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The Classification of Ephemeroidea (Ephemeroptera) in Korea

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韓國産 하루살이上科 (하루살이目)의 分類

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摘 要

韓國産 하루살이上科는 Imanishi (1940)가 *Potamanthus* nb (=*Potamanthus coreanus* sp. n.)와 *Ephemera strigata*를 韓國에서 記錄한 바 있으며, 그 外에 國內의 生態學的인 文獻에서 *Potamanthus kamonis* (=*Potamanthodes kamonis*), *Ephoron shigae*, *Ephemera orientalis* 等이 추가로 報告되었다. 本 著者들은 上記한 韓國産 하루살이上科의 하루살이類를 3科 4屬 5種으로 再整理하고, 各 種의 成虫과 幼虫을 확인하여 記錄하였다.

Family Potamanthidae Jacobson & Bianchi, 1905 (강하루살이科 : 新稱)
Genus *Potamanthodes* Ulmer, 1919 (강하루살이붙이屬 : 新稱)
1. *Potamanthodes kamonis* (Imanishi), 1940 (강하루살이붙이 : 新稱)
Genus *Potamanthus* Pictet, 1848 (강하루살이屬 : 新稱)
2. *Potamanthus coreanus* sp. n. (강하루살이 : 新稱)
Family Polymitarcyidae Banks, 1900 (흰하루살이科 : 新稱)
Genus *Ephoron* Williamson, 1802 (흰하루살이屬 : 新稱)
3. *Ephoron shigae* Takahashi, 1924 (흰하루살이 : 新稱)
Family Ephemeridae Leach, 1815 (하루살이科)
Genus *Ephemera* Linnaeus, 1758 (하루살이屬)
4. *Ephemera strigata* Eaton, 1892 (무늬하루살이)
5. *Ephemera orientalis* McLachlan, 1875 (동양하루살이)

INTRODUCTION

As to Korean Ephemeroidea, Imanishi (1940) described the nymphal stages of *Potamanthus* nb and *Ephemera strigata* from Korea for the first time. Since then several species of Ephemeroidea were recorded on their collecting localities of nymph in some ecological literatures of Korea: *Potamanthus kamonis; Potamanthus* na; *Potamanthus* naa; *Ephoron shigae; Ephemera lineata; Ephemera orientalis* and *Ephemera japonica*. Among them, we

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have confirmed the five species of Korean Ephemeroidea from our studied area and describe the adults and nymphs in this paper: *Potamanthus kamonis; Potamanthus* nb; *Ephoron shigae; Ephemera strigata* and *Ephemera orientalis.*

As to Imanishi's (1940) *Potamanthus* (*Potamanthodes*) *kamonis*, we place the species to genus *Potamanthodes* by its distinct characteristics of adult. And we newly give a name *Potamanthus* nb, recorded by Imanishi (1940) as species native to Korea, to *Potamanthus coreanus.*

All the examined materials are based on the specimens that have been collected by the authors or the other Korean scientists during the period of 1964~1985 at about 120 localities in Korea. All of them are preserved in alcohol and deposited at Korean Entomological Institute, Korea University, Seoul.

SYSTEMATICS

Family **POTAMANTHIDAE** Jacobson & Bianchi, 1905 (강하루살이科 : 新稱)
Type genus: *Potamanthus* Pictet

ADULTS: Base of veins MP_2 and CuA of fore wing strongly divergent from base of vein MP_1; vein A_1 forked near wing margin. Forceps 3 jointed, first joint longest.

NYMPHS: Mandibular tusks projecting forward and visible from above. Abdominal gills held laterally; gills on segment 1 rudimentary and unbranched; gills on segment 2~7 paired, margins with long fringes.

Genus ***Potamanthods*** Ulmer, 1919 (강하루살이붙이屬 : 新稱)
Potamanthodes Ulmer, 1919 : 11; Ulmer, 1932~33 : 200; Hsu, 1937~38 : 124
Type species: *Potamanthodes formosus* (Eaton)
Type locality: Taiwan

ADULTS: Veins MP_1 and MP_2 of fore wing not connected at base.
NYMPHS: Mandibular tusks more or less developed.

1. ***Potamanthodes kamonis*** (Imanishi), 1940 (강하루살이붙이 : 新稱) (Fig. 1~7)
Potamanthus (*Potamanthodes*) *kamonis* Imanishi, 1940 : 178
Potamanthodes formosus: Ueno, 1969 : 232

ADULTS: MALE IMAGO. Body 14.0 mm. Caudal filaments 30.0 mm. General color yellow. Eyes green; intersected by a brown band; basal part of each ocellus with a brown band. Distance between eyes: width of head ≒ 1 : 5. Pronotum with a pair of sublateral stripes and one median stripe (Fig. 3). MP_1 and MP_2 of fore wing not connected at base; base of MP_2 meet CuA (Fig. 4). Crossveins brown, distinct. In the fore legs apical half of femur and basal part of tibia brown; apical ends of tibia and 1~4 tarsal joints brown (Fig. 6). Ratio of each fore leg segment 70 : 138 : 6 : 50 : 46 : 30 : 20(Fig. 6). Ratio of each hind leg segment 65 : 62 : 7 : 6 : 3 : 15(Fig. 7). Abdomen yellow; 1~6 abdominal terga with a pair

of obscure markings on each lateral portion (Fig. 3). Penis Y-shaped; about 0.5 times length of first joint of forceps (Fig. 5). Cerci and terminal filament pale yellow. FEMALE IMAGO. General color and body shape similar to male imago. Eyes small; hinder margin of sternite 9 swallowly notched.

COLLECTING LOCALITIES OF ADULT: KG: Kap'yŏng Ch'ŏngp'yŏng (11 ♂ imagos, 130 ♀ imagos, 11 VI 1983, Y.J. Bae); Namyangju Wangsukch'ŏn (1 ♀ imago, 27 V 1983, Y.J. Bae, Obtained by rearing).

NYMPHS: Body 10.0mm. Caudal filaments 7.0 mm. General color brown, with, light markings (Fig. 1). Mandibular tusks more or less developed (Fig. 2). 1~10 abdominal terga with 3 longitudinal light stripes (Fig. 1).

COLLECTING LOCALITIES OF NYMPH: KG: Kap'yŏng Hwaaksan (1 X 1982); Kap'yŏng Myŏngjisan (22 I 1983); Kap'yŏng Chojongch'ŏn (31 VIII 1973, 22 VI 1974, 24 IX 1978); Kap'yŏng Ch'ŏngp'yŏng (12 VI 1983); Kap'yŏng Yumyŏngsan (14 V 1983); Kap'yŏng Taesŏng-ri (27 IX 1982, 24 X 1982); Yangju Iryŏng (25 III 1981); Namyangju Kwangnŭng (16 I 1983, 18 I 1983, 21 II 1983, 20 III 1983, 17 V 1983, 23 VI 1983); Namyangju P'aldang (23 V 1982); Kwangju Kyŏnganch'ŏn (30 VII 1981); Yŏju Yŏju (9 IV 1972), KW: Inje Ch'ŏndo-ri (10 X 1982); Chŏngsŏn Imgye (8 V 1984), CCB: Koesan Hwayang-ri (2 V 1982), KB: Ponghwa Naesŏng (28 I 1983), CLB: Muju Kuch'ŏndong (16~21 VIII 1970), CLN: Kwangyang Tongch'ŏn (29 V 1981, 18 VI 1983).

