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Notes on some Encyrtidae (Hymenoptera, Chalcidoidea) from Korean Peninsula

한국산 깡충좀벌

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ABSTRACT The article contains a list with comments of fifteen species of economically important family Encyrtidae known from Korean peninsula. Of these, four species, *Cerchysius subplanus* (Dalman), *Copidosoma floridanum* (Ashmead), *Homalotylus flaminius* (Dalman) and *Prionomitus tiliaris* (Dalman), were collected in the North Korea by Hungarian entomologists. Three species, *Coccidencyrtus steinbergi* Tshumakova et Trjapitzin, *Neodiscodes* sp. and *Thomsonisca shutovae* (Trjapitzin), were recorded from the North Korea by Russian specialists.

KEY WORDS Hymenoptera, Chalcidoidea, Encyrtidae, Korean Peninsula

적 요 한반도산 깡충좀벌과 15종을 보고한다. 이중 3종-*Cerchysius subplanus* (Dalman) (진디파리깡충좀벌: 신칭), *Copidosoma floridanum* (Ashmead) (꼬마깡충좀벌: 신칭), *Prionomitus tiliaris* (Dalman) (사과나무이깡충좀벌: 신칭)-은 한반도 미기록종이며, *Homalotylus flaminius* (Dalman) (무당깡충좀벌)은 북한에서 처음으로 보고한다. 우리말이 없는 종에는 새로운 이름을 붙였다.

검색어

INTRODUCTION

Encyrtidae of East Asia are still badly studied. According to data of V. A. Trjapitzin upto January 1995(Sharkov & Trjapitzin, 1995), 196 species are known from Primorye Territory (=Ussury Land) of Russia, 119 from Japan, 116 from China, 42 from Sakhalien, 19 from Taiwan, and 38 from the North and South Korea (13 unnamed species included). *Cerchysius subplanus* (Dalman), *Copidosoma floridanum* (Ashmead), *Homalotylus flaminius* (Dalman), and *Prionomitus tiliaris* (Dalman) are recorded here for the Korean fauna for the first time. *Anicetus beneficus* Ishii et Yasumatsu was introduced into South Korea from Japan (Kim *et al.* 1979). Korean fauna of encyrtids has already become important sources for introduction of beneficial insects into other regions of the world; corresponding reviews are presented in the article. Probable number of species of Korean Encyrtidae is regarded to be several hundreds. All materials are preserved in the collection of Hungarian Natural History Museum in Budapest (HMNB).

REVIEW OF SPECIES

(1) *Anicetus beneficus* Ishii et Yasumatsu, 1954 루비붉은깡충좀벌

Paik, 1978: 173-174; Kim *et al.*, 1979: 107-110; Trjapitzin, 1989: 304; DeBach & Rosen, 1991: 213-214.

The species was introduced into South Korea for bio-

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logical control of the wax scale *Ceroplastes rubens* Maskell (Homoptera, Coccidae), which is a serious pest of citrus and other subtropical plants (Kim *et al.*, 1979). This effective parasite was discovered in Japan, on the southern island Kyushu, in 1946 by Prof. K. Yasumatsu. The native land of it was supposed to be China (DeBach & Rosen, 1991), and indeed it was found there by Chinese entomologists (Liao *et al.*, 1987; Jiang & Gu, 1988). Surveys had shown that this parasite was not present on the Japanese islands Honshu and Shikoku. Beginning from 1948, *A. beneficus* was transferred in large numbers from Kyushu to various orchards on Honshu and Shikoku, resulting in complete biological control of *Ceroplastes rubens* (Yasumatsu, 1958). In India, *A. beneficus* was recorded as a parasite of *C. actiniformis* Green on lime *Citrus aurantifolia*, and in Vietnam as a parasite of *C. rubens*. It was successfully introduced from Japan to Australia for control of *C. rubens* (Wilson, 1960). Two unsuccessful attempts of introduction of *A. beneficus* to West Palaearctic were undertaken in 1990: (1) into Israel from Japan against *C. floridensis* Comstock; and (2) into the Caucasus (on the Black Sea Coast of Georgia) from Vietnam against *C. japonicus* Green and *C. sinensis* Del Guercio (Izhevsky, personal communication).

(2) *Caenohomalopoda koreana* Tachikawa, Paik et Paik, 1981 비늘깡충좀벌

Tachikawa *et al.*, 1981: 183-186.

