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.27 (1), S. Podenas (NIBR); 4♂♂, 1♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (1), S. Podenas (NIBR); 2♂♂ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.30 (1), S. Podenas (NIBR); 2♂♂, 1♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.30 (3), S. Podenas, at light (NIBR); 3♂♂, 1♀ (in EtOH and pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27448, E 127.56378, alt. 593 m, 2015.07.01 (1), S. Podenas, V. Podeniene (NIBR); 2♀♀ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.07.01 (3), S. Podenas, at light (NIBR); 1♂ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07. 02 (2), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.07.02 (4), S. Podenas, at light (NIBR); 1♀ (in EtOH), S. Korea, Gangwon-do, Yangyang-gun, Seo-myeon, Osaek-ri, Seoraksan NP, N 38.08420, E 128.45026, alt. 415 m, 2015.07.07 (2), S. Kim, S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Gangwon-do, Yangyang-gun, Seomyeon, Osaek-ri, Heullim 1 gyo (bridge), Seoraksan NP, N 38.09512, E 128.41309, alt. 800 m, 2015.07.07 (3), S. Kim, S. Podenas (NIBR); 2♂♂, 2♀♀ (in EtOH), S. Korea, Gangwon-do, Hongcheon-gun, Duchon-myeon, Cheonhyeon-ri, near Mt. Garisan, N 37.84840, E 127.98879, alt. 304 m, 2015.07.08 (3), S. Kim, S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Gangwon-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri, N37.97627, E127.441601, 2015.IX.27, Yeonjae Bae, at light (KU); 1♂ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2016.06.03 (2), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2016.06.03 (4), S. Podenas, at light (NIBR); 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2016.06.04 (2), S. Podenas (NIBR); 1♂ (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27123, E 127.57133, alt. 534 m, 2016.06.04 (5), H. Baek, S. Podenas, at light (NIBR); 2♂♂ (in EtOH, wing and leg slide-mounted), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2016.06.04 (6), V. Podeniene, at light (NIBR).

*Helius* Lepeletier and Serville, 1828 (Latreille *et al*., 1828)

(characteristic in Podenas and Byun, 2014)

**Checklist of Korean *Helius* crane flies**

*Helius* (*Helius*) *flavus* (Walker, 1856)
*Helius* (*Helius*) *gracillimus* Alexander, 1938
*Helius* (*Helius*) *nipponensis* (Alexander, 1913)
*Helius* (*Helius*) *obliteratus* (Alexander, 1920)
*Helius* (*Helius*) *polionotus* Alexander, 1938

**Key to Korean species of the genus *Helius***

1. Wing stigma distinct ····· 2
− Wing stigma light, indistinct ····· 4
2. Thorax gray. Radial sector (*Rs*) straight ····· ····· *Helius* (*Helius*) *polionotus* Alexander, 1938
− Thorax light brown or yellow. Radial sector (*Rs*) angulated or arched at base ····· 3
3. Thorax light brown. Gonocoxite of male genitalia with extra lobes on dorsal surface ····· ····· *Helius* (*Helius*) *obliteratus* (Alexander, 1920)
− Thorax brownish yellow. Gonocoxite of male genitalia without extra lobes on dorsal surface ····· ····· *Helius* (*Helius*) *gracillimus* Alexander, 1938
4. Mesonotal prescutum with three longitudinal stripes ··· ····· *Helius* (*Helius*) *nipponensis* (Alexander, 1913)
− Mesonotal prescutum without longitudinal stripes, just with dark spot at frontal margin ····· ····· *Helius* (*Helius*) *flavus* (Walker, 1856)

***Helius* (*Helius*) *flavus* (Walker, 1856)**

*Rhamphidia flava* Walker, 1856: 309.
*Helius flavus* Savchenko, 1983: 65; 1986: 209-210.

Species previously not recorded from the Korean Peninsula.

General: Body coloration yellow to brownish yellow. Male body length 7.5-9.6 mm.

Head: Dark gray with dark brown median line, covered with dark brown setae. Eyes narrowly separated dorsally and ventrally. Antenna 1.5 times as long as rostrum. Scape elongate, cylindrical, dark brown. Pedicel yellow or brownish yellow, slightly shorter than scape. Flagellum dark brown. Basal flagellomeres oval, getting elongate and narrow towards apex. Longest verticils nearly twice as long as respective segments. Rostrum 0.95 mm long, dark brown dorsally, brown ventrally. Palpus dark brown.

