

## Antochini crane flies (Diptera: Limoniidae: Limoniinae) of Korea

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Korean species of Antochini crane flies (Diptera: Limoniidae) are taxonomically revised. Identification keys, redescriptions and illustrations of all species and both sexes are presented. *Antocha (Antocha) dentifera* Alexander, 1924, *Antocha (Antocha) dilatata* Alexander, 1924 and *Elliptera zipanguensis zipanguensis* Alexander, 1924 are listed as new records for the Korean peninsula; *Limnorimarga limonioides* (Alexander, 1945) as new for South Korea. Females of *A. (A.) dentifera*, *A. (A.) integra* Alexander, 1940 and *L. limonioides* are described for the first time.

Keywords: *Antocha*, *Elliptera*, *Limnorimarga*, North Korea, South Korea

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### INTRODUCTION

Four families of crane flies, Tipulidae, Limoniidae, Pediciidae and Cylindrotomidae, make up the superfamily Tipuloidea with over 15,000 described species worldwide (Oosterbroek, 2013). Crane flies constitute a significant portion of the entomofauna in wet and shady habitats (Pritchard, 1983). Adults, whether emerging from terrestrial or aquatic habitats, often congregate along aquatic environments. The larvae develop in wide range of habitats, with aquatic and semiaquatic species predominating. The adults are long-legged, slender-bodied flies. They are weak flyers and are usually found close to habitats where their larvae develop. Usually adult crane flies are non-feeding and short lived.

Because crane flies show a high ecological diversity and high endemism, they are useful in assessing habitat quality. Apart from individual species with fairly exacting ecological requirements, the richness of species characteristic of a habitat type is a useful indicator of habitat quality (Jong *et al.*, 2008).

Species belonging to the tribe Antochini constitute a small portion of the entire crane fly population in Korea, but are found in high numbers at the edges of fast running streams. They emerge early in April and are active through the whole summer.

Antochini crane flies are characterised by:

Antennae 16-segmented; flagellomeres simple, without branches. Prescutum without tubercular pits and hardly

expressed pseudosutural foveas. Tibiae without spurs. Wings well developed, usually longer than body. Wing membrane without macrotrichiae, wing squama hairless. Wing venation characterised by comparatively long vein *Sc*, reaching beyond base of *Rs*; radial sector with two branches; cell *m*<sub>1</sub> missing; discal cell present or absent. 9th sternite of male terminalia membranous, reduced and widely separated from 9th tergite, in rare cases fully developed as in most other Limoniinae crane flies. Gonocoxite bears one or two pairs of gonostyles.

Five species of Antochini, belonging to three genera were known from the Korean peninsula. Three species of the genus *Antocha* Osten Sacken: *Antocha (Antocha) bifida* Alexander, 1924 and *Antocha (Antocha) integra* Alexander, 1940 were known from South Korea (Torii, 1992b) and from North Korea (Alexander, 1938; 1940), *Antocha (Antocha) gracillima* Alexander, 1925 was known only from South Korea (Torii, 1992b). *Elliptera jacoti* Alexander, 1925 and *Limnorimarga limonioides* (Alexander, 1945) were known only from North Korea (Alexander, 1934; 1945).

### MATERIALS AND METHODS

The crane flies of South Korea presented in this paper were collected by W.Y. Choi, J.D. Yeo, J.D. Yoon and the author in 2008, 2009 and 2012 (Table 1). Most specimens were collected by sweeping with an insect net, some by Malaise traps and some by light trap. All specimens

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

Locality	Collector
Haanmi-ri, Daehwa-myeon, Pyeongchang-gun, Gangwon-do, Mt. Gariwangsan, N37.4583333, E128.5044444	W.Y. Choi <i>et al.</i>
Hoedong-ri, Jeongseon-eup, Jeongseon-gun, Gangwon-do, Mt. Gariwangsan, N37.4275000, E128.5319444	J.D. Yeo & J.D. Yoon
Jeollabuk-do province, Piagol village, Piagol valley, N35.26586, E127.58090	S. Podenas
Jeollabuk-do province, Mount Jiri National park, N35.26137, E127.60302	S. Podenas
Gyeongsangnam-do province, Samjeong village, N35.30246, E127.63439	S. Podenas
Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, N37.74010, E128.58360	S. Podenas
Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, N37.76607, E128.57730	S. Podenas
Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Ganpyeong-ri, N37.393866, E128.345114	S. Podenas
Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, near the entrance to Odaesan National Park, N37.71187, E128.60077	S. Podenas
Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.74913, E128.57723	S. Podenas
Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.74767, E128.57962	S. Podenas
Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.73920, E128.59398	S. Podenas
Nodong-ri, Yongpyeong-myeon, Pyeongchang-gun, Gangwon-do, Mt. Gyeongbansan, N37.727976, E128.46559 (coordinates approximate)	J.D. Yeo <i>et al.</i>
Jangjeon-ri, Jinbu-myeon, Pyeongchang-gun, Gangwon-do, Mt. Gariwangsan, N37.4877778, E128.5452778	J.D. Yeo & J.D. Yoon
Jeollanam-do province, Yeosu environs, Manseongni Black Sand Beach, N34.78094, E127.74765	S. Podenas

mentioned in this study are deposited in The National Institute of Biological Resources in Incheon, Republic of Korea (NIBR). The crane flies from North Korea, collected by A. Yankovsky, A. Jacot and G. Machida are deposited at the Smithsonian Institution, National Museum of Natural History, Washington, DC, USA (USNM).

The Holotype and the other type specimens of all species, except *Antocha dilatata*, were examined. Descriptions and redescriptions are based on Korean material only, except the female of *A. (A.) dilatata*, which was not seen by the Authors. Due to variation not all features, as well as sizes of Korean specimens are exactly identical with those mentioned in original descriptions and redescriptions based on specimens from other countries.

In descriptions, the terminology of morphological structures generally follows the “Manual of Central American Diptera” (Gelhaus, 2009). Illustrations and photographs are by the senior author. The taxonomic classification follows Oosterbroek (2013).

Specimens were studied with a Motic SMZ168TL compound microscope. SEM images were taken with a Quanta 250 microscope at the Laboratory of Bedrock Geology at Nature Research Centre, Lithuania. Specimens were measured through the camera using a Lumenera Infinity Analyze 1 mounted on Nikon SMZ800 and Nikon Eclipse E200 microscopes at the Department of Zoology at Vilnius University.

General distribution of species is given according Oosterbroek (2013).

#### Check list of Korean Antochini crane flies

- Antocha (Antocha) bifida* Alexander, 1924  
*Antocha (Antocha) dentifera* Alexander, 1924

- Antocha (Antocha) dilatata* Alexander, 1924  
*Antocha (Antocha) gracillima* Alexander, 1924  
*Antocha (Antocha) integra* Alexander, 1940  
*Elliptera jacoti* Alexander, 1925  
*Elliptera zipanguensis zipanguensis* Alexander, 1924  
*Limnorimarga limonioides* (Alexander, 1945)

#### Key to the genera of Korean Antochini crane flies

1. Discal cell of wing (*D*) closed (basal part of vein *M*<sub>3</sub> normally developed) ..... 2  
– Discal cell of wing (*D*) open due to atrophy of basal part of vein *M*<sub>3</sub> ..... *Elliptera* Schiner
2. Wing with big, nearly right-angled anal angle. Basal part of vein *CuA*<sub>1</sub> at or before base of discal cell (*D*) .....  
..... *Antocha* Osten Sacken  
– Wing with small and widely rounded anal angle. Basal part of vein *CuA*<sub>1</sub> beyond base of discal cell (*D*) .....  
..... *Limnorimarga* Alexander

#### *Antocha* Osten Sacken, 1860

- Antocha* Osten Sacken, 1859; Lackschewitz, 1940; Ishida, 1958; Alexander, 1968; Savchenko and Krivolutskaya, 1976; Savchenko, 1983; Torii, 1992b.  
*Taphrophila* Rondani, 1856; Edwards, 1938; Lackschewitz and Pagast, 1942; Tjeder, 1958; Hutson and Vane-Wright, 1969.

Type species - *Antocha saxicola* Osten Sacken, 1859

Small to medium-sized crane flies with wing length ranging from 3.5 to 9.5 mm. General body coloration from brownish-yellow to brown, gray or nearly black. Antenna simple, flagellomere with ring of verticils at base. The genus *Antocha* could be easily separated from others by

wing shape and venation. Wing generally wide with large, nearly right-angled cell  $a_2$ . Wing nearly translucent, usually whitish, sometimes darkened and usually spotless. Vein  $Sc$  very close to vein  $R$ ,  $Sc_1$  ends close to branching point of  $R$ s;  $Sc_2$  indistinct or absent;  $R_1$  elongate, but very close to frontal wing margin;  $R_2$  is situated beyond  $R_1$  tip, but very light; radial sector ( $R$ s) long and straight, usually starts before middle of wing; discal cell small, sometimes absent due to reduction of cross-vein  $mq$ ; basal section of  $CuA_1$  usually before branching point of  $M$ , but sometimes at, or beyond the branching point; vein  $A_2$  straight and relatively short. Prescutum without tubercular pits and pseudosutural foveas. Legs usually long and slender, usually covered with semi-erect hairs, sometimes wide and covered with strong, erect setae and short spines. Male terminalia slightly wider than rest of abdomen. Ninth tergite transverse, ninth sternite separated from tergite; gonocoxite elongate, cylindrical, often with rounded hairy mesal lobe; two pairs of terminal gonostyles. Lower pair of gonostyles usually darkened and strongly sclerotised; edeagal complex modified, with two or one pair of gonapophyses; penis large and usually with curved apex. Ovipositor with straight or slightly arched cercus, lower margin straight, but in some species saw-shaped.

There are 155 species belonging to the genus *Antocha* worldwide (Oosterbroek, 2013). They are grouped into three subgenera (*Antocha* Osten Sacken, 1860, *Orimargula* Mik, 1883 and *Proantocha* Alexander, 1919). The genus *Antocha* is known from most biogeographic regions, but is completely missing in South America. It is most diverse in Oriental Region, where it is represented by 74 species, with highest diversity and endemism in India, from where nearly third of all *Antocha* species are described (50 species). Oriental Region is followed by Palaearctic, which has 43 species. Additional seven species are shared between Palaearctic and Oriental. Nearctic is characterised by seven species, one of which is known also from Neotropics. 21 species are known from Afrotropics, two species from Australia and one species from Oceania (Papua New Guinea) (Table 2).

Body of *Antocha* larvae slender, tapering posteriorly, ending caudally in two elongate ventral lobes, which bear a few hairs at their tips and at intervals along their length. Abdominal segments II-VII each with ventral and dorsal creeping welts. Tracheal gills four in number, large, constricted into four lobes. Larvae apneustic, without spiracles, unique for *Antocha* among all crane flies. Head capsule moderate in size, compact and not reduced, what is typical for most of Limoniinae. Hypostoma with nine or ten teeth, deeply split posteriorly (Alexander, 1920; Oosterbroek and Theowald, 1991).