DISTRIBUTION: Korea, Japan

Genus ***Potamanthus*** Pictet, 1843 (강하루살이屬 : 新稱)
Potamanthus Pictet, 1843 : 111, 197; Eaton, 1871 : 36; Eaton, 1884 : 78
Type species: *Potamanthus luteus* Linnaeus
Type locality: Europe

ADULTS: Vein MP_1 and MP_2 of fore wing connected at base.
NYMPHS: Mandibular tusks very strongly developed.

2. *Potamanthus coreanus* sp. n. (강하루살이 : 新稱) (Fig. 8~21)
Potamanthus nb: Imanishi, 1940 : 182

ADULTS: MALE IMAGO. Body 18.5 mm. Cerci 43.0 mm. Terminal filament 4.5 mm. General color brown, with reddish brown markings. Eyes orange; intersected dark grey band on the basal portion. Distance between eyes: width of head ≒ 1 : 22. Each ocellus with dark band at basal part. Thorax dark brown; pleural area somewhat light color. Fore legs brown; middle and hind legs white. Claws brown; fore leg claws similar, middle and hind leg claws dissimilar. Ratio of each fore leg segment 114 : 150 : 6 : 50 : 33 : 27 : 20(Fig. 14). Ratio of each hind leg segment 102 : 80 : 8 : 6 : 4 : 15 (Fig. 15). Wings hyaline; veins brown. Fore wings with reddish brown markings on the middle portion; with reddish brown stripes along basal and apical part of subcostal area. Basal part of MP_2 of fore wing curved and connected with MP_1. Apical half of hind wing reddish brown; costal projection

acute. Abdomen light brown; 2~9 abdominal terga with a pair of reddish brown sublateral stripes (Fig. 18). 1~9 abdominal sterna with a pair of dark spots on each lateral portion and with two pairs of obscure submedian markings. Genital forceps white, 3 jointed; 1 st joint longest. Penis illustrated in Fig. 12. Cerci reddish brown; with white bands at every two or three segments. Terminal filament very short; about 1/10 times length of cerci (Fig. 18). FEMALE IMAGO. Body 17.0 mm. Cerci 27.0 mm. Terminal filament 11.5 mm. General color white, with reddish brown markings. Eyes black. Distance between eyes: width of head ≒ 1 : 2. Each ocellus with dark brown band at basal part. Thorax white, with reddish brown markings: pronotum with a pair of sublateral stripes and one median stripe (Fig. 20). Fore legs reddish brown; basal part of tibia and 1~4 tarsal joints white. Middle and hind legs white. Claws light brown, dissimilar. Ratio of each fore leg segment 125 : 155 : 4 : 17 : 12 : 8 : 20 (Fig. 16). Ratio of each hind leg segment 125 : 105 : 10 : 7 : 5 : 22 (Fig. 17). Wings similar to male imago (Fig. 21); marginal stripe of hind wing more narrow. Abdomen white; sublateral stripes of abdominal terga more narrow and distinct (Fig. 19, 20). Subanal plate swallowly notched (Fig. 13). Cerci reddish brown; with white bands every one or two segments. Terminal filament about 2/5 times length of cerci. MALE and FEMALE SUBIMAGO. Similar to male and female imago; dull in color.

NYMPHS: Body 30.0 mm. Caudal filaments 13.0 mm. General color light brown or brown. Mandibular tusks very strongly developed; about 2 times length of head (Fig. 2). Fore tibiae long; about 1.5 times length of fore femur (Fig. 11). 1~9 abdominal terga with two pairs of light submedian markings (Fig. 8). Gills lateral; Gill 1 ludimentary, gill 2~8 bisect and pullmously (Fig. 9, 10). Caudal filaments reddish brown; with white bands every one or two segments.

TYPE SPECIMENS: HOLOTYPE. ♂ imago (KG Kap'yŏng Ch'ŏngp'yŏng, 5 IX 1985, Y.J. Bae). ALLOTYPE. ♀ imago (KG Kap'yŏng Ch'ŏngp'yŏng, 5 IX 1985, Y.J. Bae). PARATYPES. 1 ♀ imago (KG Kap'yŏug Cheryŏng-ri, 13 VIII 1982, J.U. Byun); 23 ♂ imagos, 29 ♀ imagos, 10 ♂ subimagos and 6 ♀ subimagos (KG Kap'yŏng Ch'ŏngp'yŏng, 5 IX 1985, Y.J. Bae, Among them 4 ♂ imagos, 2 ♂ subimagos and 1 ♀ subimago obtained by rearing in laboratory during 6~15 IX 1985); 1 ♀ imago and 2 ♀ subimagos (KG Namyangju Wangsukch'ŏn, 20 V 1984, Y.J. Bae, Obtained by rearing at 7 VII 1984); 1 nymph (KG Kap'yŏng Hwaaksan, 1 IV 1982, J.U. Byun); 10 nymphs (KG Kap'yŏng Myŏngjisan, 22 I 1983, Y.J. Bae); 29 nymphs (KG Kap'yŏng Chojongch'ŏn, 27 V 1973, 31 VIII 1973, 24 IX 1978, I.B. Yoon); 1 nymph (KG Kap'yŏng Namisŏm, 20 VII 1982, J.U. Byun); 18 nymphs (KG Kap'yŏng Ch,ŏngp'yŏng, 12 VI 1983, Y.J. Bae); 5 nymphs (KG Kap'yŏng Taesŏng-ri, 2 XI 1982, Y.J. Bae); 1 nymph (KG Yangju Iryŏng, 25 III 1981, J.U. Byun); 10 nymphs (KG Namyangju P'aldang, 23 V 1982, J.U. Byun); 21 nymphs (KG Namyangju Kwangnŭng, 21 II 1983, Y.J. Bae); 4 nymphs (KG Namyangju Wangsukch'ŏn, 20 V 1984, Y.J. Bae); 10 nymphs (KG Kwangju Kyŏnganch'ŏn, 26 IV 1981, 31 VII 1981, J.U. Byun); 33 nymphs (KG Yŏju Yŏju, 9 IV 1972, 17 VI 1972, I.B. Yoon); 2 nymphs (KW Yanggu Omi-ri, 19 VI 1983, I.B. Yoon); 8 nymphs (KW Inje Tut'ayŏn, 15 III 1968, I.B. Yoon); 14 nymphs (CCB Okch'ŏn Sŏdaesan, 9 IV 1972, 14 X 1972, 25 IX 1982, I.B. Yoon, J.U. Byun).

DISTRIBUTION: Korea

Family **POLYMITARCYIDAE** Banks, 1900 (흰하루살이科 : 新稱)
Type genus: *Ephoron* Williamson

ADULTS: Base of veins MP_2 and CuA strongly divergent from base of vein MP_1. Middle and hind legs of male and all legs of female feeble, nonfunctional. Color usually pale; wings somewhat translucent.