Thorax: Cervical sclerites brown. Pronotum brownish yellow with brown median stripe. Mesonotal prescutum brownish yellow with brown spot fronto-medially. Scutal lobes brownish yellow to yellow, area separating scutal lobes pale. Scutellum and mediotergite yellow. Pleuron uniformly yellow to brownish yellow.

Wing (Fig. 5A): 7.2-8.1 mm long with grayish tinge, base and costal area yellowish. Stigma light brown, indistinct. Area along cubital vein and wing apex slightly darkened, brownish. Venation: *Sc* ending before branching point of *Rs*. *Rs* medium-long and nearly straight, just slightly arched at base. $R_2$ missing. $R_3$ and $R_{4+5}$ widely diverging. Cross-vein *r-m* short or totally missing. Discal cell wide at base, getting narrower distally, twice as long as wide. Free end of $M_{1+2}$ 2.4 times as long as its basal part, that makes frontal margin of discal cell. Basal deflection of $CuA_1$ distinctly beyond branching point of *M*. Second anal vein slightly sinuous. Anal lobe medium-sized, comparatively narrow. Halter yellowish, length of male halter 1.1-1.4 mm.

Legs: Coxae yellow, trochanters brownish yellow. Femur and tibia brownish yellow with slightly darkened apex. Tarsus brown basally, turning dark brown distally. Male femur I: 6.5-8.5 mm long, II: 7.1-8.1 mm, tibiae I: 8.75 mm, II: 7.8-8.9 mm.

Abdomen: Abdominal tergites brownish yellow, sternites 1-6 yellow, seventh sternite brown, eighth yellow with brown spot at middle. Male terminalia (Fig. 5B) yellow. Ninth tergite transverse, with wide median emargination of posterior margin.

Genitalia: Gonocoxite elongate, with large setose ventro-mesal lobe. Interbase long, slightly curved with long subapical setae. Outer gonostylus bidentate and blackened at apex. Inner gonostylus with long narrow apical lobe, that is situated at right angle to gonostylus itself. Postero-lateral margin of gonostylus with five teeth, distal-most tooth could be reduced. Usually inner gonostyles on both sides aren't exactly symmetrical. Penis narrow, rod-shaped and arched at middle, reaching slightly beyond base of ventro-mesal lobe of gonocoxite. Ninth sternite simple, posterior margin rounded.