Pupal body large at the anterior end, tapering posteriorly. Head with a small median lobe frontally, a small tubercle on either side of it; genae gibbous. Pronotal breathing

**Table 2.** Distribution of genus *Antocha* (155 species worldwide).

Regions	Number of species
Oriental	74
Palaearctic	43
Palaearctic & Oriental	7
Nearctic	7
Afrotropics	21
Australia	2
Oceania	1
Totally	155

horns large, flattened, the margin branching into eight long filaments. Abdominal segments on basal ring with a double transverse row of small hooks which converge at the ends, last segment of body terminating in two strong, recurved, chitinized hooks (Alexander, 1920; Oosterbroek and Theowald, 1991). Larvae and pupae develop in fast running streams. They usually could be found in gravel or attached to the boulders (V. Podeniene, personal communication).

Two fossil species of *Antocha* are described: one from Oligocene deposits of North America (Evenhuis, 1994), the other, which preliminary was placed in this genus, from Early Cretaceous Burmese amber (Podenas and Poinar, 2009).

#### *Antocha* (*Antocha*) Osten Sacken, 1860

One hundred eleven species belong to nominative subgenus *Antocha* (*Antocha*) Osten Sacken (Oosterbroek, 2013). All Korean species also belong to subgenus *Antocha* (*Antocha*). Species belonging to subgenus *Antocha* (*Antocha*) are characterised by the combination of the following characteristics: wide wing, with large, right angled anal lobe and closed discal cell. Legs always long and slender, covered with short semi-erect setae. Cercus of ovipositor usually with smooth lower margin. Sometimes lower margin of cercus serrated, what was originally thought as unique feature only for subgenus *Antocha* (*Proantocha*). The highest diversity of species occurs in Oriental Region (59 species), with 44 species described from India alone. High diversity is in Eastpalaearctic (34 species), with highest diversity in Palaearctic part of China (16 species) and Japan with nine endemic species and additional four species shared with Far East of Russia and Korea. Seven species are shared between Oriental and Eastpalaearctic. Westpalaearctic has only two endemic species and two species, that are widely distributed also in Eastpalaearctic. Nearctic has seven species, with one of them (*A. monticola* Alexander, 1917) distributes as far south as Mexico, thus adding Neotropic element not only to subgenus, but also to the whole genus *Antocha*.

No fossil species, belonging to this subgenus are known so far.

**Key to Korean species of the  
subgenus *Antocha (Antocha)* Osten Sacken**

1. Wing with distinct dark brown stigma. Cercus of ovipositor longer than hypovalvae, tip rounded ..... *Antocha (Antocha) gracillima* Alexander, 1924
- Wing stigma light or totally missing. Cercus of ovipositor at most as long as hypovalvae, usually shorter, tip not rounded ..... 2
2. Outer gonostylus of male genitalia not branched. Cercus of ovipositor without ventro-apical angle. (Female of *A. (A.) dilatata* not sufficiently described) ..... 3
- Outer gonostylus of male genitalia with branch at the middle. Caudal margin of tergite 9 nearly straight, without extra lobes. Cercus of ovipositor with ventro-apical angle ..... *Antocha (Antocha) dentifera* Alexander, 1924
3. Caudal margin of male tergite 9 with extra lobes or bumps ..... 4
- Caudal margin of male tergite 9 smooth, without extra lobes or bumps ..... *A. (A.) dilatata* Alexander, 1924
4. Caudal margin of tergite 9 of male genitalia with two widely separated teeth, ventromesal surface of gonocoxite more or less smooth, without additional lobe, outer gonostylus with bifid apex. Lower margin of cercus smooth ..... *Antocha (Antocha) bifida* Alexander, 1924
- Caudal margin of tergite 9 of male genitalia with two closely situated bumps, dorsomesal surface of gonocoxite distinctly widened, outer gonostylus strongly widened at apex. Lower margin of cercus serrate ..... *Antocha (Antocha) integra* Alexander, 1940

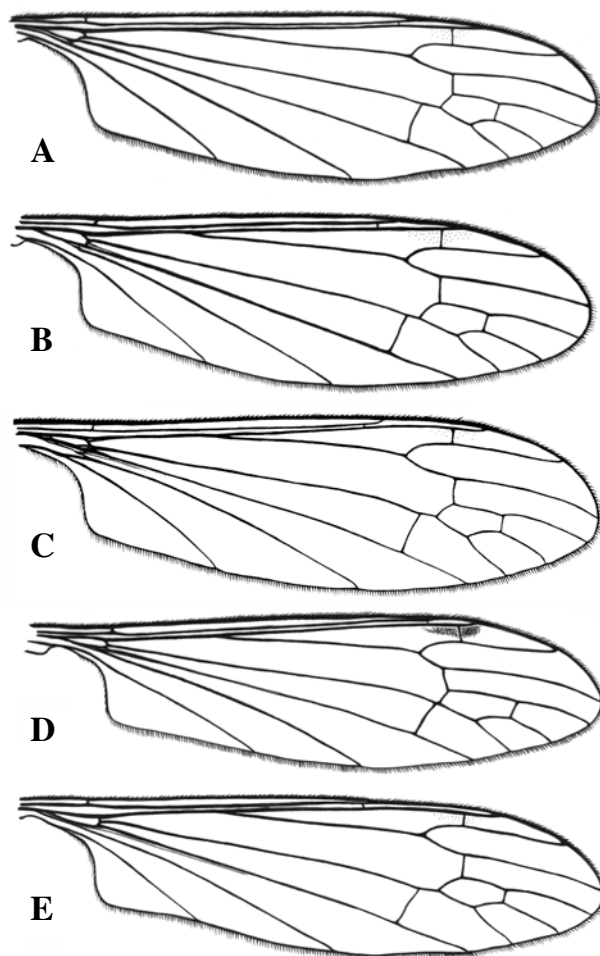
***Antocha (Antocha) bifida* Alexander, 1924**

Alexander, 1924: 562; Savchenko and Krivolutskaya, 1976: 111; Savchenko, 1983: 106; Lackschewitz, 1964: 716; Torii, 1992b: 167.

General coloration grayish yellow or gray. Body length of male 4.2 to 6.0 mm, female 5.5-6.4 mm. Wing length of male 5.3 to 7.0 mm, female 5.0-7.9 mm.

Head brownish gray, gray or dark gray, with clearer gray along the orbits. Length of male antennae 1.3-2.4 mm, that of female 1.2-1.5 mm. Scape light gray with yellowish base. Pedicel gray, but darker than scape. Flagellum: basal flagellar segments light gray or yellowish gray, distal segments darker than basal, usually dark brown. Basal segments oval, three distal segments elongate. Apical segment approximately as long as penultimate. Verticils shorter than respective segments, just slightly longer than whitish pubescence covering flagellomeres. Rostrum light gray or light brown, covered with scarce grayish pubescence. Palpus light gray or yellowish gray at base, brownish distally.

Thorax generally ochreous. Pronotal scutum brown,



**Fig. 1.** Wings of *Antocha (Antocha)*. A. *A. (A.) bifida*. B. *A. (A.) dentifera*. C. *A. (A.) dilatata*. D. *A. (A.) gracillima*. E. *A. (A.) integra*.

covered with gray pubescence. Mesonotal prescutum grayish yellow or gray with three confluent brown stripes. Median stripe broad with very narrow light median line, or this line completely missing. Mesonotal scutum brown with slightly lighter central part. Scutellum light gray with widely yellowish posterior margin. Mediotergite light gray, sometimes with darkened apex. Pleura reddish brown, slightly pruinose with gray. Wing (Fig. 1A) subhyaline, whitish. Stigma very light, nearly lacking. Stem of haltere light gray with yellowish base. Knob slightly darkened apically. Coxae yellow to yellowish brown, covered with gray pubescence. Trochanters yellow to yellowish brown. Femur obscure yellow. Tibiae obscure yellow. Tarsi obscure yellow at base passing into brown distally. Claw with a single, very slender subbasal spine.

Abdominal tergites dark brown, the caudal margins narrowly light yellowish gray. Tergites covered with sparse yellowish setae. Basal sternites grayish yellow, subterminal sternites brown with light yellowish gray caudal margins. Male genitalia (Fig. 2A) yellow. Oviposi-

tor (Fig. 3A) yellow, covered with erect whitish setae. Cercus long, narrow with upturned apex and smooth ventral margin. Cercus distinctly longer than hypovalvae. Tip of cercus (Fig. 3B) with very small hook. Hypovalvae (Fig. 3C) apically with abundant sharp triangle teeth.

**Period of activity.** Adults are flying from late April through late October in Korea.

**Habitat.** Adults are flying at edges of fast running small streams and medium-sized rivers with sandy or rocky bottoms. They are attracted to light.

**Distribution.** Known from Southern Siberia (Russia), Mongolia, North and South Korea, Japan, China and Philippines. Specimens are known to occur at altitudes from 50 m to 1500 m in Korea.

**Examined material.** 8♂♂, 1♀, North Korea, Ompo, altitude 200 feet (approximately 60 m), 1937.05.21, coll. A. Yankovsky; 1♂, North Korea, Ompo, altitude 250 feet (approximately 80 m), 1937.06.09, coll. A. Yankovsky; 4♂♂, North Korea, Ompo, altitude 650 feet (approximately 200 m), 1937.08.11, coll. A. Yankovsky; 2♂♂, 3♀♀, North Korea, Ompo, altitude 800 feet (approximately 250 m), 1937.09.22, coll. A. Yankovsky; 3♂♂, North Korea, Seren Mts., altitude 2500-3500 feet (approximately 750-1100 m), 1937.10.02-03, coll. A. Yankovsky; 4♂♂, North Korea, Seren Mts., altitude 2000-3000 feet (approximately 600-900 m), 1937.10.16, coll. A. Yankovsky; 3♂♂, 1 specimen (sex unclear, abdomen broken), North Korea, Ompo, altitude 150 feet (approximately 50 m), 1938.05.05, coll. A. Yankovsky; 4♂♂, North Korea, Ompo, altitude 700 feet (approximately 200 m), 1938.05.08, coll. A. Yankovsky; 1♂, North Korea, Seren Mts., altitude 4500 feet (approximately 1400 m), 1938.07.10, coll. A. Yankovsky; 1♂, North Korea, Kankyo Nando, Puksu Pyaksan, altitude 5000 feet (approximately 1500 m), 1939.08.03, coll. A. Yankovsky; 1♂, 1 specimen (sex unclear, abdomen broken), North Korea, Kankyo Nando, Puksu Pyaksan, altitude 5000 feet (approximately 1500 m), 1939.08.21, coll. A. Yankovsky; 1♂, Korea, 1959.08, Davis trap 8; 2♂♂, Korea, 1959.08, Davis trap 16; 1♀, South Korea, Haanmi-ri, Daehwa-myeon, Pyeongchang-gun, Gangwon-do, Mt. Gariwangsan, N37.4583333, E128.5044444, 2009.05.13-06.03, coll. W.Y. Choi *et al.*; Malaise trap; 1♀, South Korea, Hoedong-ri, Jeongseon-eup, Jeongseon-gun, Gangwon-do, Mt. Gariwangsan, N37.4275000, E128.5319444, 2009.06.04-06.17, coll. J.D. Yeo & J.D.; Malaise trap; 6♂♂, 4♀♀, South Korea, Jeollabuk-do province, Piagol village, Piagol valley, mountainous stream, N35.26586, E127.58090, altitude 448 m, 2012.04.27, coll. S. Podenas, entomological net; 1♀, South Korea, Jeollabuk-do province, Mount Jiri National park, small stream, N35.26137, E127.60302, altitude 431 m, 2012.04.29, coll. S. Podenas, entomological net; 10♂♂, 4♀♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dong-