The species was reared in South Korea from the armoured scale *Odonaspis secreta* (Cockerell) (Homoptera, Diaspididae) on bamboo.

(3) *Caenohomalopoda shikokuensis* (Tachikawa, 1956) 대비늘깡충좀벌(신칭)

Tachikawa *et al.*, 1981: 183-186; Trjapitzin, 1989: 295.

The species was reared in South Korea from an armoured scale *Odonaspis secreta* (Cockerell) on bamboo. In Japan, South African Republic and U.S.A. this species is recorded as a parasite of an armoured scale *Frogatiella penicillata* Green on bamboo.

(4) *Cercysius subplanus* (Dalman, 1820) 진디파리깡충좀벌(신칭)

Materials examined: North Korea - 1 ♀, Mt. Pektusan Nupo, brook Dehongdan, 20. VII. 1977, leg. Dely-Draskovits (HMNB).

A very common Palaearctic species, known also from Thailand. The map of its distribution in the former USSR and Mongolia was published by Trjapitzin (1978). In Russia (in North Karelia on the Shore of White Sea) the parasite was reared from puparia of the predatory fly *Chamaemyia juncorum* Fallén (Diptera, Chamaemyiidae) on the gramineous plant *Festuca ovina*. In Afghanistan, from puparium of a predatory fly, larva of which was feeding on the mealybug *Adelosoma phragmitidis* Borchsenius on the gramineous plant *Arundo donax*.

(5) *Coccidencyrtus steinbergi* Tshumakova et Trjapitzin, 1964 사철깍지깡충좀벌(신칭)

Trjapitzin, 1989: 297; Sharkov & Trjapitzin, 1995: 239-240.

The species was reared in North Korea and the Far East of Russia (Primorye Territory) from San Jose Scale *Diaspidiotus perniciosus* (Comstock) (Homoptera, Diaspididae). Citation of *C. steinbergi* as a parasite of an armoured scale *Dynaspidiotus britannicus* Newstead in Italy (Battaglia & Viggiani, 1986) is errouneous and refers to *C. dynaspidioti* Battaglia, 1988.

(6) *Copidosoma floridanum* (Ashmead, 1900) 꼬마깡충좀벌(신칭)

Materials examined: North Korea - 1♀, 20. IX. 1980, Prov. Kangwon, Wonsan, sea shore, leg. Forró et Topal; 1♀, 24. IX. 1978; 1♀, 2. X. 1978; 1♂, 12. X. 1978, the same Province, Kumgang-san, in the woods around Oe-Kumgang Rest Area, leg. A. Voinits et L. Zombory; 1♂, 12. IX. 1980; 1♂, 14. IX. 1980, Prov. North Pyongan, Myohyang-san, leg. Forr et Topal; 1♀, 25. IX. 1978, Pyongyan, garden of Hotel Pyongyan, leg. A. Voinits et L. Zombory; 1♀, I. X. 1978, Yonung-ho 10 km SW of Kaechon, leg. A. Voinits et L. Zombory; 3♀, 24. IX. 1978, Prov. South Pyongan, Ryongsan-san, 20 km W of Pyongan, leg. A. Voinits

et L. Zombory (HMNB).

A widely distributed, almost cosmopolitan polyembryonic parasite of caterpillars of Lepidoptera, mainly from the family Noctuidae (Noyes, 1988a, b; Trjapitzin, 1989), formerly in many cases erroneously identified and confused with *C. truncatellum* (Dalman, 1820). In Europe and Transcaucasus, *C. floridanum* is an usual parasite of *Phytometra gamma* Linnaeus, in U. S.A. and Thailand, of *Trichoplusia ni* Hübner; in the north Caucasus it was reared from *Cerapteryx graminis* Linnaeus on rice. In Japan, *C. floridanum* was recorded as a parasite of *Phytometra confusa* Stephen and *Thysanoplusia intermixta* Warren.

(7) *Encyrtus infidus* (Rossi, 1970) 깡충좀벌(신칭)

Clausen, 1932: 670-687; Sugonjaev & Vu, 1979: 1-85; Sugonjaev & Trjapitzin, 1981: 18; Sugonjaev & Vu, 1989: 1-108; Trjapitzin, 1989: 371-372; Sugonjaev & Voinovich, 1991: 136-140.