Elevation range in Korea: All specimens were collect-

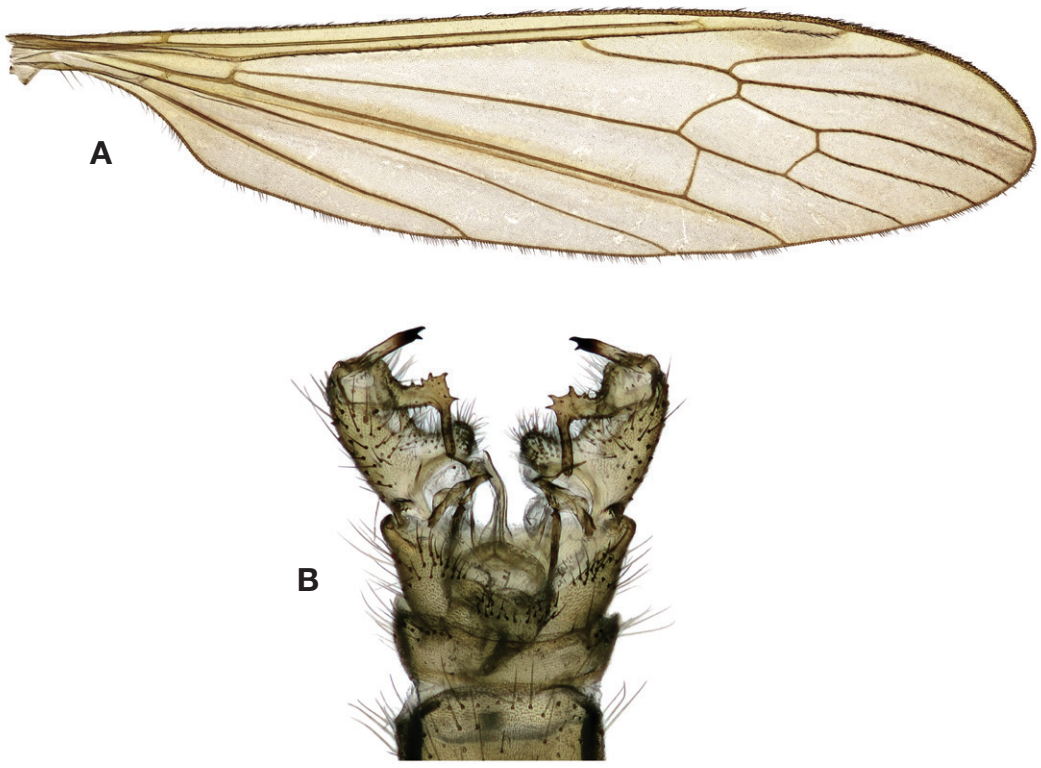


**Fig. 5.** *Helius* (*Helius*) *flavus*. A. wing. B. male genitalia, dorsal view.

ed at 30-40 m.

Period of activity in Korea: End of June through July. Same period of activity was observed in South Primorye, Far East of Russia (Savchenko, 1983).

Bionomics: Wet areas covered by deciduous trees, shrubs or grasses, muddy river, pond or lake margins. In South Korea it was found in only two localities near the demilitarized zone, and likely extends into North Korea.

Distribution: Species is widely distributed in Europe. In Asia it was known only from South Primorye, Far East of Russia (Savchenko, 1983).

Examined material: 1♂ (in EtOH, wing slide-mounted), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp, N 37°57′16.80″, E 126°40′47.92″, alt. 32 m, 2015.06.23, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR); 2♂♂ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeomwon-ri, South-MDL, N 37°56′3.53″, E 126°43′15.46″, alt. 39 m, 2015.07.03, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR); 3♂♂ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp, N 37°57′16.80″, E 126°40′47.92″, alt. 32 m, 2015.07.10, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR); 1♂ (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp, N 37°57′16.80″, E 126°40′47.92″, alt. 32 m, 2015.07.24, T.A. Klein, H.C. Kim, Mosquito Magnet (NIBR).

***Limonia* Meigen, 1803**

(characteristic in Podenas, Podeniene, 2017)

***Limonia episema* Alexander, 1924**

General: Male generally similar to female (Podenas, Podeniene, 2017). Body brownish yellow, 5.7 mm long.

Head: Dark brown. Antenna 1.5 mm long, 14-segmented. Both basal antennomeres brown, flagellomeres brown, first flagellomere with yellow basal third, second to fourth flagellomeres narrowly yellow at base. Basal flagellomeres oval, distal elongate. Longest verticils up to five times as long as respective flagellomere. Apical segment approximately 1.3 as long as preceding.

Thorax: Pronotum dark brown with yellowish posterior margin. Mesonotal prescutum semi-polished, brownish yellow, brown along frontal margin. Three brown longitudinal stripes less distinct than in female, disappearing towards posterior margin of sclerite. Scutal lobe brownish yellow with yellow postero-lateral angle. Scutellum pale yellow, mediotergite brownish yellow. Pleuron obscure yellow with brownish areas along middle and ventral part of episternum. Halter 1.7 mm long, stem pale with yellowish base and brownish distal part, knob brown with paler tip.

Wing: 9.1 mm long, distinctly reaches beyond tip of abdomen. Pattern more distinct than in female (Fig. 9 in Podenas, Podeniene, 2017).

Legs: Coxae brownish yellow, trochanter yellow. Femur yellow, distally with two distinct dark brown rings preceded by pale-yellow areas, middle of femur indistinctly darkened. Tibia yellowish brown, distal part darkened. Tarsus yellow basally, turning dark brown distally. Femur I: 5.1 mm, III: 5.8 mm; tibia I: 6.45 mm, II: 6.2 mm, III: 6.85 mm; tarsus I: 6.5 mm, II: 5.8 mm, III: 5.7 mm. Claw with three comb-like spines.