son-ri, small stream, N37.74010, E128.58360, altitude 358 m, 2012.05.01, coll. S. Podenas, entomological net; 4♂♂, 7♀♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, small stream, N37.76607, E128.57730, altitude 801 m, 2012.05.01, coll. S. Podenas, entomological net; 1♂, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Ganpyeong-ri, N37.393866, E128.345114, altitude 560 m, 2012.05.02, coll. S. Podenas, entomological net; 5♀♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, near the entrance to Odaesan National Park, agricultural fields, N37.71187, E128.60077, altitude 633 m, 2012.06.22, coll. S. Podenas, at light. Also compared with determined specimens from adjacent regions including the Holotype, 1♂, Japan, Jozankei, Hokkaido, 1927.08.19, coll. Teiso Esaki; paratypes, 1♂, 1♀, 1 specimen (sex unclear, abdomen broken), Japan, Hamiotoinep pr., Hokkaido, 1922.08.24, coll. Teiso Esaki; paratype, 1♂, Japan, Hokkaido, Jozankei, 1922.08.19, coll. Teiso Esaki; metatype, 1♂, North Korea, Ompo, altitude 900 feet (approximately 300 m), 1937.10.28, coll. A. Yankovsky; allotype, 1♀, Japan, Gifu, 1920.10.02, coll. K. Takeuchi; metatypes, 2♂♂, 2♀♀, Japan, Shikoku, Omogo, altitude 700 m, 1932.05.10, coll. Ishikara; metatype, 1♂, S.E. China, Yin Na San, E. Kwantung, altitude 1800 feet (550 m), 1936.06.14, coll. G.L. Grassitt; metatype, 1♂, Japan, Wakayama, Kii, 1928, coll. S. Sakaguchi.

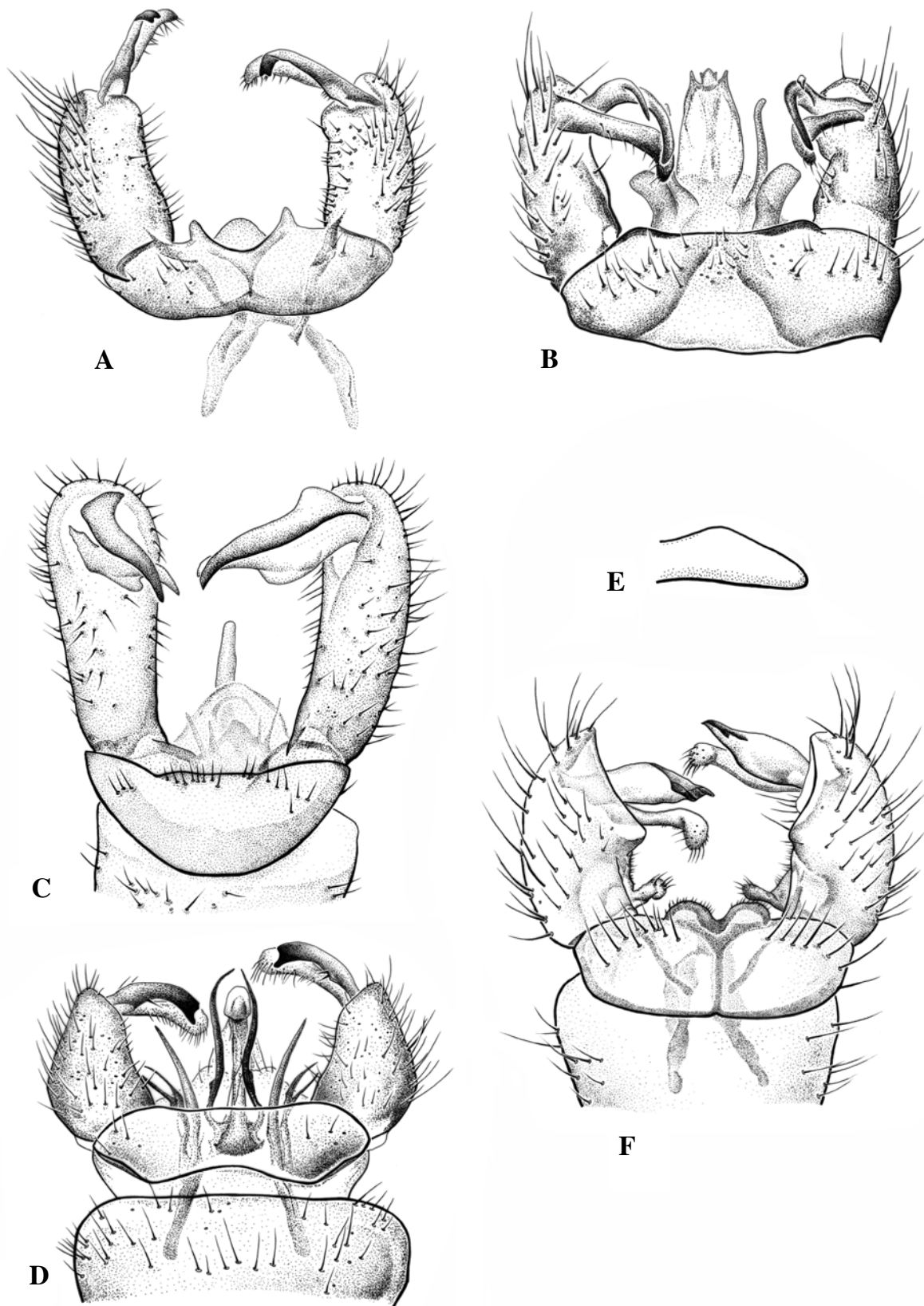
**Previous records for Korea.** 1♂, North Korea, Ompo, altitude 900 feet (about 275 m), 1937.10.28, coll. M. Yankovsky (Alexander, 1938); North Korea, Seren Mountains, altitude 3,000 feet (about 920 m), 1938.06.30, coll. M. Yankovsky (Alexander, 1940); 1♂, South Korea, Odaesanjang, Odaesan, Pyeongchang-gun, Gangwon-do, 1983.06.09, coll. S. Uchida (Torii, 1992b).

#### *Antocha (Antocha) dentifera* Alexander, 1924

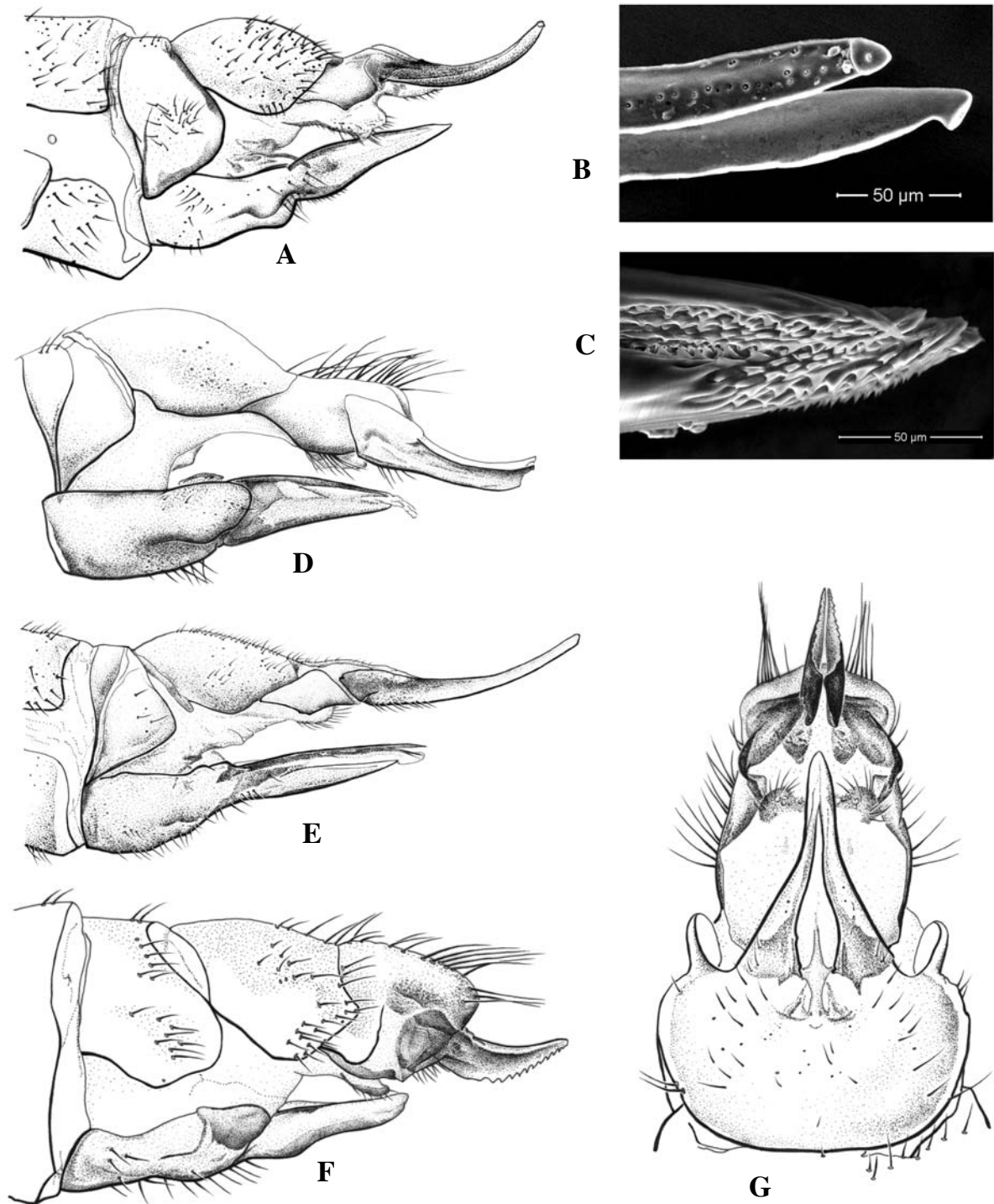
Alexander, 1924: 63; Alexander, 1969: 34; Ishida, 1957: 147; Torii, 1992b: 172.

General coloration of dry and alive specimens light gray. Specimens in ethanol turn brown. Generally females are lighter than males. Body length of male 3.2-5.0 mm, body length of female 5.5-6.2 mm. Wing length of male 3.5-6.5 mm, wing length of female 6.3-6.6 mm.

