

First Report of *Feltiella acarisuga* Vallot (Diptera: Cecidomyiidae) in KoreaHeung Su Lee*, Bu Keun Chung and Kyu Jin Kim¹

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¹Department of Agriculture Biology, Chonnam National University, Kwangju 500-757, Republic of Korea한국미기록종 *Feltiella acarisuga* Vallot (응애혹파리: 신칭) 보고이흥수* · 정부근 · 김규진¹경남농업기술원 식물환경과, ¹전남대학교 농생물학과

ABSTRACT : *Feltiella acarisuga* vallot, a predatory gall midge preying upon spider mites, is reported for the first time in Korea. It was found in a greenhouse on *Glycine soja* Sieb. et Zucc. heavily infested with *Tetranychus urticae* in Sachon, Kyongnam Province. This species is very useful biological control agent for spider mites on greenhouse vegetable crops. Brief morphological characteristics are described.

KEY WORDS : *Feltiella acarisuga* Vallot, Spider mites, *Tetranychus urticae*, Biological control

초 록 : 점박이응애 밀도가 높은 들콩에서 응애 포식천적인 *Feltiella acarisuga* Vallot (신칭; 응애혹파리)가 국내에서 처음으로 발견되었다. 이 종의 형태적 특징 및 간략한 생태정보를 보고한다.

검색어 : 응애혹파리, 점박이응애, 포식성천적, 생물적 방제

Spider mites are economically serious pests on greenhouse vegetable crops in Korea as well as other countries (Ehara, 1999; Lee *et al.*, 2003). Biological control of spider mites in greenhouses with the predatory phytoseiid mite is well developed and several species are commercially available (Gilstrap *et al.*, 1979; Van Len teren and Woets, 1988; Gillespie and Quiring, 1994). The predacious insects of spider mites which were *Stethorus* spp. (Coleoptera: Coccinellidae), *Oligota* spp. (Coleoptera: Staphylinidae), *Scolothrips* spp. (Thysanoptera: Thripidae), *Orius* spp. (Hemiptera: Anthocoridae) and *Feltiella* spp. (Diptera: Cecidomyiidae) also could be used either to replace or to supplement phytoseiid mite (Pickett and Gilstrap, 1986; Lee *et al.*, 1991; Gillespie *et al.*, 1997; Morishita, 2000; Takahashi *et al.*, 2001; Kishimoto, 2002).

Predatory gall midges (Cecidomyiidae) are considered to be effective biological agent of aphids and

spider mites. Since 1973, a predatory midge, *Aphidoletes aphidimyza* has been used for biological control of aphid population on vegetable crops (Harris, 1973; Markkula *et al.*, 1979). A few cecidomyiids are endoparasitic in aphids and life history of these species have been described (Barns, 1954; Mackauer and Footitt, 1979; Tang *et al.*, 1994).

Feltiella larvae are known to be important predators of spider mite in lots of greenhouse vegetables and often considered one of the most important predators (Oatman *et al.*, 1985; Nakagawa, 1986; Pickett and Gilstrap, 1986). Larvae and cocoons of *Feltiella* species are widely found among colonies of spider mites (Barns, 1933; Nijeltdt, 1969). Moreover, *Feltiella acarisuga* Vallot has been evaluated as a biological agent for spider mites (Vacant, 1985; Wardlow and Tobin, 1990; Gillespie *et al.*, 1997; Opit, *et al.*, 1997).

A zoophagous midge, *F. acarisuga* Vallot was

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found for the first time from Korea in a greenhouse on October, 2003 in Sachon, Kyongnam Province, on *Glycine soja* Sieb. et Zucc. which heavily infested with *Tetranychus urticae*. This paper presents the morphological features and brief biology of the cecidomyiid, *F. acarisuga* Vallot.