NYMPHS: Mandibular tusks curved downward apically as viewed laterally; with numerous tubercles and setae. Ventral apex of hind tibiae rounded. Gills dorsal; gills on abdominal segment 1 vestigial.

Genus ***Ephoron*** Williamson, 1802 (흰하루살이屬 : 新稱)
Ephoron Williamson, 1802 : 71; Eaton, 1883 : 43
Polymitarcys Eaton, 1868 : 84
Type species: ***Ephoron leukon*** Williamson
Type locality: New Jersey

ADULTS: Wings of female (subimago) distinctly translucent; wings of male slightly translucent. Wings with numerous crossveins and netlike marginal intercalaries. Genital forceps four segmented.

NYMPHS: Mandibular tusks with numerous tubercles on upper and lateral surface. Head with round median frontal process. Gills on abdominal segment 1 single; segment 2~7 forked, each lamella with short fringes.

3. ***Ephoron shigae*** **Takahashi, 1924** (흰하루살이 : 新稱) (Fig. 22~29)
Polymitarsis shigae Takahashi, 1924 : 379
Polymitarcis shigae: Ueno, 1931 : 189

ADULTS: MALE IMAGO. Body 12.0 mm. Cerci 38.0 mm. Terminal filament 0.5 mm. General color white. Eyes black. Distance between eyes: width of head ≒ 1 : 1.6. Basal area of ocelli dark brown; with black band. Thorax white. Fore legs femur brown; tibiae light brown. Ratio of each segment of fore leg 40 : 65 : 70 : 70 : 48 : 48 : 22 (Fig. 27). Middle and hind legs short and feeble (Fig. 28). Wings slightly translucent; with numerous crossveins and net-like marginal intercalaries. Costal projection of hind wing moderate. Abdominal terga with light brown obscure markings. Cerci long; about 4 times length of body. Terminal filament rudimentary. Forceps four segmented; penis V-shaped, divergent laterally (Fig. 25). FEMALE SUBIMAGO. General color and body shape similar to male imago (Fig. 26). Distance between eyes: width of head ≒ 1 : 1.6. All legs short and feeble. Wings similar to male imago; translucent (Fig. 29). Three long caudal filaments; with numerous hairs (Fig. 26).

COLLECTING LOCALITIES OF ADULT: SL: Kangdong-gu Myŏngil-dong (31 ♀ imagos, 15 IX 1983, Y.J. Bae); CLB: Okch'ŏn Kŭmgang-Park (1 ♂ imago, 1 ♀ imago, 18 IX 1983, Y.J. Bae).

NYMPHS: Length 17.5 mm. Caudal filaments 9.0 mm. General color white; with light brown markings. Anterior half of head brown (Figg. 22). Mandibular tusks with numerous tubercles and setae (Fig. 22, 23). Pronotum with V-shaped brown marking (Fig. 22). Gill on abdominal segment 1 single; segment 2~7 forked, with short fringes (Fig. 24). Abdominal terga with light brown obscure markings.

COLLECTING LOCALITIES OF NYMPH: KG: Kap'yŏng Ch'ŏngp'yŏng (12 VI 1983); Kwangju Kyŏnganch'ŏn (31 VII 1981), KW: P'yŏngch'ang Noeun-ri (9 VII 1983), CCB: Ch'ungju Talch'ŏn (12 VI 1983)

DISTRIBUTION: Korea, Japan

Family **EPHEMERIDAE** Leach, 1815 (하루살이科)
Type genus: ***Ephemera*** Linnaeus

ADULTS: Base of veins MP_2 and CuA strongly divergent from base of vein MP_1. Vein A_1 unforked, attached to hind margin by three or more veinlets. Abdomen of most species with striking dark pattern on terga and sterna. Genital forceps four segmented.

NYMHS: Mandibular tusks curved upward apically as viewed laterally. Ventral apex of hind tibiae projected into distinct acute point. Gills dorsal; gills on abdominal segments 1 reduced, segments 2~7 forked with margins long fringed.

Genus ***Ephemera*** Linnaeus, 1758 (하루살이屬)
Ephemera Linnaeus, 1758 : 546; Eaton, 1868 : 85; Eaton, 1883 : 58
Type species: *Ephemera vulgata* Linnaeus
Type locality: Europe

ADULTS: Wings with distinct pattern of dark markings; crossveins crowded together near bullae; vein A_1 attached to hind margin by three to many veinlets. Genital forceps four segmented. Terminal filament as long as cerci.

NYMPHS: Head with frontal process bifid. Gills on abdominal segment 1 bifid near base.

4. *Ephemera strigata* Eaton, 1982 (무늬하루살이) (Fig. 30~36)
Ephemera strigata Eaton, 1892 : 302; Ueno, 1931 : 191; Immanishi, 1940 : 175; Tshernova, 1952 : 237; Tshernova, 1973 : 332

ADULTS: MALE IMAGO. Body 15.0 mm. Cerci 35.5 mm. Terminal filament 33.0 mm. General color white. Eyes black; basal area of ocelli dark brown. Distance between eyes: width of head ≒ 1 : 2.9. Thorax yellow; with dark brown markings. Pronotum with a pair of sublateral stripes. Fore legs dark brown; middle and hind legs white. Ratio of each segment of fore legs 72 : 198 : 9 : 75 : 60 : 42 : 24 (Fig. 35). Wings hyaline; veins brown. Fore wings with 2~3 crossveins crowded together near bullae; with distinct dark brown markings on the portion (Fig. 34). Costal projection of hind wing round; outer margin of hind wing brown. 1~10 abdominal terga with a pair of dark brown stripes (Fig. 33); 1~9 abdominal sterna with a pair of slender dark brown stripes. Genital forceps four segmented,

2nd joint longest; penis V-shaped, small (Fig. 32). Caudal filaments brown; basal parts darker. Terminal filament nearly as long as cerci. FEMALE IMAGO. Body 23.5 mm. Cerci 32.0 mm. Terminal filament 29.0 mm. General color and body shape similar to male imago. Distance between eyes: width of head ≒ 1 : 1.8.

COLLECTING LOCALITIES OF ADULT: SL Kangnam-gu Hŏninnŭng (3 ♂ imagos, 12 ♀ subimagos, 22 V 1981, M.L. Kim); SL: Tobong-gu Pukansan (4 ♂ imagos, 1 ♀ imago, 1 IV 1984, Y.J. Bae, Obtained by rearing during 24 IV 1983-2 V 1983); KG: Namyangju Kwangnŭng (5 ♂ imagos, 5 ♀ imagos, 1 ♀ subimago, 17 IV 1983, Y.J. Bae, Obtained by rearing during 18 IV 1983~5 V 1983); KB: Yŏngp'ung Sobaeksan (2 ♀ imagos, 7 VI 1981, M.L. Kim, 3 ♀ imagos, 17 V 1984, Y.J. Bae); KB: Kŭmnŭng Chikchisa (2 ♂ imagos, 3 VI 1982, J.U. Byun); CLB: Muju Tŏkyusan (2 ♂ imagos, 3 ♀ imagos, 22 V 1983, Y.J. Bae); CLN: Sŭngju Songgwangsa (2 ♂ imagos, 30~31 V 1981, J.U. Byun).