Head brownish gray, clearer gray along the orbits, covered with sparse setae. Antenna light brown to brown. Length of male antennae 0.7-0.8 mm, female 0.8-1.6 mm. Antenna short in both sexes, reaching only frontal margin of prescutum, if bent backwards, far not reaching base of wing. Scape yellow with brownish apex, pedicel dark brown, flagellum brown, composed of 14 oval flagellomeres. Verticils approximately as long as respective segments. Rostrum of male grayish brown, covered with



**Fig. 2.** Male genitalia of *Antocha (Antocha)*. A. A. (A.) *bifida*. B. A. (A.) *dentifera*. C. A. (A.) *dilatata*. D. A. (A.) *gracillima*. E. A. (A.) *integra*, outer gonostylus, posterior view. F. A. (A.) *integra*. A, B, C, D, F. dorsal view.



**Fig. 3.** Ovipositor of *Antocha* (*Antocha*). A. A. (*A.*) *bifida*. B. A. (*A.*) *bifida*, tip of cercus. C. A. (*A.*) *bifida*, distal part of hypovalvae. D. A. (*A.*) *dentifera*. E. A. (*A.*) *gracillima*. F. A. (*A.*) *integra*. G. A. (*A.*) *integra*, ventral view. A, D, E, F. lateral view.

sparse setae, rostrum of female yellow. Palpus of male brown to dark brown, that of female grayish.

Thorax generally brown. Pronotal scutum brown dorsally, yellowish laterally. Mesonotal prescutum pale obscure gray with three rather indistinct brown stripes.

Mesonotal scutum light gray, brown, when submerged in ethanol, with distinct yellow spots at bases of wings. Scutellum greyish brown with indistinct yellowish median line. Mediotergite brown basally and dark brown distally. Pleura gray with brown spots. Wing (Fig. 1B) sub-

hyaline, tinged with gray, whitened at base. Vein *Sc* short, ends some distance before fork of *Rs*. Stigma scarcely indicated, pale brown. Haltere pale, the knob brownish. Coxae testaceous, very sparsely pruinose. Trochanters pale yellow to testaceous. Femur of male dark brown, femur of female brownish with yellowish base. Tibiae of male dark brown, tibiae of female brownish yellow. Tarsi of male dark brown, tarsi of female brownish with yellow base of basal segment. Claw with a single subbasal spine.

Abdomen of male brown, of female pale brown. Abdominal tergites pale brown, sternites pale brown, basal sternites somewhat lighter. Male genitalia as in Fig. 2B. Outer gonostylus of male hypopygium with an acute chitinized spine on the lateral face immediately before midlength. Ovipositor (Fig. 3D) generally brown, cercus rusty brown, smooth ventrally, distal end obliquely truncated and weakly gauged, acute in extreme dorsal tip, bearing obtuse ventro-apical angle. Hypogynial valvae yellowish, moderately chitinized, tip with fleshy extension.

**Flight period.** lasts from early April through second ten-day period of August in Korea. Active from beginning of June through end of August (Savchenko and Krivolutsкая, 1976) in Russia.

**Habitat.** small to medium sized mountainous streams with rocky bottoms and covered with deciduous or mixed forests.

**Distribution.** Described from Japan (Honshu island) (Alexander, 1924), later discovered in Sakhalin and Kuril islands (Russia) (Savchenko and Krivolutsкая, 1976). Collected from the elevation 300-750 m in Korea.

**Examined material.** 1 ♂, 1 ♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.74913, E128.57723, altitude 726 m, 2012.06.22, coll. S. Podenas, entomological net; 1 ♂, 4 ♀ ♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.74767, E128.57962, altitude 733 m, 2012.06.22, coll. S. Podenas, entomological net. Also compared with the Japanese specimens including the Holotype, 1 ♂, Japan, Mt. Takao[san], altitude 1000-2000 feet (approximately 300-600 m), 1922.05.07, coll. Teiso Esaki; paratype, 1 ♂, Japan, Mt. Takao, 1923.04. 13, coll. T. Esaki; metatype, 1 ♂, Japan, Korokawa, Echigo, 1954.05.18, coll. Kintaro Baba; metatype, 1 specimen with broken abdomen, Japan, Korokawa, Echigo, 1954.08.18, coll. Kintaro Baba; metatype, 3 ♂ ♂, Japan, Korokawa, Echigo, 1955.05.02, coll. Kintaro Baba.

**Notes.** First record for Korean peninsula. Four females were mentioned from the southern Kuril Island (Savchenko and Krivolutsкая, 1976), but their morphology was not described. Korean specimens generally are bigger than those collected in Japan (compared with data from Torii, 1992b).

***Antocha (Antocha) dilatata* Alexander, 1924**

Alexander, 1924: 566; Savchenko, 1983: 106; Torii, 1992b: 174.

General coloration brownish grey. Male body length, 4.5-5.7 mm, female about 6 mm. Male wing length 4.6-6.6 mm, female 6.5-7.0 mm.

Head dark brown, covered with light gray pruinosity, which especially intense on genae. Male antenna 0.9-1.3 mm long. Scape and pedicel light gray covered with scarce gray pruinosity. Flagellum light brown or yellowish brown at base passing into brown apically. Verticils shorter than respective segments. Flagellomeres covered with dense whitish pubescence. Rostrum brown to dark brown. Palpus brown to dark brown.

Thorax brown, but densely covered with light gray pruinosity. Pronotal scutum grayish brown with narrow yellowish brown posterior margin. Mesonotal praescutum dull gray with three brown stripes, which could be hardly visible through pruinosity. Central stripe wide with indistinct lighter median line and somewhat lighter lateral margins. Few short setae situated between stripes. Mesonotal scutum light gray, central parts of lobes slightly darkened. Scutellum uniformly light gray. Mediotergite light gray with slightly darkened posterior portion. Pleura brown beneath dense gray pruinosity. Ventral part of katepisternum indistinctly blackened. Wing (Fig. 1C) subhyaline or whitish subhyaline, veins light brown, yellowish at wing base. Stigma indistinct. *Sc* short, *Sc*<sub>1</sub> ending some distance before fork of *Rs*; basal deflection of *CuA*<sub>1</sub> some distance before fork of *M*. Haltere with yellowish brown base, whitish stem and light brown knob. Coxae brownish yellow, fore coxa gray pruinose frontally. Trochanters brownish yellow. Femora brownish yellow, covered with dense semi-erect light setae. Tibiae light brown. Basal tarsomere light brown, terminal segments brown. Claw of male with setiferous subbasal teeth.

Abdomen grayish brown. Abdominal tergites grayish brown with narrow whitish posterior margins. Sternites lighter than tergites, rusty gray with narrow whitish posterior margins. Male genitalia (Fig. 2C): gonocoxite relatively long but stout, conspicuously rusty yellow, long, erect golden setae uniformly distributed; outer gonostylus tapering gradually to the gently curved, subacute blackened apex; inner gonostylus conspicuously dilated on inner margin at base. Parameres short, appearing as rather broad flattened blades. Aedeagus slender, sides at base weakly setiferous. Ovipositor undescribed and not illustrated.

Type specimens include females, but they are not described or illustrated.

**Flight period.** lasts from early May through middle of August.

**Distribution.** Known from Japan and Far East of Rus-



sia. Collected from the elevation up to 200 m in Korea.

**Examined material.** 1♂, North Korea, Ompo, altitude 200 feet (approximately 60 m), 1937.05.21, coll. A. Yankovsky; 2♂♂, North Korea, Ompo, altitude 650 feet (approximately 200 m), 1937.08.11, coll. A. Yankovsky; 1♂, North Korea, Ompo, altitude 700 feet (approximately 200 m), 1938.05.08, coll. A. Yankovsky.

**Note on biology.** Species is attracted to light (Savchenko, 1983).

***Antocha (Antocha) gracillima* Alexander, 1924**

Alexander, 1925a: 67; Alexander, 1954: 289; Savchenko and Krivolutsкая, 1976: 111; Savchenko, 1983: 106; Torii, 1992b: 175.

General coloration brownish gray, but some specimens are obscure yellow. Body length of male 4.2-6.0 mm, that of female 6.7-8.8 mm. Wing length of male 5.0-8.0 mm, of female 7.1-9.3 mm.

Head dark brown, pruinose, especially densely pruinose frontally. Antenna brown, dark brown or black. Length of male antennae 1.5-1.8 mm, if bent backward extending slightly beyond wing base. Length of female antenna 2.1-2.6 mm. Both basal segments dark brown. Basal flagellar segments elongate, becoming shorter towards apex. Flagellum covered with dense whitish pubescence. Verticils shorter than respective segments, just slightly extending beyond pubescence. Rostrum yellowish brown to brownish black in some individuals. Palpus dark brown to brownish black.

Thorax covered with pruinosity. Pronotal scutum yellowish brown to dark brown, laterally yellowish. Mesonotal prescutum yellowish brown, brownish gray, brown or dark brown, slightly paler laterally and with three hardly distinguishable dark brown longitudinal stripes. The middle stripe nearly reaches frontal margin of prescutum, where it becomes wider. Mesonotal scutum slightly darker than prescutum, brown to dark brown, paler laterally. Scutellum brown to dark brown with indistinct narrow yellowish median line which fades posteriorly. Often median line totally missing. Mediotergite brown to dark brown, sometimes with indistinct lighter lateral spots. Laterotergite reddish brown with dark brown markings. Pleura generally brown and vaguely pruinose, dorsally paler. Wing (Fig. 1D) grayish subhyaline, whitened basally. Stigma distinct, dark brown with fuzzy margins. Stem of haltere light gray, base yellowish, knob darkened distally. Coxae yellow to brownish testaceous, mesal surfaces lighter. Frontal pair darkened except distal part. Trochanters obscure yellow to yellowish brown. Femur light brown with yellow to yellowish brown base. Specimens in ethanol could have faded entirely yellow femorae. Tibiae brown. Tarsus brown basally turning dark brown distally. Claw with a single subbasal spine.

Abdomen yellowish brown to dark brown. Basal abdominal tergites reddish brown, distal tergites dark brown. Basal abdominal sternite brown, second and third sternites yellowish with darkened posterior margin, remaining sternites dark brown. Male genitalia (Fig. 2D) reddish brown. Outer gonostylus distinctly darkened, bearing apical tooth. Ovipositor (Fig. 3E) with cercus long and narrow, distinctly longer than hypogynial valvae, smooth ventrally, distal end rounded.

**Flight period.** lasts from late April through early August in Korea.

**Habitat.** Adults are flying at edges of fast running medium-sized rivers with rocky bottoms. They are also attracted to light.

**Distribution.** Described from Japan (Alexander, 1924), later found in Far East of Russia (Savchenko, 1983) and South Korea (Torii, 1992b). Collected from the elevation 200-800 m in Korea.