Abdomen: Yellowish brown, darkened laterally.

Genitalia: Male genitalia dark brown (Fig. 6A): Ninth tergite transverse with widely rounded posterior margin. Postero-medial part membranous. Gonocoxite elongate, subcylindrical, without ventro-mesal lobe. Gonostylus elongate, setose, slightly curved, getting narrower distally, blunt-apexed. Paramere (Fig. 6B) with extended sickle-shaped blunt-apexed distal part. Penis (Fig. 6C) wide at base, distinctly narrower at apex, reaching to about four-fifths of gonocoxite, with distinctly curved downwards distal part, bifid at apex.

Elevation range in Korea: 850 m to nearly 1,700 m.

Period of activity in Korea: Lasts whole June and July.

Bionomics (after Podenas, Podeniene, 2017): For North Korean specimens unknown. Yadamsuren *et al*. (2015) mentions that species develops in wet soils, Savchenko (1983) writes, that species is flying in mixed and coniferous woods.

Examined material: 1♂ (pinned), N. Korea, Seren Mts., alt. 2800 ft., June 22, 1938, A. M. Yankovsky (USNM).

Remarks: Original description (Alexander, 1924) was based on four females from Sakhalin Island (now the Far East of Russia), later males were found in Japan and continental Far East of Russia, but undescribed and not illustrated (Ishida, 1957; Savchenko, 1983).

***Limonia juvenca* Alexander, 1935**

Species previously not recorded from North Korea.

Examined material: 1♀ (pinned), N. Korea, Seren Mts., alt. 5500 ft., October 3, 1937, Yankovsky (USNM).

***Thrypticomyia* Skuse, 1890**

*Thrypticomyia* Skuse, 1890: 774; Savchenko, Krivolutskaya, 1976: 123; Savchenko, 1983: 115; 1989: 345.

Type species - *Thrypticomyia aureipennis* Skuse, 1890 (monotypic).

Genus previously not recorded from the Korean Peninsula.

General: Small crane flies, body length 5.0-6.0 mm.

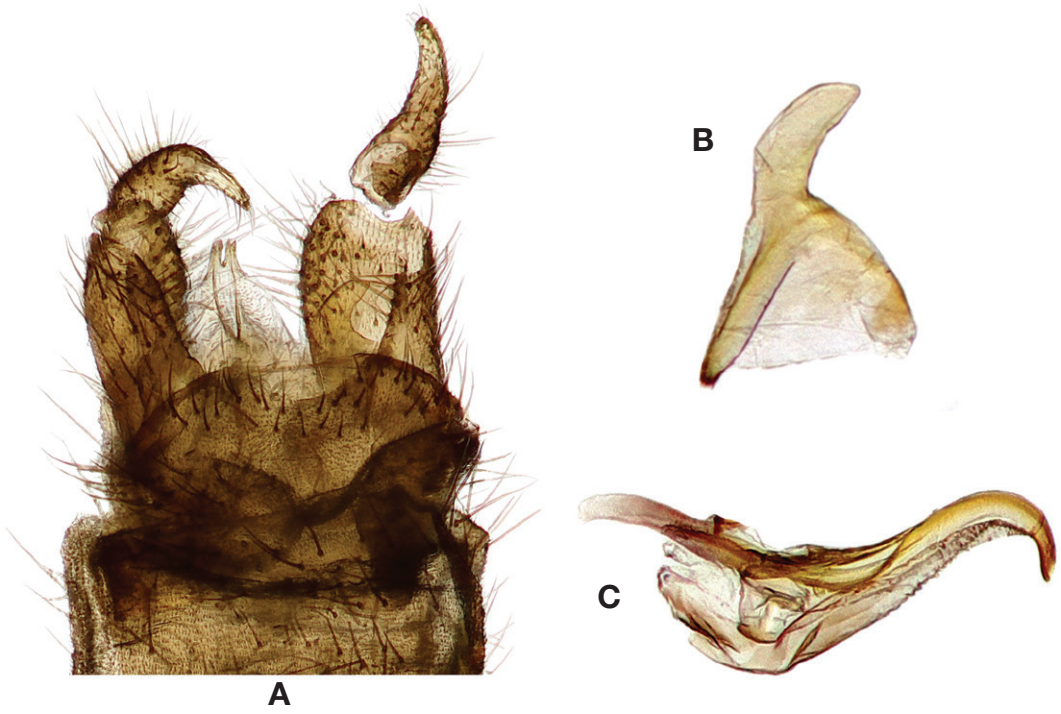


**Fig. 6.** *Limonia episema*. A. male genitalia, dorsal view. B. paramere. C. penis, lateral view.

Body yellow, brown to dark brown. Mesonotum gibbous.