NYMPHS: Body 22.5 mm. Caudal filaments 8.5 mm. General color white or light brown. 1~10 abdominal terga with a pair of dark brown stripes (Fig. 30).

COLLECTING LOCALITIES OF NYMPH: SL: Tobong-gu Tobongsan (11 III 1982); Kangnam-gu Hŏninnŭng (21 V 1981) KG: P'och'ŏn Paegunsan (9 VIII 1984); P'och'ŏn Wangbangsan (1 V 1982, 16 V 1982); Kap'yŏng Hwaaksan (1 Y 1982); Kap'yŏng Myŏngjisan (30 VIII 1981, 2 IX 1981, 21 X 1981, 29 III 1982, 23 IV 1982, 4 IX 1982); Kap'yŏng Chojongch'ŏn (29 IV 1973, 24 IX 1978); Kap'yŏng Yumyŏngsan (8 V 1983, 14 V 1983); Yangju Pogwangsa (4 IV 1981, 25 III 1984); Yangju Iryŏng (25 III 1981); Namyangju Kwangnŭng (18 V 1982); Namyangju Ch'ŏnmasan (14 II 1981); Namyangju Suraksan(21 XI 1982); Ansŏng Ch'iljangsa (25 XI 1984), KW: Hongch'ŏn Kyebangsan (6 VI 1983); Wonsŏng Ch'iaksan (31 VII 1975, 2 IX 1982, 10 IV 1983, 15 VIII 1984, 2 IX 1984); Chŏngsŏn Imgye (8 V 1984); Inje Chinbu (27 IX 1972); Inje Paektamsa (4 VI 1979); Inje Pangdaesan (30 VII 1981); Hoengsŏng Kyech'onch'ŏn (1 IV 1985); Yangyang Osaek (2 X 1983), CCB: Poŭn Songnisan (11 VIII 1983); Koesan Kwanp'yŏng-ri (16 IX 1984), CCN: Yesan Sudŏksa (2 X 1983); Chŏngyang Ch'ilgapsan (21 VIII 1982, 3 X 1983); Kongju Kapsa (23 IX 1982, 3 IV 1983, 3 X 1983); Kongju Tonghaksa (3 IV 1983); Kŭmsan Taedunsan (15 X 1984), KB: Yŏngp'ung Sobaeksan (27 I 1983); Ponghwa Naesŏng (28 I 1983); Mungyŏng Mungyŏngsaejae (12 VIII 1983); Ch'ŏngsong Chuwangsan (29 I 1983); Taegu Tonghwasa (30 I 1983); Talsŏng Pisŭlsan (24 IX 1984), KN: Hapch'ŏn Haeinsa (31 I 1983); Yangsan Hoeyach'ŏn (23 IX 1984); Pusan Paegyangsan (5 I 1983); Namhae Mangunsan (3 VII 1983); Kŏje Iyang-ri (24 IX 1983), CLB: Muju Tŏkyusan (20~21 V 1983); Muju Minjujisan (2 X 1984); Kimje Moaksan (30 IX 1984)

DISTRIBUTION: Korea, Japan, Siberia

REMARKS: In some specimens of nymph, color variation is shown: the stripes of abdominal terga, especially on segments 7~9, more narrow and completely separated each other (Fig. 31).

5. ***Ephemera orientalis*** **McLachlan, 1875** (동양하루살이) (Fig. 37~43)

Ephemera orientalis McLachlan, 1875 : 167; Ulmer, 1925 : 98; Tshernova, 1973 : 326

Ephemera lineata: Imanishi, 1940 : 176

ADULTS: MALE IMAGO. Body 19.0 mm. Cerci 37.0 mm. Terminal filament 33.0 mm. General color white. Eyes black; upper portion light brown with orange ring (Fig. 40). Distance between eyes: width of head ≒ 1 : 2.9. Basal part of ocelli with dark spots. Thorax white, with brown markings; pronotum with a pair of dark brown sublateral stripes (Fig. 40). Fore legs brown; each jointing area dark. Ratio of each segment of fore leg 72 : 174 : 6 : 75 : 68 : 43 : 27 (Fig. 42). Middle and hind legs white. Fore wings with 2~3 crossveins crowded together near bullae; with dark markings on the portion; with dark spot at the base of IMP (Fig. 41). Costal projection of hind wing round; outer margin of hind wing brown. 3~9 abdominal terga with 2~3 pairs of dark submedian stripes and with a pair of sublateral stripes; stripes on abdominal terga 7~9 each ends meet (Fig. 40). 2~9 abdominal sterna with a pair of dark submedian stripes. Genital forceps 4 segmented; 2nd segment longest. Penis with a pair of ventral spines (Fig. 39). Caudal filaments white; each joint with dark band, with dark hairs. Terminal filament nearly as long as cerci. FEMALE IMAGO. Body 18.0 mm. Cerci 20.0 mm. Terminal filament 19.5 mm. General color and body shape similar to male imago. Distance between eyes: width of head ≒ 1 : 2.

COLLECTING LOCALITIES OF ADULT: SL: Kangdong-gu Myŏngil-dong (1 ♀ imago, 15 IX 1983, Y.J. Bae); KG: Namyangju Wangsukch'ŏn (1 ♂ imago, 10 ♂ subimagos, 7 ♀ subimagos, 18 V 1982, J.U. Byun); KG Namyangju Kwangnŭng (4 ♂ subimagos, 2 ♀ subimagos, 18 V 1982, J.U. Byun; 1 ♀ subimago, 17 IV 1983, Y.J. Bae, obtained by rearing at 5 V 1984; 1 ♀ subimago, 23 VI 1983, Y.J. Bae); KG Kap'yŏng Cheryŏng-ri (1 ♀ subimago, 13 VIII 1982, J.U. Byun); KG Kap'yŏng Ch'ŏngp'yŏng (8 ♀ imagos, 11 VI 1983, Y.J. Bae); KW: Chunsŏng Kangch'on (2 ♂ imagos, 30 VIII 1983, J.W. Lee); KB: Mungyŏng Mungyŏngsaejae (2 ♂ subimagos, 2 ♀ subimagos, 11 VIII 1983, Y.J. Bae); KB: Ch'ŏngsong Chuwangsan (3 ♂ subimagos, 2 ♀subimagos, 29 VII 1983, J.W. Lee); KN: Kŏje Kuch'ŏn-ri (15 ♂ subimagos, 15 ♀ subimagos, 4 VII 1983, Y.J. Bae); CCN: Okch'ŏn Kŭmgang-Park (3 ♀ imagos, 18 IX 1983, Y.J. Bae); CLN: Sŭngju Songgwangsa (2 ♀ subimagos, 29 V 1983, Y.J. Bae)

NYMPHS: Body 23.5 mm. Caudal filaments 8.5 mm. General color white or light brown. 3~9 abdominal terga with 2~3 pairs of submedian stripes; stripes on 7~9 abdominal terga each ends meet (Fig. 38).