**Examined material.** 6♂♂, 1♀, South Korea, Jeollabuk-do province, Piagol village, Piagol valley, mountainous stream, N35.26586, E127.58090, altitude 448 m, 2012.04.27, coll. S. Podenas, entomological net; 2♂♂, 2♀♀, South Korea, Gyeongsangnam-do province, Samjeong village, swift rocky stream, N35.30246, E127.63439, altitude 640 m, 2012.04.28, coll. S. Podenas, entomological net; 1♂, South Korea, Gangwon-do province, Odaesan National Park, N37.73920, E128.59398, altitude 794 m, 2012.06.22, coll. S. Podenas, entomological net; 1♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, near the entrance to Odaesan National Park, agricultural fields, N37.71187, E128.60077, altitude 633 m, 2012.06.22, coll. S. Podenas, at light. Also compared with the Japanese specimens including the Holotype, 1♂, Japan, Mt. Wakasugi, Chikuzen, Kiushiu, 1924.05.19, coll. H. Hori; metatype, 1♂, Japan, Kyushu, Sobosan (Bungo), 1931.08.02, coll. K. Yasumatsu; metatype, 1♂, Japan, Mt. Daisen, Hoki, 1931.07.02, coll. Tokunaga; metatype, 1♂, Japan, Mt. Daisen, Tottori, Honshu, 1931.07.21, coll. Tokunaga; metatype, 2♂♂, Japan, Shikoku, Omogokei, altitude 800 m, 1952.07.28, coll. Ishihara; metatype, 1♂, Japan, Shikoku, Sugitate Iya, 1953.04.27, coll. K. Baba; metatype, 1♂, Japan, Kurokawa, Echigo, 1954.06.08, coll. Kintaro Baba; metatype, 1 specimen with broken abdomen, Japan, Kurokawa, Echigo, 1954.06.10, coll. Kintaro Baba; metatype, 1♂, Japan, Kurokawa, Echigo, 1955.04.27, coll. Kintaro Baba; metatype, 1♂, Japan, Kurokawa, Echigo, altitude 200 m, 1955.07.12, coll. Kintaro Baba.

**Previous records for Korea.** 1♂, South Korea, Sesokpyongjon, Jiri-san, Hamyang-gun, Gyeongsangnam-do, 1983.06.05, coll. S. Uchida (Torii, 1992b).

**Note.** Korean specimens generally are bigger than those collected in Japan (compared with data from Torii, 1992b).

***Antocha (Antocha) integra* Alexander, 1940**

Alexander, 1940: 43; Savchenko, 1983: 106; Torii, 1992b: 177.

General body coloration yellowish. Body length of male 4.7-7.1 mm, female 5.2-6.3 mm. Wing length of male 4.9-7.5 mm, female 5.3-6.9 mm.

Head generally light gray to brown, posterior part obscure yellow. Male antennae 1.3-1.4 mm long, female antennae 1.5-1.9 mm long. Male antenna brown, female antenna somewhat lighter. Scape and pedicel of male antenna yellow above, darker beneath, scape of female yellow, pedicel yellow at base, brownish distally. Male flagellum black, female flagellum brown. Antennae bears 14 flagellomeres, which are oval, clothed with a conspicuous white pubescence. Distal flagellomeres elongate. Verticils approximately as long as respective segments. Rostrum yellow. Palpus black.

Thorax yellowish. Pronotal scutum darkened medially, sides yellow. Mesonotal prescutum yellowish, darkened medially in front, but virtually immaculate behind. Mesonotal scutum whitish yellow. Scutellum whitish. Mediotergite slightly darker than scutellum, yellowish, with remnants of indistinct dark median line. Pleura yellow. Anepisternum and katepisternum testaceous. Wing (Fig. 1E) whitish subhyaline. Prearcular region milky white. Veins brown and distinctly visible against whitish membrane. Stigma pale, scarcely differentiated. Haltere with light, grayish yellow stem and just little darkened knob. Coxae pale yellow to testaceous yellow. Frontal pair darker than second and third. Anterior surface of frontal and middle coxae tinged with brown. Trochanters pale yellow to yellow. Femur of male brown, dark brown or black with restrictedly brightened base. Femur of female yellowish brown. Tibiae of male light brown, tibiae of female yellow. Tarsus with basal segment light brown and succeeding segments dark brown. Claw with a single very slender subbasal spine.

Male abdomen light brown, distal segments dark brown. Female abdomen obscure yellow with slightly infuscated posterior margins of tergites and sternites and with indistinct remains of lateral and dorsal stripes. Male genitalia (Fig. 2E, F) brownish yellow. Ovipositor (Fig. 3F, G) reddish brown. Cercus serrated ventrally, sternite 8 bearing a pair of latero-caudal processes.

**Flight period.** lasts from late May through middle of July in Korea.

**Habitats.** adults are flying at margins of medium sized, fast running mountainous rivers.

**Distribution.** Known from Far East of Russia and Korea.

**Examined material.** Holotype, 1♂, North Korea, Ompo, altitude 800 feet (approximately 250 m), 1938.07.13, coll. A. Yankovsky; 2♀♀, North Korea, Ompo, altitude 150 feet (approximately 50 m), 1937.06.07, coll. A. Yankov-

sky; 1♂, North Korea, Ompo, altitude 600 feet (approximately 180 m), 1937.06.23, coll. A. Yankovsky; 2♀♀, North Korea, Seren Mts., altitude 2500-3000 feet (approximately 760-900 m), 1938.06.30, coll. A. Yankovsky; 1♀, North Korea, Seren Mts., altitude 4500 feet (approximately 1400 m), 1938.07.10, coll. A. Yankovsky; 1♀, North Korea, Ompo, altitude 800 feet (approximately 240 m), 1938.07.13, coll. A. Yankovsky; 2♂♂, 2♀♀, North Korea, Seren Mts., altitude 3500-4000 feet (approximately 1100-1200 m), 1938.07.15, coll. A. Yankovsky; 4♀♀, North Korea, Seren Mts., altitude 3000 feet (approximately 900 m), 1938.07.16, coll. A. Yankovsky; 1♀, North Korea, Kankyo Nando, Puksu Pyaksan, altitude 5000 feet (approximately 1500 m), 1939.06.08, coll. A. Yankovsky; 1♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.74913, E128.57723, altitude 726 m, 2012.06.22, coll. S. Podenas, entomological net; 32♂♂, 7♀♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.74767, E128.57962, altitude 733 m, 2012.06.22, coll. S. Podenas, entomological net.

**Previous records for Korea.** 16♂♂, South Korea, Samjong, Gayasan, Hapchon-gun, Gyeongsangnam-do, 1983.05.25-26, coll. S. Uchida (Torii, 1992b).

**Discussion.** *Antocha integra* was originally described from male specimen collected in North Korea (mountain Ompo). Later species was found in South Korea (Torii, 1992b), but again only males were collected. One male was also collected in the Far East of Russia by Savchenko (Savchenko, 1983). No females were known so far. Original description of subgenus *Antocha (Proantocha)* Alexander, 1919 was based only on male characters. The most distinctive feature of *Proantocha* being opposable tubercles at tip of femur and base of tibia on hindlegs. Subgenus *Antocha* has none of them. Later Alexander (1924) added description of females belonging to the subgenus *Proantocha*. According to him, *Proantocha* females have serrated ventral margin of cercus, at the moment, when females of subgenus *Antocha* have smooth ventral margin of cercus. Later Torii (1992a; 1992b) described *Antocha latistilus* and found females of *A. sagana* Alexander, 1932, males of which have simple posterior legs, but females have serrated ventral margin of cercus. To solve the confusion, Torii proposed, that females of subgenus *Antocha* also could bear serrated ventral margin of cercus, but in addition to that, sternite 8 of females has latero-caudal processes, which are absent in *Proantocha*.

*Antocha* crane flies are specialized for developing in fast running water. Differently from other crane flies, they spent their entire life submerged. Their respiratory system is completely closed. Female ovipositor is also an adaptation for such life conditions of larvae, because

eggs should be laid differently than by other crane flies. We noticed, that at least all Korean *Antocha* females could be easily separated because of species-specific structure of their ovipositors. At the moment, there are only two species belonging to *Proantocha* (*A. spinifer* Alexander, 1919 and *A. uyei* (Alexander, 1928)) and three species belonging to subgenus *Antocha*, but having serrated cerci (*A. integra* Alexander, 1940, *A. latistilus* Torii, 1992, and *A. sagana* Alexander, 1932). Not only serrated cercus, but the whole structure of ovipositor in these species is different from typical of *Antocha* (*Antocha*) and is similar to that of *Proantocha*, suggesting, that they have similar adaptations for laying eggs in fast running water and, most probably, similar adaptations of larvae. In this case, larval morphology would be more helpful for separation of subgenera, and we would expect, that *A. integra* Alexander, 1940, *A. latistilus* Torii, 1992 and *A. sagana* Alexander, 1932 to be moved to *Proantocha*.

### ***Elliptera* Schiner, 1863**

*Elliptera* Schiner, 1863; Edwards, 1938; Lackschewitz and Pagast, 1942; Ishida, 1958; Savchenko and Krivolutskaya, 1976; Savchenko, 1983.

Type species - *Elliptera omissa* Egger, 1863

Small genus of medium-sized crane flies (wing length from 5.5 to 9 mm). Body usually brown, sometimes yellowish gray. Flagellum beaded. Prescutum without tubercular pits and pseudosutural foveas. Wing well developed, translucent without dark markings or with smoky edging on cord, anal angle widely rounded. Wing venation: vein *Sc* long, *Sc*<sub>1</sub> nearly reaching branching point of *Rs*; *Sc*<sub>2</sub> far from *Sc*<sub>1</sub> tip, before base of *Rs*; radial sector long and straight, situated very close to *R* and nearly parallel to it; *R*<sub>2</sub> light, thus nearly invisible, situated some distance beyond fork of *Rs*, discal cell open due to the atrophy of basal part of *M*<sub>3</sub>; basal section of *CuA*<sub>1</sub> close to the branching point of *M*. Male terminalia large; ninth tergite transverse; ninth sternite could be well developed or reduced; gonocoxite elongate with two terminal gonostyles; penis straight and short. Ovipositor elongate and sclerotised; cercus with apex strongly bent upwards.

There are 10 species belonging to the genus. All are distributed in Holarctic Region except one subspecies, which is known from Taiwan (Oosterbroek, 2013). Two species are known to occur in Korean peninsula.

Larval body is distinctly depressed, greenish white, scarcely shiny, with delicate appressed grayish hairs which are thicker at both ends of the body, especially on last segment, where they become almost villous. Integument very transparent. Creeping welts are on dorsal and ventral part on 3-9 abdominal segments. Spiracular field with four lobes whose inner part are narrowly lined with black sclerite; lobes are provided with lashes of long gray

hairs; dorsal lobes shorter and broader and bearing on their inner part two elongate spiracles. Head capsule is massive, slightly longer than broad, black. All sclerites compact and closely united; anterior projecting part of capsule with margins transparent, rusty brown; median part with two small knobs, laterally of which are two larger projections which are crowned with short points; capsule weakly keeled behind on dorsum, anterior to which are two swollen elevations. Labium strongly chitinized, triangular, split longitudinally. Mandible is claw-like in appearance, a little smaller than either half of labium, on inner face with a chitinized projection, which is serrated. Larvae live in silken tubes and occur on the wet walls of wooden chutes or runways and also on dripping chalk cliffs (Alexander, 1920).

