

Korean Species of the Subtribe Stigmina (Hymenoptera: Crabronidae: Pemphredoninae)

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Abstract: Three Korean species of the subtribe Stigmina are treated: *Carinostigmus filippovi* Gussakovskij, *Tzustigmus rhinoceros* Budrys, and *Stigmus japonicus* Tsuneki. The last two genera and species are new to Korea. A key to Korean genera of the subtribe Stigmina and diagnostic features of three species with digital images are provided.

Key words: stigmina, Pemphredoninae, Crabronidae, Hymenoptera, Korea

INTRODUCTION

Pemphredoninae is cosmopolitan and contains about 860 species in two tribes, Pemphredonini and Psenini (Bohart and Menke, 1976; Finnamore and Michener, 1993). They are solitary wasps, except for social in one genus *Microstigmus*. Nests are constructed in hollow twigs (or stems) or soil, and are provisioned with mainly various Homopteran families (Iwata, 1971; Finnamore and Michener, 1993; O'Neil, 2001).

Recently, while examining Korean Pemphredoninae, we have found three Stigmina species. The subtribe Stigmina is clearly defined by microsetal or micropore fields laterally on metasomal tergum II, more or less lower part on the forewing stigma and on the vertex between lateral ocellus and eyes (in circles of Fig. 1A-C).

We report three Korean species of Stigmina in the present paper: *Carinostigmus filippovi* Gussakovskij, *Tzustigmus rhinoceros* Budrys, and *Stigmus japonicus* Tsuneki. The last two genera and species are new to Korea. A key to Korean genera of the subtribe Stigmina and diagnostic features of the three species with digital images are given.

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MATERIALS AND METHODS

Morphological terminology mainly followed Bohart and Menke (1976) and Finnamore (1995). All measurements were taken as the maximal length of the part being taken under an image analyzer (Tomoro Digital Imaging). Body length was measured from the anterior margin of head to the posterior end of metasoma.

Acronyms for type depositories as follows: [ZIL] Zoological Institute, Academy of Sciences, Leningrad, Russia; [MNHAH] The Museum of Nature and Human Activities, Hyogo, Japan.

All the examined specimens are deposited at Insect Diversity Lab. in Hanseo University.

SYSTEMATIC ACCOUNTS

Family Crabronidae Latreille, 1802
Subfamily Pemphredoninae Dahlbom, 1835
Tribe Pemphredonini Dahlbom, 1835
Subtribe Stigmina Bohart and Menke, 1976

Key to Korean Genera of the Subtribe Stigmina

1. Submedian cell of hind wing reduced, cu-a positioned about halfway from wing base to origin of media (Fig. 2A) *Carinostigmus* Tsuneki
- Submedian cell of hind wing not reduced, cu-a positioned near origin of media (Fig. 2B) 2
2. Acute frontal tubercle present. Eyes margined by foveolate broad sulcus (Fig. 3F). Petiol largely smooth, at most a pair of submedian longitudinal carina (Fig. 3H) *Tzustigmus* Finnamore
- Frontal tubercle absent, at most with trace of tubercle. Eyes margined by simple narrow sulcus (Fig. 3J). Petiol carinate and reticulate (Fig. 3L) *Stigmus* Panzer

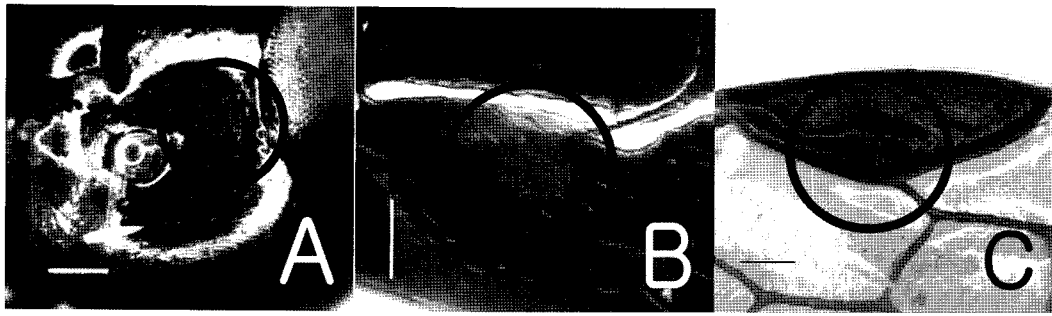


Fig. 1. Microsetal or micropore fields. A, Head. B, Sternum II. C, Stigma (for more detailed structure, refer to Finnamore, 1995). Scale bars: 0.2 mm.