COLLECTING LOCALITIES OF NYMPH: KG: P'och'ŏn Paegunsan (9 VIII 1984); Kap'yŏng Chojongch'ŏn (24 IX 1978); Kap'yŏng Taesŏng-ri (27 IX 1981, 24 X 1982); Yangju Pogwangsa (12 IV 1981); Namyangju Kwangnŭng (19 V 1983, 23 VI 1983, 26 VII 1983, 25 VIII 1983); Namyangju Paldang (23 V 1982); Kwangju Kyŏnganch'ŏn (30 VII 1981); Yŏju Yŏju (9 IV 1972), KW: Inje Chinbu (27 IX 1972); Wonsŏng Ch'iaksan (31 VII 1975, 1 VIII 1975); Chŏngsŏn Imgye (8 V 1984), CCB: Okch'ŏn Sŏdaesan (9 IV 1972), KB: Yŏngpy'ŏng Sobaeksan (27 I 1983); Ponghwa Naesŏng (28 I 1983); Ch'ŏngsong Chuwangsan (29 I 1983), CLB: Muju Kuch'ŏndong (15 VIII 1970); Muju Minjujisan (2 X 1984).

DISTRIBUTION: Korea, Japan, Manchuria, Siberia

Adult identification key to Korean species of Ephemeroidea

1. Middle and hind legs of male and all legs of female feeble, nonfunctional; color usually pale; wings somewhat translucent and colorless (Fig. 29). .... Fam. Polymitarcyidae ..... Gen. *Ephoron* ..... *Ephoron shigae*
— All legs of both sexes well developed, functional; color variable. 2
2. Vein A_1 of forewing forked near wing margin (Fig. 4, 21); genital forceps 3 jointed (Fig. 5, 12); abdomen usually yellow, in some species with reddish lateral stripes. .... Fam. Potamanthidae ... 3
— Vein A_1 of forewing unforked, attached to hind margin by several to numerous veinlets (Fig. 34, 41); genital forceps 4 jointed (Fig. 32, 39); abdomen of most species with striking dark pattern on terga and sterna. ..... Fam. Ephemeridae ..... Gen. *Ephemera* ... 4
3. Vein MP_1 and MP_2 of forewing not connected at base (Fig. 4). ..... Gen. *Potamanthodes* ..... *Potamanthodes kamonis*
— Vein MP_1 and MP_2 of forewing connected at base (Fig. 21). ..... Gen. *Potamanthus* ..... *Potamanthus coreanus* sp. n.
4. 7~9 abdominal terga with a pair of dark submedian stripes (Fig. 33). .... *Ephemera strigata*
— 7~9 abdominal terga with 3 pairs of slender submedian stripes, each ends meet (Fig. 40). ..... *Ephemera orientalis*

Nymphal identification key to Korean species of Ephemeroidea

1. Abdominal gills held laterally (Fig. 1). ..... Fam. Potamanthidae ... 2
— Abdominal gills held dorsally (Fig. 38). 3
2. Mandibular tusks slightly to moderately developed (Fig. 1); mature nymph about 10 mm. ..... Gen. *Potamanthodes* ..... *Potamanthodes kamonis*
— Mandibular tusks very strongly developed (Fig. 11); mature nymph about 30 mm. .... Gen. *Potamanthus* ..... *Potamanthus coreanus* sp. n.
3. Mandibular tusks curved upward; with numerous tubercles and setae on upper and lateral surface (Fig. 22, 23); head with round median frontal process (Fig. 22). .... Fam. Polymitarcyidae ..... Gen. *Ephoron* ..... *Ephoron shigae*
— Mandibular tusks curved upward; frontal process of head bifid (Fig. 37). .... Fam. Ephemeridae ..... Gen *Ephemera* ... 4
4. 7~9 abdominal terga with a pair of thick submedian stripes (Fig. 30) or somewhat slender sublateral stripes (Fig. 31). ..... *Ephemera strigata*

— 7～9 abdominal terga with 3 pairs of slender submedian stripes, each ends meet (Fig. 38). ..... *Ephemera orientalis*

SUMMARY

We reviewed the five species of Korean Ephemeroidea, including 4 genera and 3 families, which were recorded by Imanishi (1940) and some ecological literatures of Korea in the present paper. All the adults and nymphs were described with illustrations and adult and nymphal identification key was provided. As to *Potamanthus* nb, we newly give a name as *Potamanthus coreanus*.

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EXPLANATION OF FIGURES

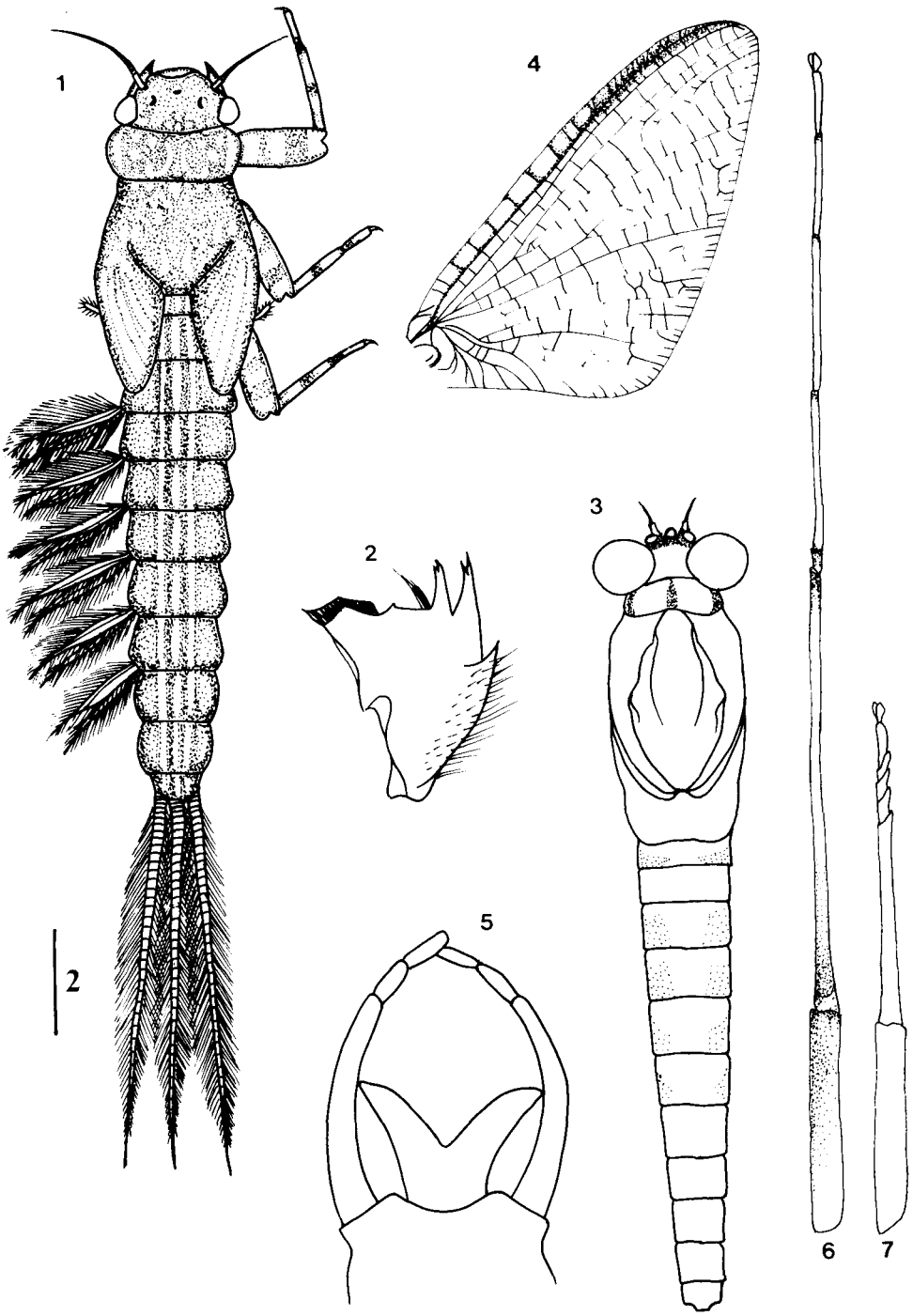
Fig. 1~7. *Potamanthodes kamonis* (1~2: nymph, 3~7: adult) 1. dorsal view 2. mandible 3. dorsal view (♂ imago) 4. fore wing (♂ imago) 5. genitalia (♂ imago) 6. fore leg (♂ imago) 7. hind leg (♂ imago)