In Korea, this widely distributed Palaearctic species parasitizes *Eulecanium kunoense* Kuwana (Homoptera, Coccidae). The map of its distribution in the former USSR, Mongolia, Japan, and Korea was published by Sugonjaev et Trjapitzin(1981).

(8) *Homalotylus flaminius* (Dalman, 1820) 무당깡충좀벌

Materials exmained: North Korea - 1♀, 12. IX. 1980, Prov. North Pyongan, Mt. Myohyang-san, leg. Forró et Topal (HMNB).

World wide distributed parasite of larvae and pupae of many species of ladybird beetles (Coleoptera, Coccinellidae) (Trjapitzin & Semyanov, 1982; Trjapitzin, 1989), including usual and economically important species, such as *Coccinella septempunctata* Linnaeus, *Chilocorus bipustulatus* Linnaeus, *Ch. renipustulatus* Scriba, *Ch. kuwanae* Silvestri, *Exochomus quadripustulatus* Linnaeus, and *Adalia bipunctata* Linnaeus, etc.

(9) *Neodiscodes* sp.

Trjapitzin, 1971: 131; Myartseva, 1984: 39.

This species was reared in North Korea from the Comstock mealybug, *Pseudococcus comstocki* Kuwana (Homoptera, Pseudococcidae) by the entomologists of Quarantine Service of the USSR and introduced into Uzbekistan to control this mealybug, a dangerous pest of mulberry (*Morus* spp.). There was no information concerning acclimatization of the parasite in Uzbekistan, but in 1980 Dr. Svetlana N. Myartseva reared several males of *Neodiscodes* sp. from mummies of *P. comstocki* on mulberry in the city of Ashgabat (=Ashkhabad), Turkmenistan.

(10) *Ooencyrtus kuvanae* (Howard, 1910) 짚시알깡충좀벌

Schaefer *et al.*, 1988: 430-444; Izhevsky, 1989: 10; Lee & Lee, 1989: 221-228; Trjapitzin, 1989: 207-208; Elkinton & Liebhold, 1990: 577-578; Volkov & Mironova, 1990: 577-578; Izhevsky & Korotkova, 1993: 25-26.

This important egg parasite of the Gypsy Moth, *Lymantria dispar* Linnaeus (Lepidoptera, Lymantriidae) was reported from this host both in South and North Korea.

The natural habitat of *Ooencyrtus kuvanae* comprises Japan, Korean Peninsula, China, and southern part of Primorye Territory (=Ussury Land) of Russia. In China (Provinces Liaoning and Jilin) it was reared from the egg of *Malacosoma neustria testacea* Motschulsky (Lepidoptera, Lasiocampidae) (Lou, 1989).

In 1908-1909, *Ooencyrtus kuvanae* was introduced into U.S.A. to control *Lymantria dispar*, established there, and in 1976 was successfully introduced into Canada. In 1922-1933, it was introduced from U.S.A. to Spain, then to Morocco (1929-30), Portugal(1932), Algeria, and Tunisia. In 1950 the parasite was discovered in Bulgaria and in Yugoslavian Macedonia where it undoubtedly penetrated from Bulgaria. In 1959 the parasite was successfully introduced on the island Hvar near the Adriatic Coast of Croatia. Shipment of *O. kuvanae* to Slovakia failed, but the parasite was found in eastern Austria. It was introduced to Turkey and was discovered on island of Sardinia (Italy). In 1989, *O. kuvanae* was reared from the egg of *L. dispar* in Zakarpatye Province of Ukraine, probably it penetrated

there from Rumania.

1n 1987 Dr. M. A. Kravtchenko and Mr. O. G. Volkov (all Union Institute of Plant Quarantine, Bykovo near Moskow) visited the North Korea and shipped into the USSR a cold resistant population of *O. kuvanae*. The parasite was released in Moskow and Ulianovsk Provinces and in Krasnodar Territory of Russia, as well as in Ukraine, Georgia, Uzbekistan and Kirghizia (Kyrghyzstan); it was reported to have overwintered in Moscow and Ulianovsk Provinces.

(11) *Prionomitus tiliaris* (Dalman, 1820) 사과나무이깡충좀벌(신칭)

Materials exmained: North Korea - 1♀, 18. VII. 1977, Mt. Pektusan, 2~6 km N Samzi-yan Hotel, wood, netting in grasses, leg. Dely-Draskovots (HMNB).