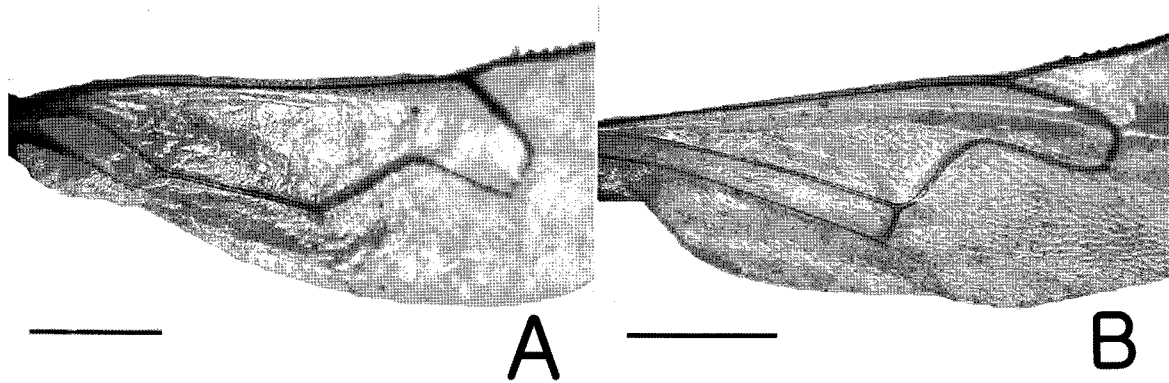


Fig. 2. Hindwing venation. A, *Carinostigmus filipovi*. B, *Tsustigmus rhinocerus*. Scale bars: 0.5 mm.

Genus *Carinostigmus* Tsuneki

Carinostigmus Tsuneki, 1954: 3 (originally as subgenus of the genus *Stigmus*, and later elevated to generic rank by Bohart and Menke, 1976). Type species: *Stigmus congruus* Walker 1860, original designation.

***Carinostigmus filipovi* (Gussakovskij)**

Stigmus filipovi Gussakovskij, 1934: 83, ♀, Takao-san (60 km of Tokyo), Honshu, Japan (ZIL); Kim, 1970: 598.

Female. Body 5.7 mm long, and forewing 4.2 mm long.

Ground color black, but following parts creamy white; antennal scape below, basal half of mandible, labrum, labial and maxillary palpi, and pronotal lobe. Antennal flagellum and all legs yellowish brown to blackish brown. Tegula semitransparent brown. Apical marginal parts of metasomal segments tinged with reddish black.

Head. Seen from above, 1.2 X as broad as long, lateral margins behind eyes somewhat strongly converging, breadth between posterior points of eyes approximately 2.2 X of dorsal occipital carina length, and anterior margin somewhat deeply concave (due to excavation of scapal basin); area behind eyes extended, gena in its broadest portion in profile, approximately 1.35 X of the eye (Fig. 3A, B). Scapal basin shagreened. Clypeus somewhat polished and weakly microcoriaceous, with sparse punctures; apicomedian margin biemarginate and tridentate, each

emargination somewhat shallow, but tips of all teeth angled. Inner and outer orbit margined by coarsely foveolate broad sulcus (Fig. 3B) evanescent or absent anterodorsally and ventrally. Frontal carina distinct almost up to anterior ocellus (but weaker near ocellus), with small acute frontal tubercle just above interantennal area. Mandible with three apical teeth. Apical margin of labrum widely rounded. Larger lower part of gena densely carinate (Fig. 3A).

Mesosoma. Pronotal carina strongly developed, at each dorsal corner of pronotum acutely produced. Anterior part of mesonotum with a pair of weak fissures extending about midlength of mesoscutum medianly, and a pair of weak pit rows extending 1/4 to 1/3 of mesoscutum submedianly. Mesonotum mat, with irregularly set sparse punctures; its posterior marginal part with weak (sometimes evanescent) longitudinal carina. Upper half of dorsal mesopleuron compactly striate/ finely carinate, and remaining part smooth; anterior half of ventral mesopleuron weakly striate and mainly carinate in remain part (Fig. 3C). Scutellum mat, almost without punctures. Metanotum with subparallel longitudinal carina in its entire face. Entire face of metapleuron vertically carinate. Propodeal dorsum loosely reticulate; propodeal posterior face mainly obliquely carinate; anterior half of lateral face longitudinally carinate, and loosely reticulate in remaining part.