Fig. 8~21. *Potamanthus coreanus* (8~11: nymph, 12~21: adult) 8. dorsal view of abdomen 9. abdominal gill (3rd) 10. abdominal gill (1st) 11. dorsal view of head and prothorax 12. genitalia (♂ imago) 13. subanal plate (♀ imago) 14. fore leg (♂ imago) 15. hind leg (♂ imago) 16. fore leg (♀ imago) 17. hind leg (♀ imago) 18. dorsal view (♂ imago) 19. lateral view of abdomen (♀ imago) 20. dorsal view (♀ imago) 21. fore wing (♀ imago)

Fig. 22~29. *Ephoron shigae* (22~24: nymph, 25~29: adult) 22. dorsal view of head and prothorax 23. lateral view of mandible 24. abdominal gill (3rd) 25. genitalia (♂ imago) 26. dorsal view (♀ imago) 27. fore leg (♂ imago) 28. hind leg (♂ imago) 29. fore wing (♀ subimago)

Fig. 30~36. *Ephemera strigata* (30~31: nymph, 32~36: adult) 30. stripes on abdominal terga 31. stripes on abdominal terga (variation) 32. genitala (♂ imago) 33. dorsal view (♂ imago) 34. fore wing (♂ imago) 35. fore leg (♂ imago) 36. hind leg (♂ imago)