Head: Eyes widely separated. Antena medium-long, nearly reaching wing base, if bent backwards.

Wing: Long and narrow, especially extended basal part. Humeral vein distinctly before arculus. *Sc* short, tip of $Sc_1$ reaching base of *Rs*. $Sc_2$ at or before tip of $Sc_1$. Radial sector long, arched at base. $R_1$ elongate, often with short branches. $R_2$ at right angle to $R_1$. Discal cell elongate. Basal deflection of $CuA_1$ at or beyond middle of discal cell. Longitudinal wrinkle beyond *Cu* (remains of $Cu_2$) totally missing. Anal lobe totally reduced.

Legs: Very long, tarsi white. Abdomen elongate.

Genitalia: Male genitalia with two pairs of gonostyles. Inner gonostylus rounded, fleshy with rostral appendage. Rostrum armed with two spines. Outer gonostylus narrow, arched, strongly sclerotised. Gonocoxite with very long ventro-mesal subapical lobe, that extends distinctly beyond gonostyles. Ovipositor with tenth tergite elongate. Cercus long and narrow, slightly arched. Hypovalva elongate, wide at base, distinctly narrower distally.

Elevation range in Korea: Sea level to nearly 1,700 m.

Period of activity in Korea: Beginning of June through September.

Bionomics: Mountainous river slopes covered by deciduous forests and shrubs.

Genus includes 38 species, 24 are recorded from Australia. Only one species in the Palearctic. Larva and pupa unknown.

***Thrypticomyia unisetosa unisetosa* (Alexander, 1929)**

*Thrypticomyia arcuata* Alexander, 1920: 4.

*Limonia* (*Thrypticomyia*) *unisetosa* Alexander, 1929: 248.

*Thrypticomyia unisetosa* Savchenko, Krivolutskaya, 1976: 123-124; Savchenko, 1983: 115; 1989: 345.

General: Body brown with yellow pleuron and white tarsi. Male body length 4.3-6.9 mm, female 4.1-5.0 mm.

Head: Dark brown to black dusted with gray, posterolateral margins indistinctly yellowish. Eyes widely separated dorsally. Antenna (Fig. 7A) 1.1-1.4 mm long in male, 1.0-1.3 mm in female, reaching slightly before wing base if bent backwards. Both basal segments yellowish brown, flagellum dark brown. Scape slightly longer than wider, pedicel subglobular, approximately as long as scape. Basal flagellomeres spindle-shaped with distinct apical pedicels, getting more elongate towards apex. Apical segment 1.7 times as long as preceding. Verticils arranged unilaterally, on 1-6 flagellomeres twice as short as respective segments, on 7-11 flagellomeres up to 1.8 times as long as respective segments. Rostrum grayish yellow, sparsely dusted with light gray. Basal palpomere yellow, remaining segments dark brown.