Pupa has pronotal breathing horns large, ear-shaped, bright yellowish white in color, in contrast to dirty yellowish brown skin of head, thorax, and appendages. Each horn consists of two parts: the dorsal side, appearing smooth and homogeneous; the ventral side with two longitudinal furrows converging toward apices, and with abundant elongate tubercles. Margin of breathing horn chitinized and very finely notched. On outer basal part of each ear a parchment-like lobe, which joins ear to side of prothorax; in addition to this, each ear at base is drawn out into an almost rectangular lobe, which is closely approximated to pronotum. Leg sheaths extending about to base of fifth abdominal segment. Abdomen distinctly depressed, greenish white in color; segments 3-7 dorsally and ventrally with creeping welts (Alexander, 1920).

No fossil species of that genus are known so far.

### **Key to Korean species of the genus *Elliptera* Schiner**

1. Apex of male wing blunt, widely rounded, with unusually widened distal end of cell *sc*; wing of female slightly narrowed to apex; both sexes with cord surrounded by smoky edging and distinctly widened cell *r*<sub>3</sub> at distal end. Prescutum gray with dull lateral margins .....  
..... *Elliptera jacoti* Alexander, 1925
- Apex of wing slightly narrowed to apex in both sexes; distal end of cell *sc* not widened distally; cord without smoky edging, cell *r*<sub>3</sub> just slightly widened at distal end. Prescutum brown with shining lateral margins ...  
... *Elliptera zipanguensis zipanguensis* Alexander, 1924

### ***Elliptera jacoti* Alexander, 1925**

Alexander, 1925b: 388; Savchenko and Krivolutskaya, 1976: 113; Savchenko, 1983: 109.

General coloration brown to grayish brown, body sparsely pruinose. Body length of male 4.2-8.7 mm, female 5.7-7.2 mm. Wing length of male 8.8-16.1 mm, female 8.8-12.2 mm.

Head black, covered with gray pruinosity, especially anteriorly and at the margins of eyes. Antenna brown, 16-segmented. Male antenna 1.7-2.4 mm long, female 1.4-1.8 mm. Scape brown with darkened apex, cylindrical. Pedicel brown, oval. Basal flagellomeres with light brown base and darkened apex, distal flagellomeres dark brown. Flagellomeres narrow basally, strongly dilated at about two thirds of length, with distinct apical pedicels. Apical flagellomere elongate, nearly cylindrical, longer than preceding segment. Verticils approximately as long as respective segments. Dense short pubescence covers all flagellomeres. Rostrum dark brown dorsally, yellowish brown ventrally. Palpus dark brown, covered with short erect setae.

Thorax brown, covered with gray pruinosity. Pronotal scutum brown, posteriorly ringed with light brown, sides covered with sparse pruinosity. Mesonotal prescutum uniformly shiny brown dorsally, sides mate gray covered with dense pruinosity. Prescutal stripes not expressed. Scutellum brown, slightly lighter postero-laterally. Mediotergite uniformly brown, covered with sparse pruinosity. Pleura uniformly brown, covered with gray pruinosity. Wing tinged with brown. Male wing (Fig. 4A) with widened distal part of cell *sc*, thus tip of wing is blunt and widely rounded. Female wing (Fig. 4B) with usual, not widened distal part of cell *sc*, thus wing apex is more narrow, than in male. Cell *r*<sub>3</sub> distally strongly widened in both sexes. Discal cell missing, basal deflection of vein *CuA*<sub>1</sub> some distance before branching point of *M*. Both anal veins long and nearly straight. Frontal wing margin slightly darker than rest membrane of wing. Stigma indistinct or completely lacking. Cord surrounded by dark band. Haltere with dark brown knob and yellowish base of stem. Coxae yellow with testaceous bases. Darkening on frontal pair more intense than on second and posterior pair. Trochanters yellowish, rimmed with black distally. Legs generally brown with slightly darkened tips of femur, tibia and distal segments of tarsus. Male claw with two unequal teeth, shorter at base, longer before middle. Female claw simple, toothless.

Abdomen brownish dorsally, light brown ventrally. Male abdominal tergites brownish, covered with pruinosity, bearing darker lateral and posterior margins. Female abdomen with weak median line. Basal sternites of male abdomen light brown, distal sternites dark brown. Sternites of female abdomen light brown. Male genitalia (Fig. 4D) rusty brown. Ovipositor (Fig. 4G) with tenth tergite dark brown, cercus and hypovalvae yellowish brown. Cercus with rised apical part.

**Flight period.** lasts from late May through end of October in Korea.

**Habitat.** shaded wet rocks.

**Distribution.** Recorded from Eastern China, North Korea, South-West Siberia and Far East of Russia. Collected

from the elevation 30-1500 m in Korea.

**Examined material.** 1♂, Korea, Mt. Kongo, 1933.10.18, coll. G. Machida; North Korea, Ompo, altitude 160 feet (approximately 50 m), 1937.06.3, coll. A. Yankovsky; 3♂♂, 5♀♀, North Korea, Ompo, altitude 120 feet (approximately 35 m), 1937.06.10, coll. A. Yankovsky; 2♀♀, North Korea, Ompo, 1937.06.12, coll. A. Yankovsky; 1♂, Korea, Seren, altitude 4700 feet (approximately 1400 m), 1937.10.2, coll. A. Yankovsky; 1♂, North Korea, Ompo area, altitude 800 feet (approximately 240 m), 1937.10.7, coll. A. Yankovsky; 1♂, North Korea, Ompo, altitude 400 feet (approximately 120 m), 1937.10.30, coll. A. Yankovsky; 1♂, North Korea, Ompo, altitude 150 feet (approximately 50 m), 1938.05.26, coll. A. Yankovsky; 1♂, North Korea, Kankyo Nando, Puksu Pyaksan, altitude 5000 feet (approximately 1500 m), 1939.07.11, coll. A. Yankovsky; 1♂, North Korea, Kankyo Nando, Puksu Pyaksan, altitude 5000 feet (approximately 1500 m), 1939.08.11, coll. A. Yankovsky; 1♂, North Korea, Kankyo Nando, Puksu Pyaksan, altitude 4000 feet (approximately 1200 m), 1939.08.14, coll. A. Yankovsky. Also compared with determined specimens from adjacent regions including Holotype, 1♂, China, Taishan, Shantung, 1923.07, coll. A. Jacot; Allotype, 1♀, China, Taishan, Shantung, 1923.07, coll. A. Jacot, det. C. Alexander; metatype, 1♀, China, Szechwan, Mt. Omei, altitude 3500 feet (approximately 1100 m), 1931.08.14, coll. Franck; metatypes, 2♂♂, China, Szechwan, Mt. Omei, altitude 3500 feet (approximately 1100 m), 1931.08.17, coll. Franck; metatype, 1♀, China, Tren-mu-shan, N. Caekiang, 1937.05.31, coll. E. Suenson; metatypes, 2♂♂, 1♀, USSR [Russia, Far East], Sichte Alin Reserve, 1969.09.13, coll. P. Budylyjova.

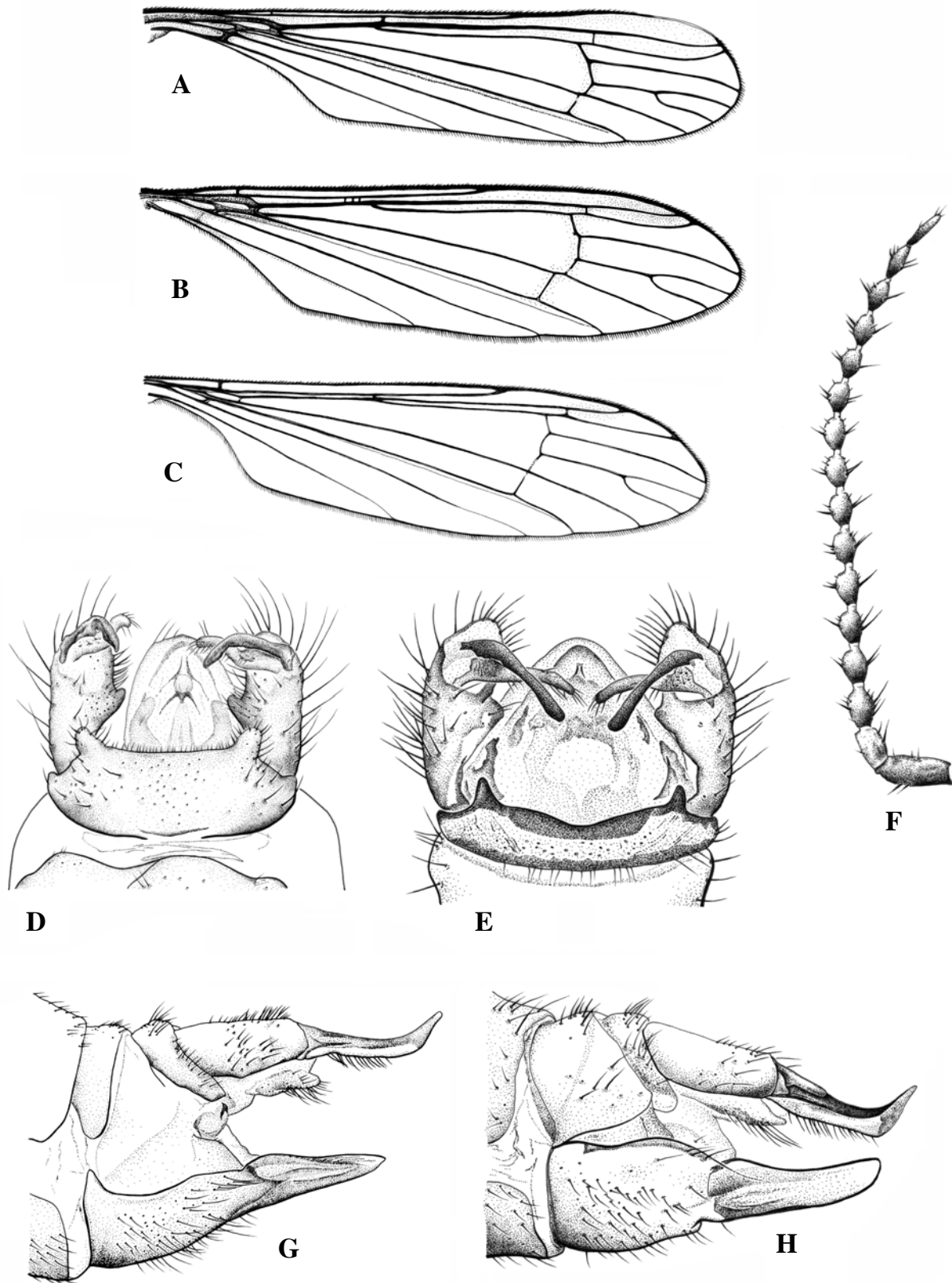
**Previous records for Korea.** Alexander (1934) writes, that *E. jacoti* is present in Korea (North Korea), but gives no information about studied specimens.