Fig. 37~43. *Ephemera orientalis* (37~38: nymph, 39~43: adult) 37. dorsal view of head and prothoax 38. dorsal view of abdomen 39. genitalia (♂ imago) 40. dorsal view (♂ imago) 41. fore wing (♂ imago) 42. fore leg (♂ imago) 43. hind leg (♂ imago)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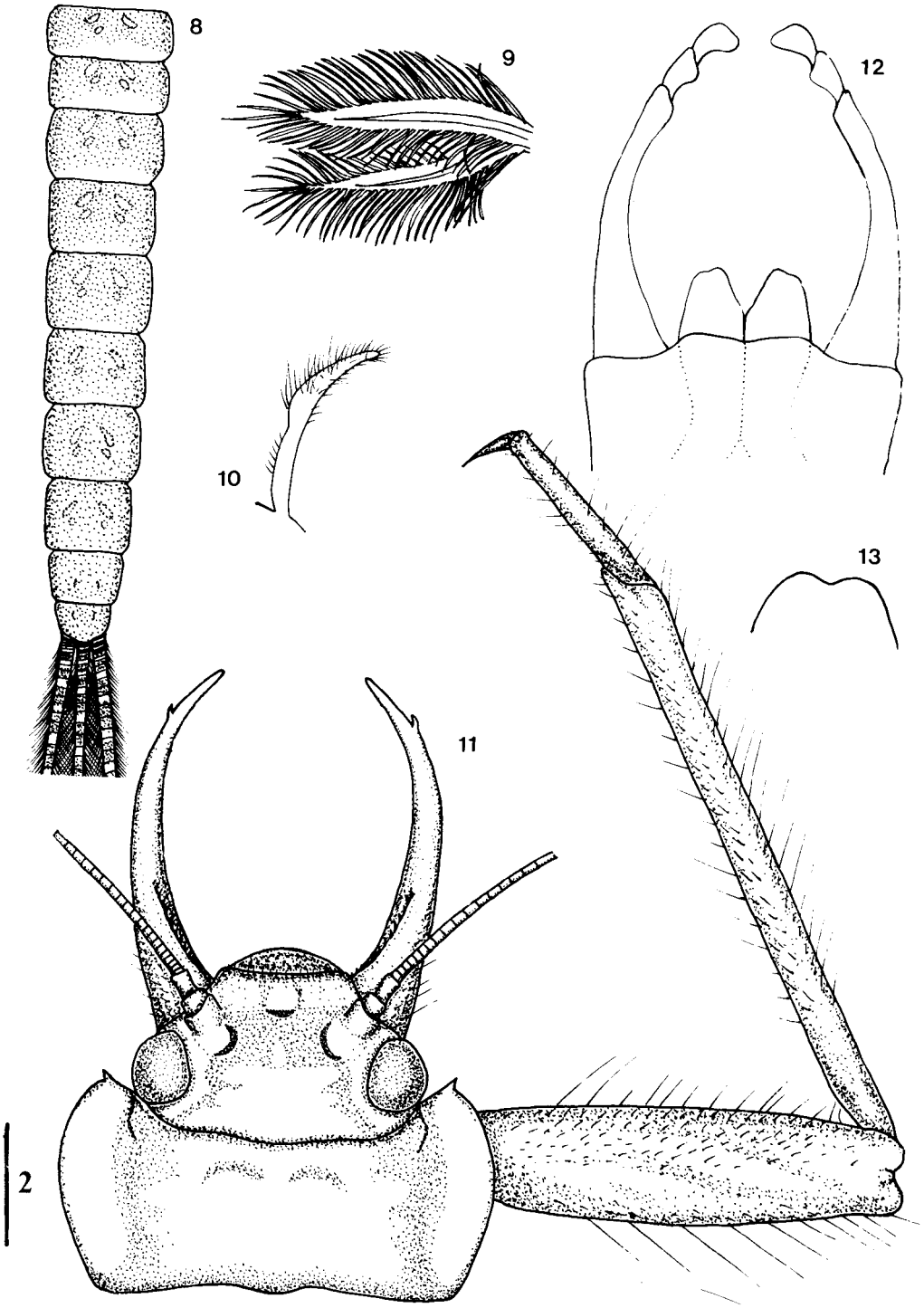
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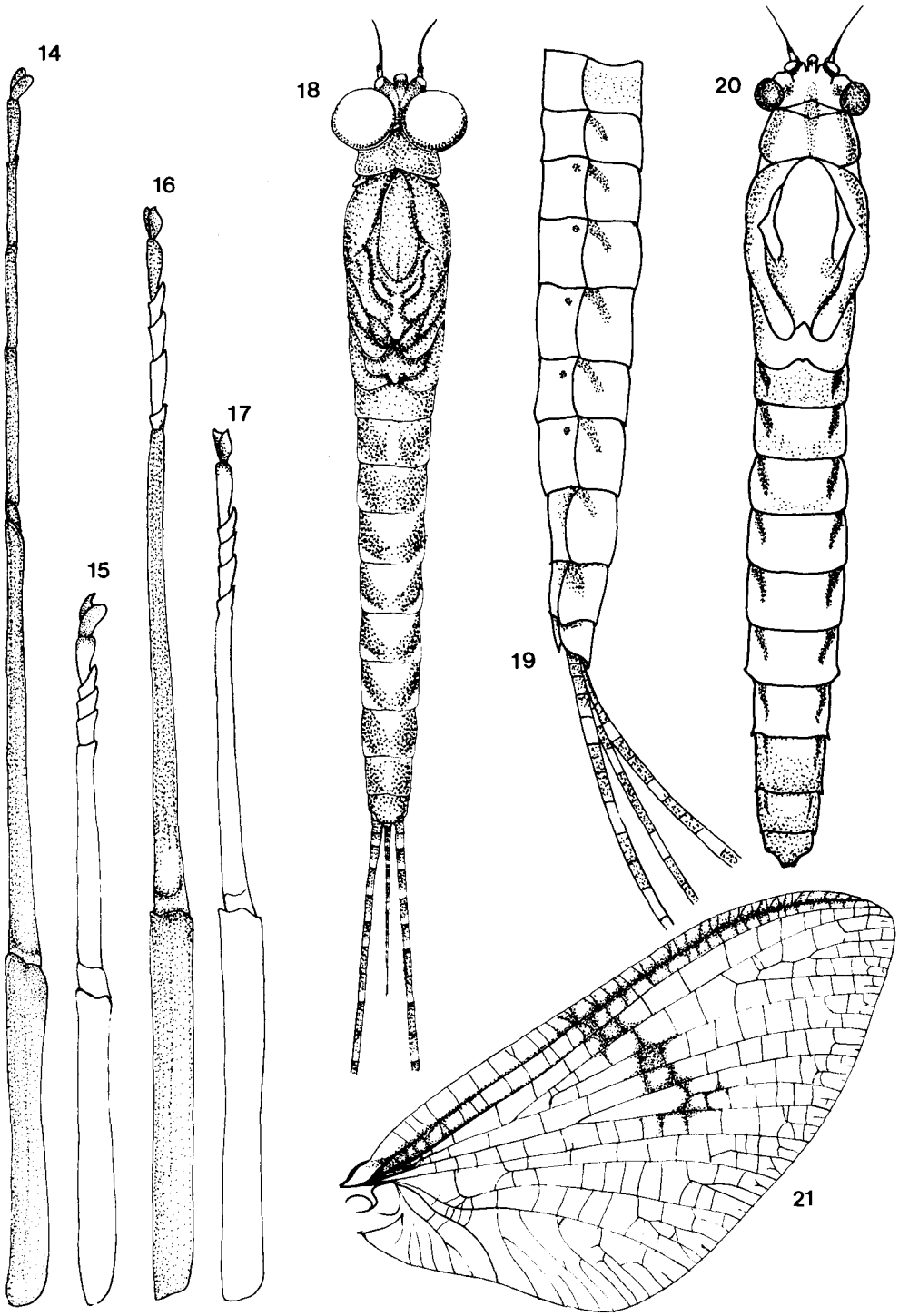
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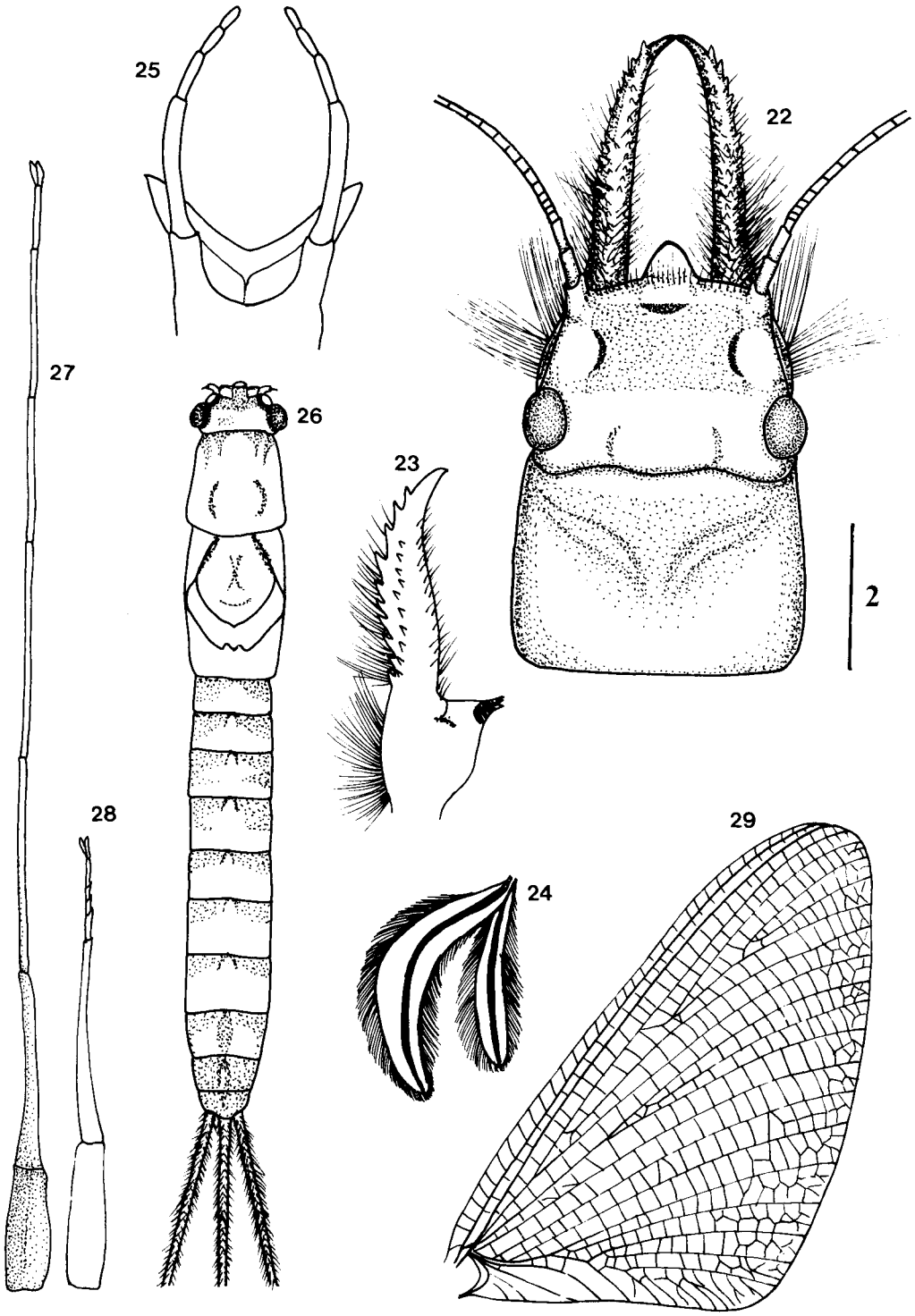