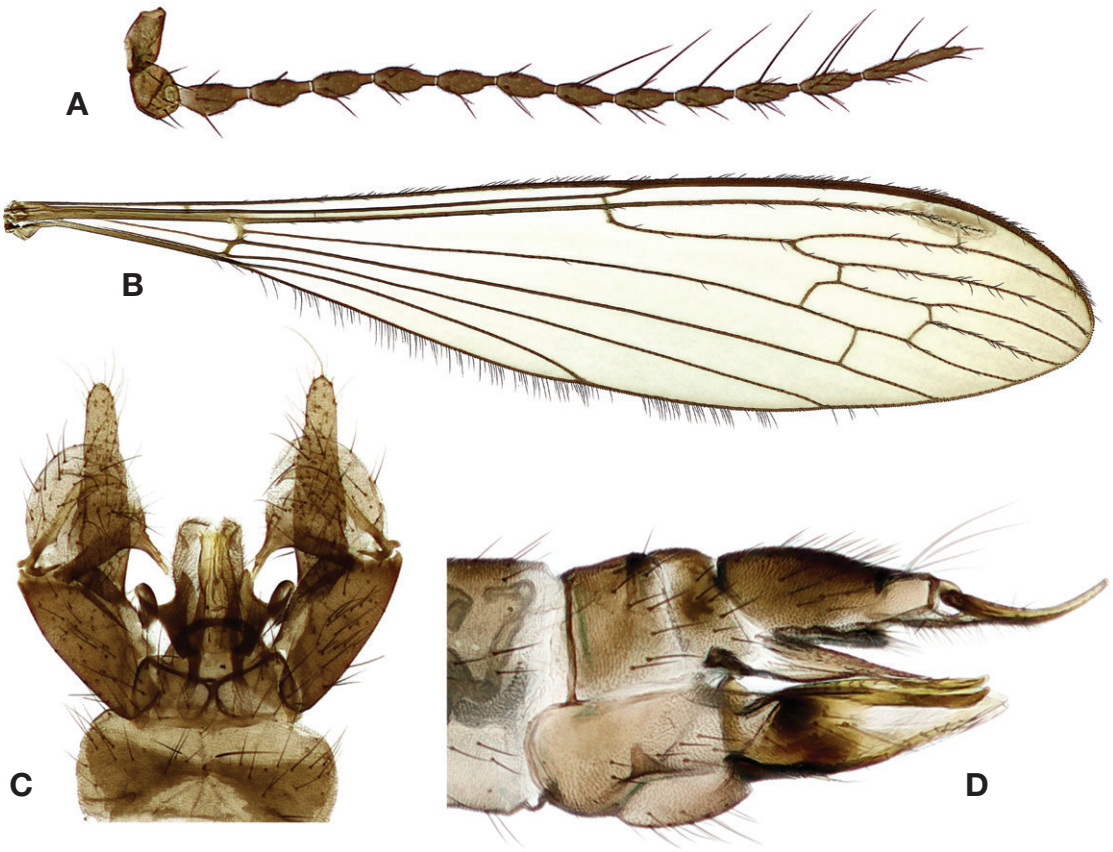


**Fig. 7.** *Thrypticomyia unisetosa unisetosa*. A. antenna. B. wing. C. male genitalia, dorsal view. D. ovipositor, lateral view.

Thorax: Cervical sclerites and pronotum dorsally dark brown, laterally pale brown to yellowish. Mesonotal prescutum polished, grayish brown without stripes, lateral margin and area around pseudosutural fovea yellowish. Scutal lobe concolorous, area separating scutal lobes paler. Scutellum and mediotergite yellowish gray. Pleuron light yellow, just katepisternum somewhat brownish yellow.

Wing (Fig. 7B): Length of male 5.3-7.3 mm, of female 4.4-6.2 mm. Hyaline, apex slightly darkened. Stigma oval, brown. Veins dark brown. Venation: *Sc* short, $Sc_1$ ending slightly beyond base of *Rs*. $Sc_2$ some distance from tip of $Sc_1$, at base of *Rs*. *Rs* long, arched or angulated at base. $R_1$ has no connection with C. $R_2$ transverse. $R_{4+5}$ distinctly arched. Cross-vein *r-m* distinct, distinctly beyond base of discal cell. Discal cell elongate, approximately 3.5 times as long as wide. Basal deflection of $CuA_1$ at middle of discal cell. First anal vein straight, second, slightly arched. Cell $a_2$ long and narrow, anal lobe missing. Halter black, stem pale brown at base. Length of male halter 0.9-1.3 mm, female 0.7-1.1 mm.

Legs: Coxae and trochanters pale. Femur dark brown with paler base. Tibia dark brown, paler at base indistinctly darker at apex. Tarsomeres white, just very base of first tarsomere brownish. Male femur I: 3.7-4.9 mm long, II: 3.8-5.7 mm, III: 4.2-6.2 mm, tibiae I: 4.5-7.2 mm, II: 4.6-6.2 mm, III: 4.9-7.3 mm, tarsus I: 3.8-6.6 mm, II: 3.7-5.4 mm, III: 3.6-5.6 mm. Female femur I: 3.3-3.8 mm, II: 3.7-4.4 mm, III: 4.0-4.9 mm, tibiae I: 4.5-5.2 mm, II: 4.1-4.9 mm, III: 4.2-5.2 mm, tarsus I: 4.0-5.2 mm, II: 3.7-4.0 mm, III: 3.4-4.3 mm. Claw dark brown.