A widely distributed Palaearctic species, parasite of psyllids (Homoptera, Psylloidea). In Leningrad Province of Russia and in Moldavia (Moldova) it infests in the nymphs of *Psylla mali* Schmiedberger on apple trees, and also is known as a parasite of *P. ulmi* Fö rster (in Leningrad Province) and *P. peregrina* Förster (in France).

(12) *Pseudaphycus malinus* Gahan, 1946 가루깍지깡충좀벌

Gahan, 1946: 313, 317-319; Trjapitzin, 1989: 220-221; Izhevsky, 1990: 116-117; DeBach & Rosen, 1991: 222.

This species is an effective parasite of the Comstock mealybug, *Pseudococcus comstocki* Kuwana (Homoptera, Pseudococcidae), a dangerous pest of mulberry (*Morus* spp.) and other plants. Its native range of distribution comprises Japan and Korean Peninsula (except, probably extreme northern regions). In 1950-1970 Soviet specialists believed that *P. malinus* occurs in the Far East of Russia, in the Primorye Terrtory (= Ussury Land) as a parasite of the mealybug *Coccura suwakoensis* (Kuwana et Toyoda). However, A. V. Sharkov (1985) showed that the parasite of *C. suwakkoensis* belongs to an undescribed species, its description is now in print. In Japan *P. malinus* is propagated in insectaries and used as a "Living insectcide".

In 1939 the work was carried on introduction of *Pseudoaphycus malinus* from Japan to U.S.A. It resulted in establishement of the species and in the biological suppression of *Pseudococcus comstocki* in U.S. A. and Canada as a pest. In 1945 the parasite was introduced from the U.S.A. into Uzbekistan. It has been established in Uzbekistan, Tadzhikistan, Turkmenistan, Kirghizia (Kyrghyzsta) and southern Kazakhstan, in Transcaucasus (Georgia, Armenia, and Azerbaidzhan), in Russia (Krasnodar and Stavropolye Territories of the north Caucasus), in Moldavia (Moldova) and in southern Ukraine. Problem of *Pseudococcus comstocki* as a pest was solved everywhere.

(13) *Thomsonisca shutovae* (Trjapitzin, 1963) 샌호제깡충좀벌(신칭)

Belyavskaya, 1962: *Euussuria shutovae* Trjapitzin (nomen nudum); Trjapitzin, 1963: 689-690 (*Euussuria*); Belyavskaya, 1964: 42 (*Euussuria*); Shutova, 1967: 6, 12 (*Euussuria*); Izhevsky, 1988: 453; Trjapitzin, 1989: 290; Izhevsky, 1990: 118, 144.

This parasite of San Jose Scale, *Diaspidiotus perniciosus* Comstock (Homoptera, diaspididae) was described from the North Korea and later found on the Island Sakhalien. In 1960 it was introduced from the North Korea to the North Caucasus (Krasnodar and Stavropol Territories of Russia), but failed to establish.

(14) *Tyndarichus navae* (Howard, 1910) 세모깡충좀벌

Schaefer *et al.*, 1988: 430-444; Trjapitzin, 1989: 318-319.

The species is known from Japan, South Korea and China (Province Shandong). It was reared in Japan from the egg of the gypsy moth, *Lymantria dispar* Linnaeus (Lepidoptera, Lymantriidae) as a hyperparasite through the primary parasite *Ooencyrtus kuvanae* (Howard) and introduced to U.S.A. together with other parasites of the gypsy moth (Howard & Fiske, 1911), but there are no reliable data concerning its establishment; it was found also that *T. navae* can parasitize either *Pachyneuron* sp. (Hymenoptera, Ptero-

malidae) or *Anastatus* sp. (probably *A. japonicus* Ashmead) (Hymenopera, Eupelmidae) in the egg of *Lymantria dispar*.

(15) *Zaomma lambinus* (Walker, 1838) 털깡충좀벌

Trjapitzin, 1989: 312-313; Park & Kim, 1990: 111 (*Apterencyrtus microphagus*).

The species almost of world wide distribution, but not found in Tropical and South Africa. A secondary parasite of various armoured scales (Homoptera, Diaspididae) through Encyrtidae and Aphelinidae. It was reared in the South Korea from *Pseudaulacaspis pentagona* Targioni-Tozzetti on *Prunus mume*.

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