Metasoma. Petiole smooth and somewhat abruptly bent at basal 1/5, with weak two pairs of dorsal longitudinal

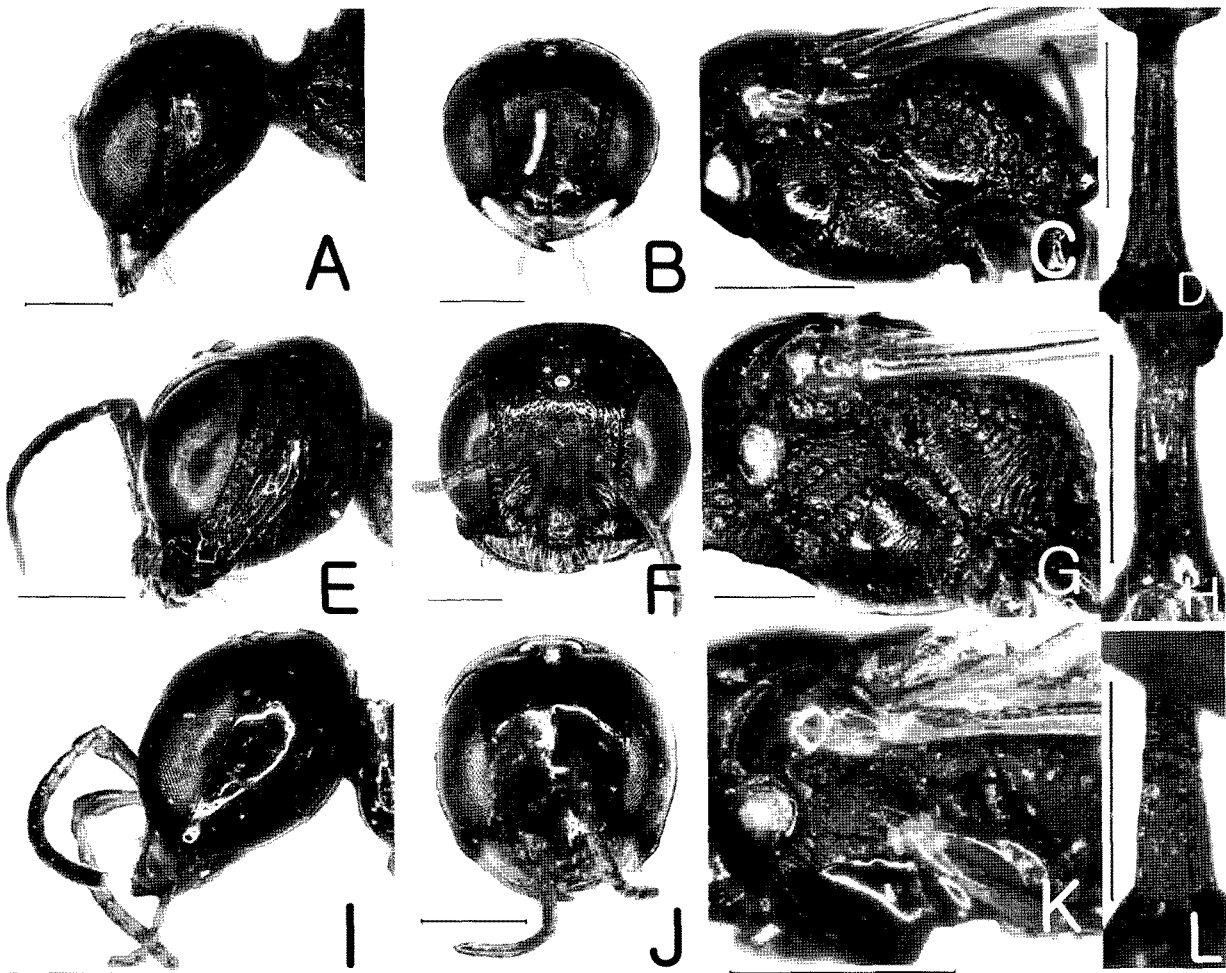


Fig. 3. External features of *Carinostigmus filippovi* (A-D), *Tzustigmus rhinocerus* (E-H) and *Stigmus japonicus* (I-L). A, Head, in profile, ♀. B, Head, in front, ♀. C, Mesosoma, in profile, ♀. D, petiol, dorsal, ♀. E, Head, in profile, ♀. F, Head, in front, ♀. G, Mesosoma, in profile, ♀. H, petiol, dorsal, ♀. I, Head, in profile, ♀. J, Head, in front, ♀. K, Mesosoma, in profile, ♀. L, petiol, dorsal, ♀. Scale bars: 0.5 mm.

carina submedially and laterally (Fig. 3D); almost as long as hind femur. Metasomal terga and sterna smooth without distinct punctures. Pygidial plate long oval in shape.