Abdomen: Elongate. Tergites dark brown. Sternites brown.

Genitalia: Male terminalia (Fig. 7C) dark grayish brown. Ninth tergite transverse, widely concave at posterior margin. Gonocoxite elongate, with very long setose subapical ventro-mesal lobe directed caudad and extending beyond tips of gonostyles. Outer gonostylus long and narrow, strongly sclerotised, slightly arched at distal end. Inner gonostylus subglobular with narrow unarmed rostral lobe. Paramere with extended narrow postero-mesal angle. Penis long and narrow. Ninth sternite small simple, posterior margin rounded. Ovipositor (Fig. 7D) with tenth tergite dark brown, elongate. Cercus long and narrow, slightly arched, dark grayish brown. Hypovalva dark brown and wide at base, getting yellowish

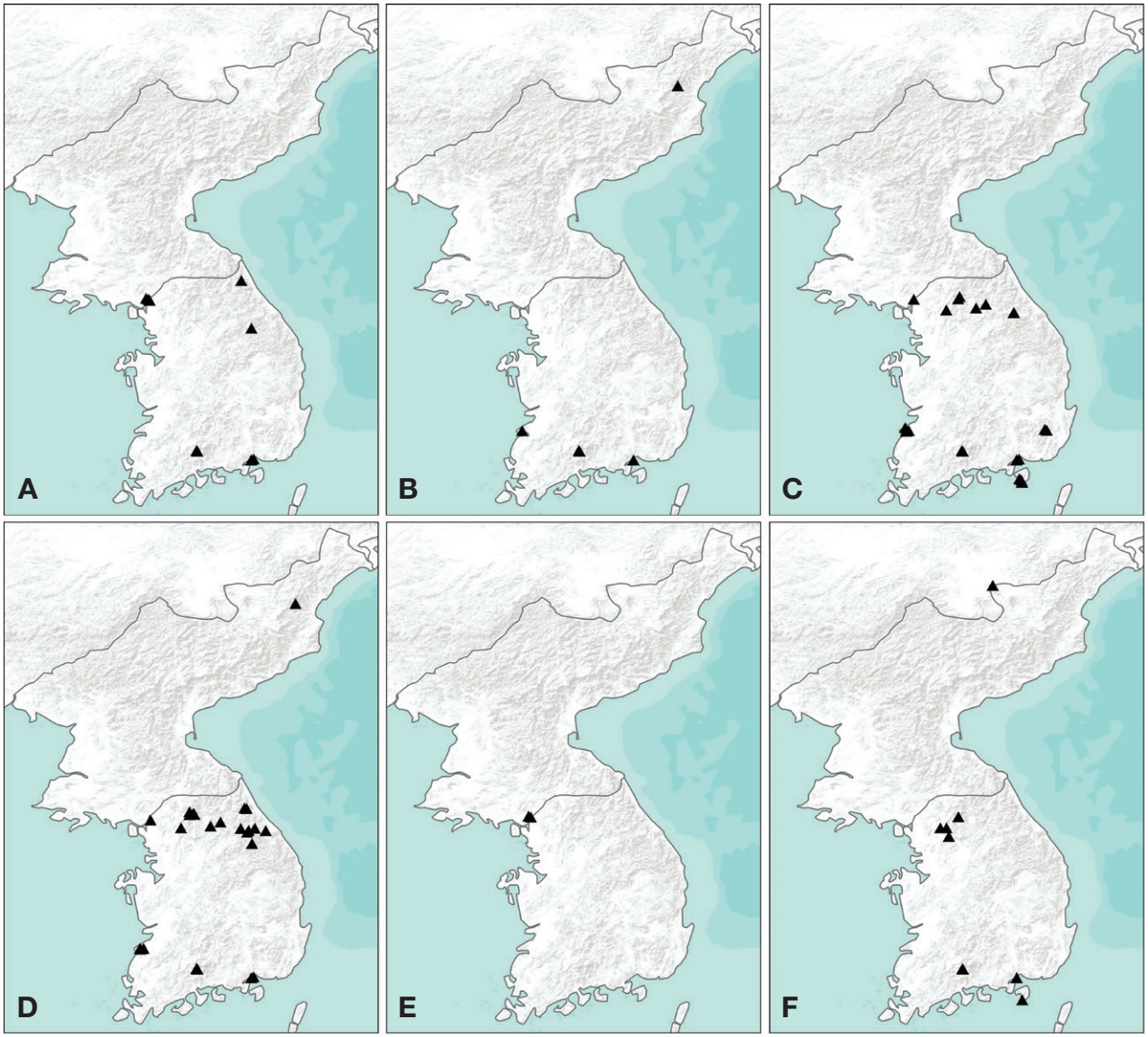


**Fig. 8.** Distribution maps. A. *Atypophthalmus* (*Atypophthalmus*) *crinitus*. B. *A.* (*A.*) *stylacanthus*. C. *A.* (*Microlimonia*) *inelegans*. D. *A.* (*M.*) *machidai*. E. *Helius* (*Helius*) *flavus*. F. *Thrypticomyia unisetosa unisetosa*.

and distinctly narrower distally, apex reaching to about one-third of cercus length.

Elevation range in Korea: Sea level to nearly 1,700 m.

Period of activity in Korea: Beginning of June through September.

Bionomics: Mountainous river slopes covered by deciduous forests and shrubs. Species is attracted to light. Note by Dr. G. W. Byers on label says, that this species can hang from spider web and likes medium-shaded places.

Distribution: Species is recorded from Far East of Russia, including Kurile Islands, Japan and Southeastern China, including Taiwan.