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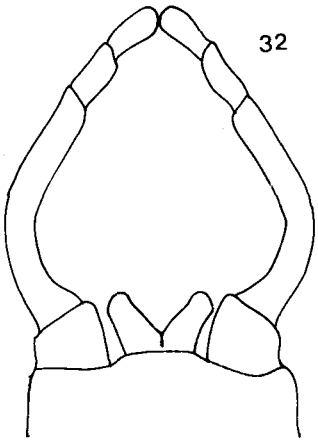
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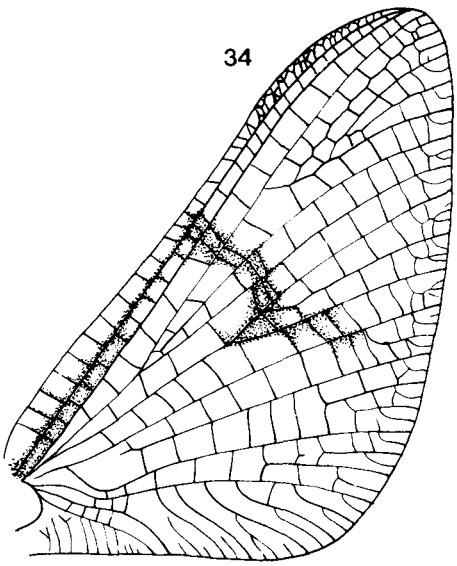
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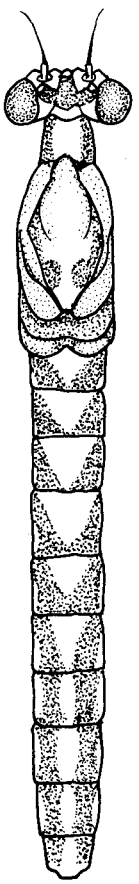
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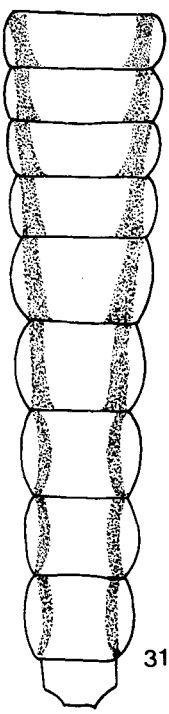
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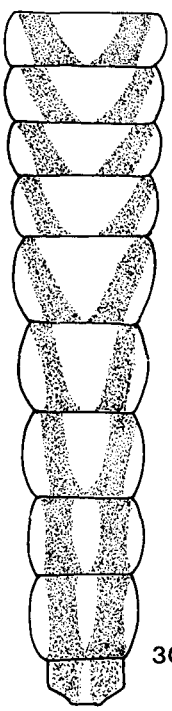
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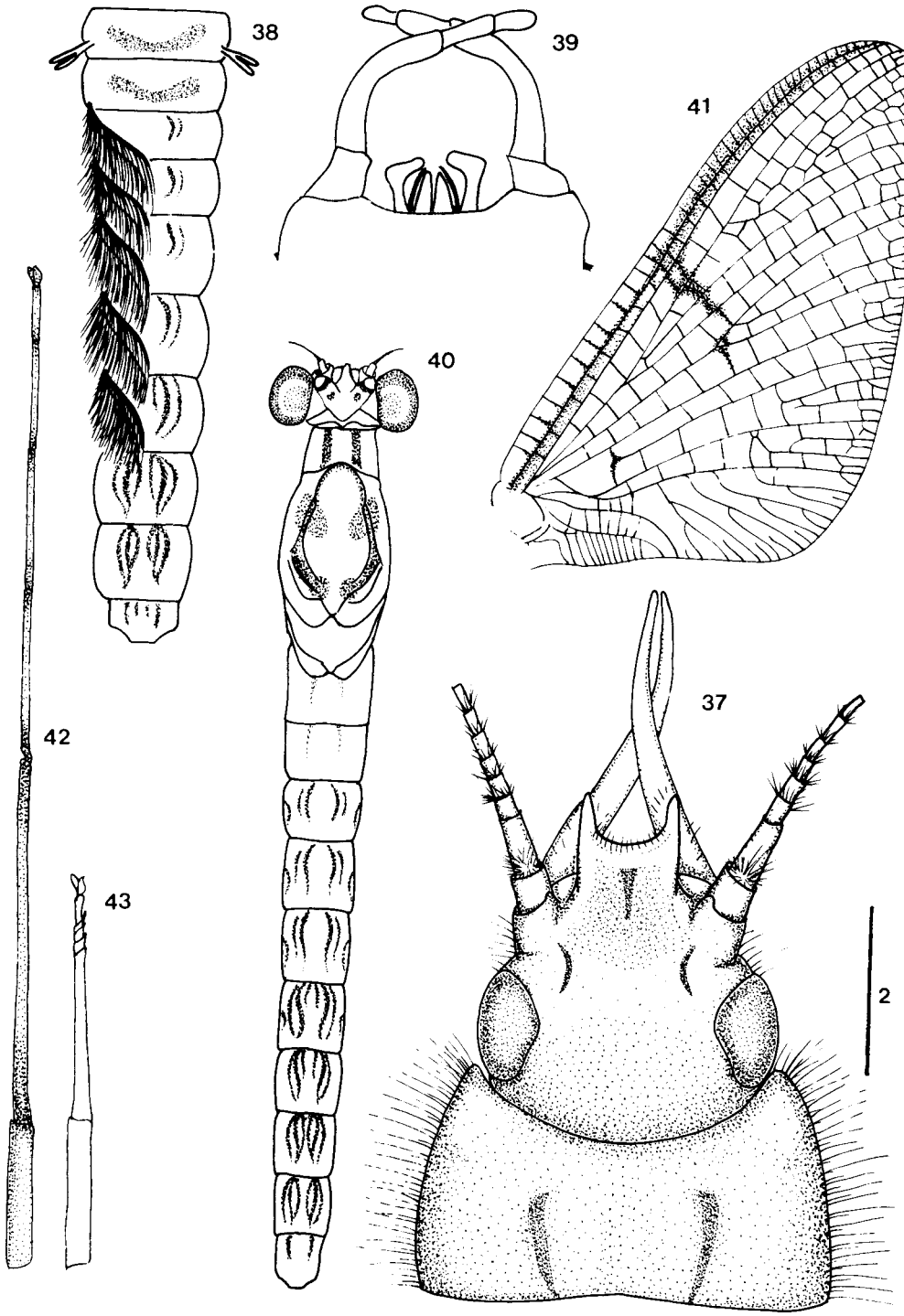
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