Male. Much as in the female except in the following details. Body shorter, 5.5mm long. Head, seen from above, much broader than long, approximately 1.5 X as broad as long. Apicomedian margin of clypeus truncate. Antennal scapes partly blackish brown.

Specimens examined. 1 ♀, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Baekdun-ri, Myongjisan, 26.iv.2001 (H.C. Park); 1 ♀, Gangwon-do, Inje-gun, Buk-myeon, Yongdae-ri, Baekdamsa, 25.v.2002 (J.D. Yeo); 2 ♀ ♀, Gangwon-do, Yeongwol-gun, Mt. Taebaeksan, 20.vi~14.v.1999 (D.S. Gu); 1 ♂, Gangwon-do, Wonju-si, Gwirae-myeon, Mt. Sibjabongsan, 7.v.2007 (H.S. Lee).

Distribution. Korea, Japan.

Genus *Tzustigmus* Finnamore

Tzustigmus Finnamore, 1995: 211. Type species: *Tzustigmus syam* Finnamore, 1995, original designation.

***Tzustigmus rhinocerus* (Budrys)**

Tzustigmus rhinocerus Budrys 1987: 54, ♀ ♂, Levaya River, Khekhtsir Range Khabarovsk, Federation, Russian (ZIL).

Female. Body 7.0 mm long, and forewing 5.0 mm long.

Ground color black, but pronotal lobe creamy white. Antennal flagella, antennal scape below, basal half of mandible, labrum, labial and mandibular palpi, and all legs blackish brown. Tegula semitransparental brown.

Head. Seen from above, much broader than long, approximately 1.6 as broad as long, and anterior margin somewhat deeply concave; in profile, vertex somewhat

strongly swollen; area behind eyes extended, gena in its broadest portion in profile, approximately 1.68 X of eye (Fig. 3, E). Upper median part of scapal basin microcarinate; lower median part strongly shagreened; lateral parts loosely reticulate. Clypeus strongly bulging medially with coarse dense punctures; its apicomedian margin tridentate, each emargination somewhat deep, and tips of all teeth rounded (Fig. 3F). Frontal tubercle strongly developed, and frontal carina shortly present in lower frontal area. Gena with sparse punctures, and larger part of lower gena striatopunctate and carinate (Fig. 3E). Mandible with three apical teeth. Apical margin of labrum with four large teeth of which tips rounded.

Mesosoma. Pronotum with transverse sulcus longitudinally carinate in its bottom. Mesonotum polished, in its anterior half with curvilinear carinae becoming longitudinal ones adjacent to median lines. Dorsal mesopleuron loosely reticulate and partially longitudinally carinate; ventral mesopleuron polished with both moderate to dense small-sized punctures; hypoepimeral area longitudinally carinate. Metapleuron longitudinally carinate (Fig. 3G). Scutellum polished, with both dense micropunctures and sparse punctures, and microcoriaceous in its posterior part. Metanotum strongly shagreened. Propodeal areola strongly reticulate; propodeal posterior face mainly longitudinally carinate; anterior 2/3 of lateral face longitudinally carinate, and reticulate in remaining posterior part.

Metasoma. Petiole cylindrical and short, approximately 0.7 X as long as hind femur, and polished with a pair of weak submedian carinae dorsally (Fig. 3H). Metasomal terga and sterna polished, without distinct puncture. Pygidial plate anteriorly paralleled and posteriorly converging with rounded apical margin.

Male. Unexamined.

Specimens examined. 1 ♀, Gangwon-do, Hongcheon-gun, Nae-myun, Mt. Gachilbong, 25.v.1996 (H.Y. Han, H.W. Byun).

Distribution. Korea (new record), Russian Far East.

Genus *Stigmus* Panzer

Stigmus Panzer, 1804: 86. Type species: *Stigmus pendulus* Panzer, 1804, by monotypy.