***Elliptera zipanguensis zipanguensis* Alexander, 1924**

Alexander, 1924: 559; Savchenko and Krivolutskaya, 1976: 113; Savchenko, 1983: 108.

General coloration of male dark brown to brownish black, female generally lighter than male. Body length of male 4.7-6.9 mm, that of female 5.3-6.7 mm. Wing length of male 6.9-9.6 mm, that of female 6.7-9.5 mm.

Head black, anterior part of vertex sparsely pruinose with grayish pubescence. Vertex between eyes broad, with a compressed median ridge immediately behind antennal bases. Antenna (Fig. 4F) dark brown to black, 16-segmented. Length of male antennae 2.0-3.6 mm, female 2.1-2.6 mm. Male antenna, if bent backward, nearly reaches base of wing, that of female reaches middle of prescutum. Scape uniformly dark brown or with blackish apex. Pedicel uniformly dark brown or black.



**Fig. 4.** *Elliptera*. A. *E. jacoti*, male wing. B. *E. jacoti*, female wing. C. *E. zipanguensis zipanguensis*, wing. D. *E. jacoti*, male genitalia, dorsal view. E. *E. zipanguensis zipanguensis*, male genitalia, dorsal view. F. *E. zipanguensis zipanguensis*, male antenna. G. *E. jacoti*, ovipositor, lateral view. H. *E. zipanguensis zipanguensis*, ovipositor, lateral view.

Flagellar segments covered with a dense gray pruinosity, oval, with distinct apical pedicels, covered with dense and short whitish pubescence in both sexes. Because female antenna is shorter than male, female flagellomeres as well as apical pedicels are shorter than in male. Apical segment cylindrical. Longest verticils approximately as long as respective segments. Rostrum dark brown to brownish black dorsally, light brown ventrally. Three basal palpal segments brownish black, distal segment light brown, tip same color as basal segments.

Thorax dark brown laterally, black dorsally. Pronotal scutum dark brown. Mesonotal prescutum shiny brownish black, the lateral margins paler, but also shiny brown, covered with grayish pruinosity. Mesonotal scutum dark brown, lateral angles light brown. Scutellum dark brown or black basally, redish brown apically. Specimens in ethanol have lateral and posterior margin light brown. Mediotergite dark brown with blackened posterior margin. Some specimens have lighter spot in the middle. Pleura brownish black with a longitudinal gray stripe across dorsal margin of sternopleura. Fronto-ventral angle of anepisternum, right behind frontal coxae distinctly blackened. Ventral part of katepisternum blackened. Dorsopleural membrane dark brown. Spiracles surrounded by black. Wing (Fig. 4C) distinctly and uniformly tinged with brown. No other darker spots, except elongate stigma, which is slightly darker than the rest surface of wing. Wing apex extended into an angle, rounded. Vein *Rs* long and straight, and is very close to vein *R*. Cross-vein *r* beyond branching point of *Rs*, light, thus probably was overlooked by Savchenko and Krivolutskaia (1976, Fig. 46b). Discal cell open by the atrophy of the outer deflection of *M*<sub>3</sub>. Basal deflection of *CuA*<sub>1</sub> at branching point of *M*. Both anal veins long and straight. Haltere brownish, the base of stem whitish. Frontal coxae brown frontally, whitish yellow posteriorly, middle and posterior coxae whitish yellow. Trochanters of all legs whitish yellow stained with blackish and with narrow dark brown rim at apex. Femur light brown with yellowish base and very narrow blackened rim at articulation with trochanter. Tibiae and tarsus brown. Male claw with a single, very slender subbasal spine. Spine is completely missing on female claw.

Abdomen dark brown, covered with grayish pruinosity. Abdominal tergites dark brown to black, sternites yellowish brown, subterminal segments blackish. Male genitalia (Fig. 4E) dark brown. Ninth tergite with distinct lateral lobes on posterior margin. Both gonostyles long and slender. Outer gonostylus dark brown with yellowish base, strongly sclerotised and hairless. Inner gonostylus fleshy and hairy. Ovipositor (Fig. 4H) with cercus yellow, short and very strongly upcurved. Tip hardened. Hypovalvae yellow, wide and blunt-apexed.

**Flight period.** lasts from April through middle of Novem-

ber in Korea.

**Habitat.** Adults are found at waterfalls, on wet rocks, along rocky streams and rivers in deciduous and mixed forests.

**Distribution.** Described from Japan and Far East of Russia. Collected from the elevation 90-1800 m in Korea.

**Examined material.** 2♂♂, 1♀, North Korea, Ompo, 1937.06.12, coll. A. Yankovsky; 1♀, North Korea, Seren Mts., altitude 6000 feet (approximately 1800 m), 1937.10.9, coll. A. Yankovsky; 1♂, 1 (sex unknown), North Korea, Ompo, altitude 300 feet (approximately 90 m), 1938.06.3, coll. A. Yankovsky; 1♂, North Korea, Ompo, altitude 400 feet (approximately 120 m), 1938.06.11, coll. A. Yankovsky; 1♂, North Korea, Seren Mts., altitude 4000 feet (approximately 1200 m), 1938.06.25, coll. A. Yankovsky; 1♂, North Korea, Seren Mts., altitude 3000 feet (approximately 900 m), 1938.7.3, coll. A. Yankovsky; 1♀, North Korea, Seren Mts., altitude 4000 feet (approximately 1200 m), 1938.7.15, coll. A. Yankovsky; 1♂, South Korea, Nodong-ri, Yongpyeong-myeon, Pyeongchang-gun, Gangwon-do, Mt. Gyebangsan, N37.727976, E128.46559 (coordinates approximate), 2008.05.15-07.19, coll. J.D. Yeo *et al.*, malaise trap; 1♀, South Korea, Jangjeon-ri, Jinbu-myeon, Pyeongchang-gun, Gangwon-do, Mt. Gariwangsan, N37.4877778, E128.5452778, 2009.06.04-06.17, coll. J.D. Yeo & J.D. Yoon, malaise trap; 6♂♂, 9♀♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.73920, E128.59398, altitude 794 m, 2012.06.22, coll. S. Podenas, entomological net; 4♂♂, 2♀♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.74913, E128.57723, altitude 726 m, 2012.06.22, coll. S. Podenas, entomological net. Also compared with the Japanese specimens including the Holotype, 1♀, Japan, Shikotsu, Hokkaido, 1922.09.24, coll. Taiso Esaki; metatype, slide mounted wing, Japan, Kibune, Kyoto, Honshiu, 1932.08.17, coll. Tokunaga; metatypes, 1♂, 1♀ and 2 specimens with broken abdomens, Japan, Kibune, Kyoto, 1935.04, coll. Tokunaga; metatypes, 3♂♂, Japan, Hida, Akigami, Ontake, 1960.11.10, coll. T. Mishima; metatype, 1♂, Japan, Shikoku, Iwai-m, Imanoyama, altitude 200 m, 1951.05.11, coll. Issiki-Ito.

**Note.** species previously was unknown from Korean peninsula.

#### ***Limnorimarga* Alexander, 1945**

*Limnorimarga* Alexander, 1945; Alexander, 1954; Savchenko, 1983.

Type species - *Limnorimarga limonioides* Alexander, 1945

Dark bodied, medium-sized crane flies (wing length

about 7.0-7.3 mm). Antennae 16-segmented; flagellomeres simple, without branches. Prescutum without tubercular pits and pseudosutural foveas. Tibiae of legs without spurs. Tarsal nail without basal spine. Wing well developed, translucent with blackish tinge; anal angle big. Wing venation: *Sc* long; *Sc*<sub>1</sub> nearly reaching branching point of *Rs*; *Sc*<sub>2</sub> close to *Sc*<sub>1</sub> tip; *R*<sub>1</sub> elongate; *R*<sub>2</sub> short and transverse; radial sector long, slightly arched at base; discal cell small, distinctly shorter than branches of *M* beyond it; basal section of *CuA*<sub>1</sub> situated slightly beyond branching point of *M*; *A*<sub>2</sub> short and straight. Male terminalia medium-sized; ninth tergite transverse with two rounded lobes on posterior margin, separated by V-shaped notch; ninth sternite medially semi-membranous; gonocoxite elongate, nearly cylindrical, without additional lobes, with two terminal rod-shaped gonostyles. Ovipositor with long and nearly straight cercus, ending in blunt rounded apex. Hypoalvae long, reaching approximately to about one-third or one-fourth of cercus.

The genus *Limnorimarga* is monotypic known only from East Palearctic (originally as subgenus of genus *Orimarga* Osten Sacken), which was described from North Korea (Alexander, 1945), later found in Russian Far East and Japan (Oosterbroek, 2013).

Preimaginal stages are unknown.

#### Key to Korean species of the genus *Limnorimarga* Alexander

1. General coloration black. Rostrum, palpus and antenna black. Haltere elongate with brownish-black knob. Wing with strong, uniformly blackish tinge, stigma scarcely differentiated. Vein *R*<sub>2</sub> present, discal cell (*D*) closed, basal deflection of *CuA*<sub>1</sub> beyond base of discal cell. Both gonostyles of male genitalia elongate  
..... *Limnorimarga limonioides* (Alexander, 1945)

#### *Limnorimarga limonioides* (Alexander, 1945)

Alexander, 1945: 242; Alexander, 1954: 287.

General coloration of both sexes black or blackish brown. Body length of male about 7.1-8.0 mm, that of female 8.5 mm. Wing length of male 6.8-7.4 mm, that of female 7.9 mm.

Head frontally grey, getting darker behind. Head of specimens in ethanol completely black. Anterior vertex in both sexes narrow, forming low crest, not wider than three rows of ommatidia. Length of male antennae 2.5-3.7 mm, female 2.2 mm. Antenna (Fig. 5C) black throughout. Scape short, cylindrical. Pedicel pear shaped. Male flagellar segments oval, female flagellar segments distinctly narrower than in male, spindle shaped to cylindrical. Apical segment of male antennae distinctly smaller than penultimate. Apical segment of female antennae nearly as long as penultimate, but wider. Flagellomeres

covered with short brownish pubescence, which is less dense in female. Longest verticils of male flagellum slightly shorter than respective segments, that of female approximately as long as respective segments. Rostrum black. Palpus very short in both sexes. Basal segment strongly reduced, second palpomere cylindrical, approximately as long as rostrum, third segment elongate in male, rounded in female, distal palpomere oval. Palpus black in male, dark brown in female.