Examined material: metatype, male (slide-mounted), Japan, Kibune, October 21, 1928, Ex Tokunaga (USNM); 1 specimen of unclear sex, N. Korea, Pontani Paiktusan, alt. 5500 ft., VII-19, 1940, Yankovsky (USNM); 1♂, 1♀ (pinned), S. Korea, #17, Central National Forest, 18 miles NE of Seoul, alt. 350-500 ft., 20 June, 1954, G. W. Byers (USNM, SMEK); 2♂♂ (pinned), S. Korea, #20, 2 mi. S. Pup'yong-ni, 16 mi. NE Seoul, alt. 300-450 ft., 11 July, 1954, G. W. Byers (SMEK); 1♀ (pinned), S. Korea, #25, Central National Forest, 18 miles NE of Seoul, alt. 350-500 ft., 14 August, 1954, G. W. Byers (SMEK); 2♂, 2♀♀ (pinned), S. Korea, #35, Cheju-do [Jeju], Halla-san (volcano), alt. 1500 ft., 9 September, 1954, G.

W. Byers (SMEK); 1♂ (pinned), S. Korea, #39, Central National Forest, 18 miles NE of Seoul, alt. 350-500 ft., 26 September, 1954, G. W. Byers (SMEK); 1♀ (pinned), S. Korea, #40, 6 mi. E of Seoul, 30 September, 1954, G. W. Byers (U-M); 4♂♂ (pinned), S. Korea, Gyeongsangnam-do, Geoje-si, Nambu-myeon, Dapo-ri, Geojedo Island, N 34.72538, E 128.62608, alt. 52 m, 2014.08.30 (2), S. Podenas (NIBR); 2♂♂ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11149, E 128.53142, alt. 11 m, 2014.08.31 (1), S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11309, E 128.53067, alt. 20 m, 2014.08.31 (2), S. Podenas (NIBR); 1♂ (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Jindong-myeon, Dagu-ri, N 35.11149, E 128.53142, alt. 11 m, 2015.07.04, S. Podenas (NIBR); 1♀ (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri, Garim-gyo (Br.), GREC-F, 2015-VI-23 ~ 29, Malaise trap (KU); 5♂♂, 1♀ (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2016.06.03 (2), S. Podenas (NIBR); 1♀ (in EtOH, wing and antenna slide-mounted), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2016.06.03 (4), S. Podenas, at light (NIBR).

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