Stigmus japonicas Tsuneki

Stigmus japonicus Tsuneki, 1954: 29, ♀ ♂ (♂=*Stigmus quadriceps*), Kyogoku-mura near Kucchian, Hokkaido, Japan (MNHAH).

Female. Body 5.0 mm long, and forewing 3.9 mm long.

Ground color black, but following parts yellowish white: pronotal lobe, mandibles except apex, and labrum. Yellowish brown: inner margin of fore tibiae and distal half of hind

tibiae except for extreme apex dark brown. Tegula semi-transparental brown.

Head. Polished and largely impunctate; seen from above, broader than long, approximately 1.4 as broad as long, and anterior margin somewhat deeply concave; in profile, vertex somewhat swollen; area behind eyes extended, gena in its broadest portion in profile, approximately 1.37 X of eye (Fig. 3I). Frontal carina absent. Scapal basin microcoriaceous. Inner and outer orbit margined by simple narrow sulcus. Clypeus somewhat polished with sparse small punctures, and apicomedian margin bidentate, teeth triangular in shape. Mandible with three apical teeth (middle one longest) and one weak inner tooth.

Mesosoma. Pronotal carina well-developed, but not angled at each dorsal corner. Pronotal dorsum and lateral face mat, with evanescent sculptures. Mesonotum polished with a pair of longitudinal fissures medially and a pair of somewhat distinct pit rows submedially. Mesopleuron mat and loosely reticulate (Fig. 3K; but in this figure lower part of mesopleuron looks like smooth due to glue). Scutellum polished with sparse small punctures. Metanotum microcoriaceous.

Metasoma. Petiol approximately 0.85 X as long as hind femur; its dorsoanterior part reticulate, and remaining dorsoposterior, lateral and ventral parts longitudinally carinate (Fig. 3L). Metasomal terga and sterna polished, without distinct punctures. Pygidial plate long oval in shape.

Male. Uuexamined.

Specimens examined. 1 ♀, Gangwon-do, Baekdam, Mt. Sorak, 10.v.2006 (J.K. Kim).

Distribution. Russian Far East, Korea (new record), Japan.

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REFERENCES

- Bohart RM and Menke AS (1976) Sphecid wasps of the world. California University Press, 695 pp.
- Burdrys ER (1987) Roiushchie osy rodov *Stigmus* Panzer and *Carinostigmus* Tsunemi (Hymenoptera, Sphecidae) dal'nego Vostoka SSSR. In: Lehr PA and Storoshev (eds), Novye Dannye po Sistematike Nasekomykh Dal'nego Vostoka. Biological Pedological Institute, Far East Section, Academy of Science, pp. 49-56.
- Finnamore AT (1995) Revision of the World Genera of the

- Subtribe *Stigmina* (Hymenoptera: Apoidea: Sphecidae: Pemphredoninae), Part 1. *J Hym Res* 4: 204-284.
- Finnamore AT and Michener CD (1993) Superfamily Apoidea. In: Goulet H and Huber JT (eds), Hymenoptera of the world: An identification guide to families. Canada communication Group, Ottawa, Canada, pp. 279-357.
- Gussakovskij VV (1934) Schwedisch-chinesische wissenschaftliche Expedition nach den nordwestlichen Provinzen Chinas, unter Leitung von Dr. Sven Hedin und Prof. Sü Ping-chang. Insekten gesammelt vom schwedischen Arzt der Expedition Dr. David Hummel. 41. Hymenoptera, 6. Sphegidae. *Arkiv för Zoologi* 27A(21): 1-15.
- Iwata K (1971) Evolution of Instinct, Comparative Ethology of Hymenoptera. Mono-shoten, Kanagawa-ken, 503 pp.
- Kim CW (1970) Illustrated Encyclopedia of Fauna and Flora of Korea Vol. 11 Insecta (III). Samhwasa, Seoul, Korea. 891 pp.
- O'Neill KM (2001) Solitary Wasps, Behavior and Natural History. Cornell University Press, 406 pp.
- Panzer GWF (1804) Fauna Insectorum Germaninae Intiae oder Deutschlands Insekten. Heft 86. Nürnberg.
- Tsuneki K (1954) The genus *Stigmus* Panzer of Europe and Asia with descriptions of eight new species (Hymenoptera, Sphecidae). *Memoires of the Faculty of Liberal Arts, Fukui University Series 2 Natural Science* 3: 1-38.

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