Thorax black dorsally and ventrally, sides brown. Pronotum black dorsally, brown laterally, with small horn-shaped bump on both sides dorso-laterally in both sexes. Sometimes these bumps could be asymmetrically reduced. Mesonotal prescutum polished black, without stripes, covered with long, but very sparse setae. Mesonotal scutum brownish black with light brown lateral angle. Scutellum uniformly dark brown or blackish. Mediotergite slightly lighter than prescutum, uniformly dark brown. Pleura generally dark brown. Ventral part of katepisternum black, dorsal part dark brown, covered with sparse short setae. Dorsal part of anepisternum light brown, wing base surrounded by obscure yellow. Wing (Fig. 5A) with a strong, uniformly blackish tinge, which is slightly brighter at base. Veins brown. Vein *Sc*<sub>1</sub> ends slightly before branching point of *Rs*. *Sc*<sub>2</sub> is situated slightly before tip of *Sc*<sub>1</sub>. *Rs* long and straight. Discal cell present. Position of basal deflection of *CuA*<sub>1</sub> is variable from very slightly before to well beyond branching point of *M*. In some cases it reaches about one third of discal cell's length. Both anal veins long and nearly straight. Anal angle big. Stigma long, oval, scarcely differentiated. Haltere elongate. Stem obscure yellow at base, brown distally, knob brownish-black with lighter apex. Frontal coxae brown with obscure yellow fronto-ventral and postero-ventral surfaces. Second and third pairs obscure yellow. Trochanters obscure yellow with black spot at ventro-median angle. Male femur brownish black with lighter base, tibiae and tarsus brownish black. Entire leg of female brown. Claw elongate, untoothed in both sexes.

Male abdomen black, basal sternites brownish yellow. Female abdomen uniformly dark brown. Male genitalia (Fig. 5B) same color as abdomen. Ninth tergite with two postero-lateral blunt-apexed lobes. Gonocoxite elongate, without additional lobes. One pair of gonostyles. Gonostylus long and slender, frontal and posterior margins sclerotised, central part less so and is lighter. Thus gonostylus looks as it is composed of two long bars close together and that's why Savchenko made mistake re-describing and illustrating species, as having two pairs of long rod-like gonostyles (Savchenko, 1989, Fig. 142, 3). Eighth tergite of female abdomen yellow with slightly darkened lateral sides, ninth tergite blackish yellow, tenth tergite blackish. Ovipositor (Fig. 5D) with cercus long and narrow, rusty brown at base, turning yellowish

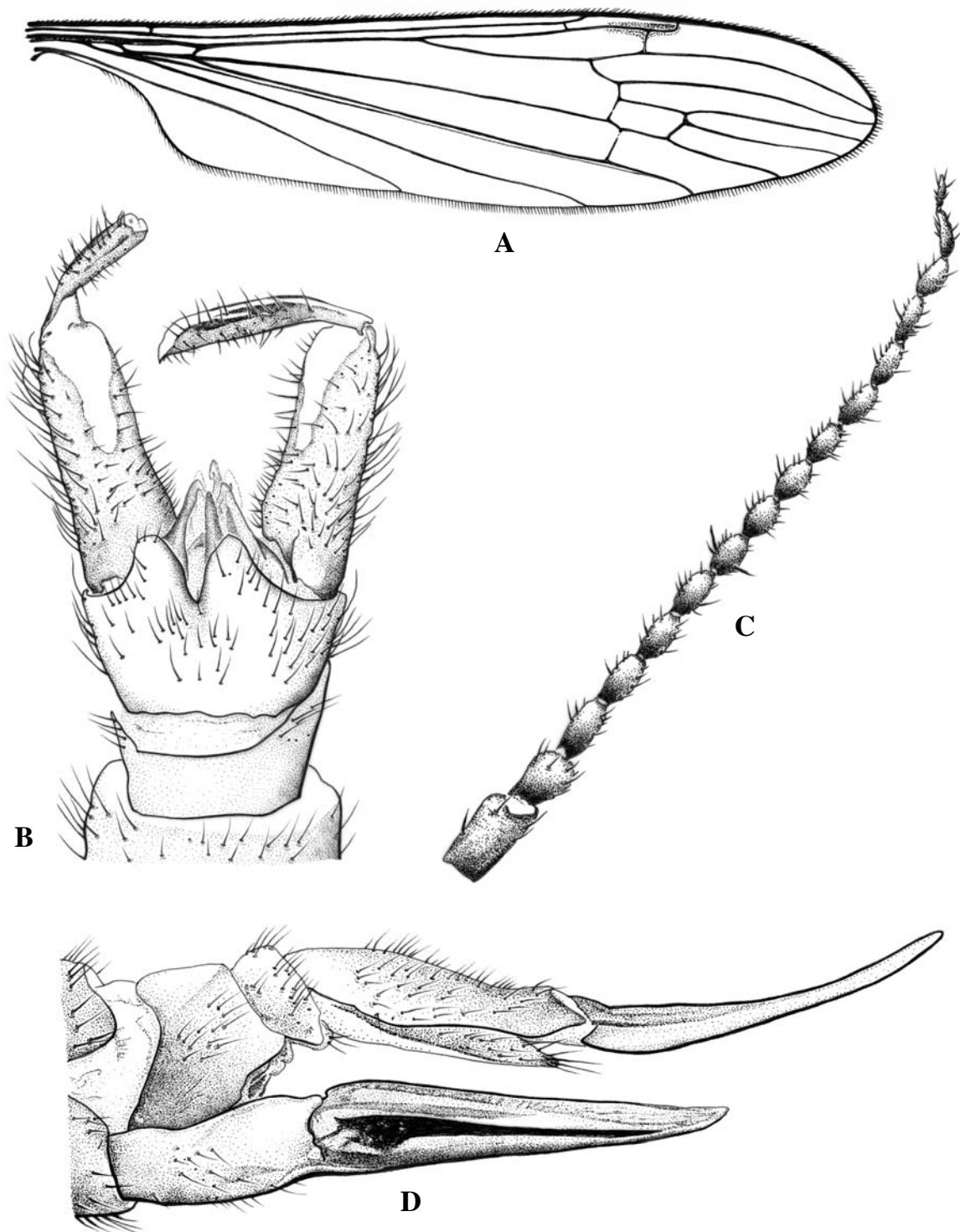


Fig. 5. *Limnorimarga limonioides*. A. wing. B. male genitalia, dorsal view. C. antenna. D. ovipositor, lateral view.

distally. Hypovalvae long and narrow, reaching one third of cercus length, generally light brown with distinct black longitudinal line.

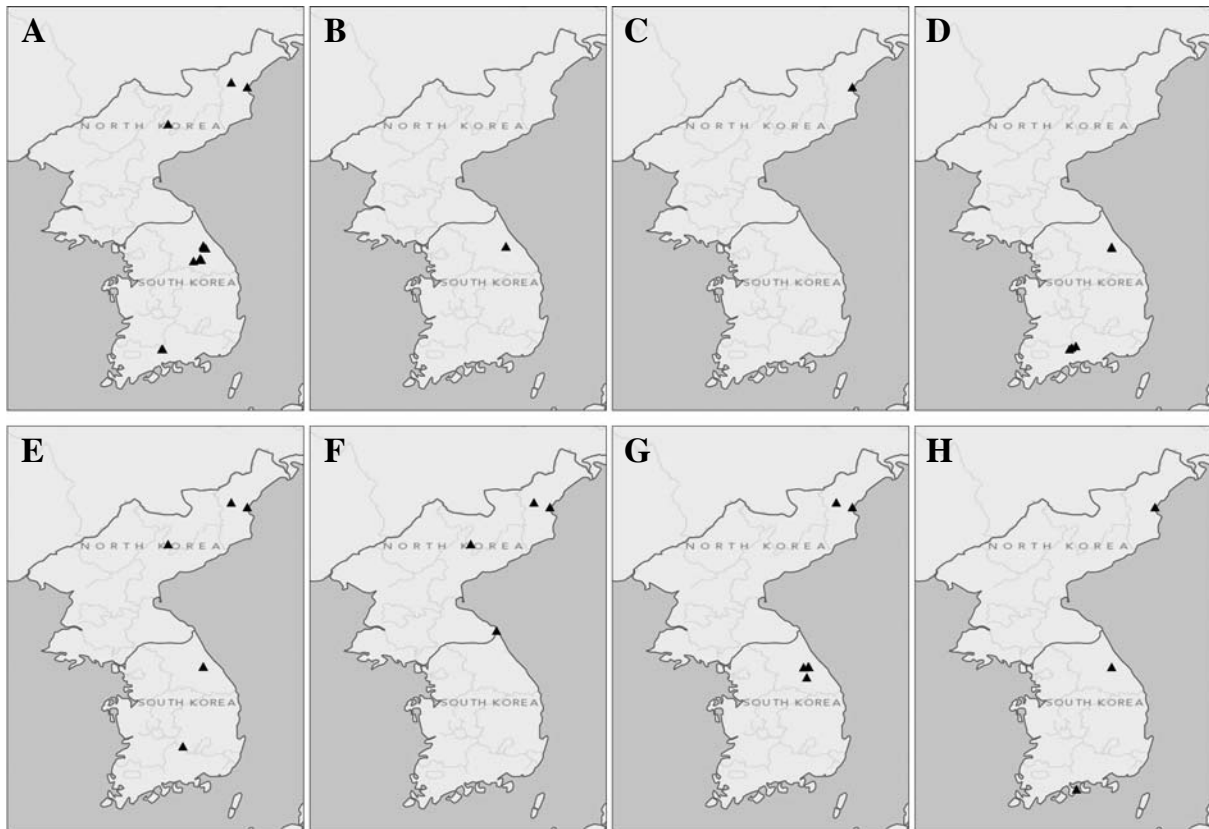
**Flight period.** lasts from late May through middle of July.

**Habitat.** Surface of wet rocks (*fauna hygropetrica*).

**Distribution.** Known only from Korea, Japan and Far East of Russia.

**Examined material.** Holotype, 1 ♂, North Korea, Ompo, altitude 300 feet (approximately 90 m), 1938.05.30, coll.





**Fig. 6.** Distribution maps of Korean Antochini crane flies. A. *Antocha (Antocha) bifida*. B. *A. (A.) dentifera*. C. *A. (A.) dilatata*. D. *A. (A.) gracillima*. E. *A. (A.) integra*. F. *Elliptera jacoti*. G. *E. zipanguensis zipanguensis*. H. *Limnorimarga limonioides*.

Yankovsky; 1 ♀, South Korea, Gangwon-do province, Pyeongchang-gun, Jinbu-myeon, Dongson-ri, Odaesan National Park, N37.73920, E128.59398, altitude 794 m, 2012.06.22, coll. S. Podenas, entomological net; 7 ♂♂, South Korea, Jeollanam-do province, Yeosu environs, Manseongni Black Sand Beach, N34.78094, E127.74765, altitude 12 m, 2012.06.25, collected S. Podenas with aspirator from wet rocks. Also compared with the Japanese specimens including the metatype, 1 ♀, Japan, Shikoku, Omogo-kei, altitude 800 m, 1952.07.14, coll. Ishihara; metatypes, 1 ♂, 1 specimen missing, only labels left, Japan, Shikoku, Omogo-kei, 1952.6.6, coll. T. Yano.

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