Materials and Methods

Larvae and cocoons of *Feltiella* were collected on *Glycine soja* Sieb. et Zucc. which was infested with spider mites in Sachon, 10th, October 2003. Adults were obtained by placing leaves with cocoons in a closed container and waiting up to several days for them to emerge. Adult specimens preserved in ethanol (75%) and were subsequently mounted on slide for identification. The identified specimens were confirmed by Dr. R.J. Gagne, Systematic Entomology Lab. Plant Sciences Institute U.S. Department of Agriculture. Terminology for adult morphology follows usage by Gagne (1994). Materials used in this paper are deposited in the Division of Plant Environment, Kyongnam Agricultural Research & Extension Services (KNRDA), Jinju, Korea.

Systematic Account

Genus *Feltiella* Rübsaamen, 1910

Feltiella Rübsaamen, 1910, Z. Wiss. Insektenbiol. 6: 283

Type species, *Feltiella Tetranchyi* Rübsaamen (= *F. acarisuga* Vallot)

Therodiplosis Keiffer, 1912a, Bitsche. Reprinted in Marcellia II.

Type species, *Therodiplosis persicae* Keiffer (= *F. acarisugaacarisuga* Vallot)

Feltiella acarisuga Vallot 응애혹파리(신칭) (Fig. 1. A-I)

Cecidomyia acarisuga Vallot, 1827, Arts Belles-Lettres Dijon; 95. Dijon, France.

Mycodiplosis minuta Felt, 1907, State Education Department, Albany, N.Y. USA.

Feltiella tetranchi Rubasaamen, 1910, Z. Wiss. Insektenbiol. 6: 283. Berlin, Germany.

Therodiplosis persicae Keiffer, 1912, Bitsche. Reprinted in Marcellia II. France.

Feltiella davisii Felt, 1915a, J. Econ. Entomol. 8: 405. Indiana, USA.

Arthrochnodax rutherfordi Felt, 1915b, J.N.Y. Entomol. Soc. 23: 180, Srilanka

Feltiella americana Felt, 1916, Can. Entomol. 48: 33. USA.

Feltiella ithacae Felt, 1926, Entomol. News. 37: 141. USA.

Therodiplosis beglarovi Mamaev and Krivosheina, 1965, Akad. Nauk USSR, Moscow. Russia.

Feltiella quadrata Kashyap, 1989, Int. 9: 60. India

Description

Adult is a delicate pink-brown fly about 1.19 mm (1.11-1.33 mm, ♂, Fig. 1. A) to 1.36 mm (1.27-1.58 mm, ♀, Fig. 1. B) in length with long legs. Eyes connate at vertex. Frons with 3-5 setae per side. Labella hemispherical, rounded at apex, each with 6-8 lateral setae. Palpus with 4 segments. Antennae with first and second flagellomeres connate. Length of antennae in male (1.38 mm; 1.15-1.54 mm) was comparatively longer than that in female (0.65 mm; 0.60-0.70 mm). Male flagellomeres binodal covered with long hairs, female flagellomeres cylindrical with short necks, the neck without setula, about one quarter the length of node (Fig. 1. C. D).

Wing: R₅ nearly straight, joining costa near wing apex; costa broken at juncture with R₅; R_s present as stub but closer to apex of R₁ than to arculus; Wing length 1.08 mm (0.97-1.23 mm).

First tarsomeres without spur. Tarsal claws strongly curved near midlength, foreclaws toothed, midclaws usually simple; empodia about as long as bend in claws. Male abdomen has 8 tergites;

Male genitalia (Fig. 1. E): Hypoproct parallel-sided, elongate, narrow, posterior margin concave to convex, with 2 pairs of caudal setae; aedeagus much longer than hypoproct, cylindrical, tapering to rounded apex; gonocoxite with large, setulose, mesobasal lobe. Female ovipositor barely protrusive; tenth tergum evenly setose; tenth sternum setose, cerci ovoid (Fig. 1. F).

Larvae (Fig. 1. G, H) are creamy yellow-brown and 0.29 (1st instar)-1.14 mm (4th instar) long; Body elongate, spindle-shaped. Integument mostly smooth. Terminal segment with 2 pairs of elongate setae.

Pupae are fluffy white, 1.11 to 1.47 mm length, can be found inside the white cocoons along the the underside of a leaf next to a vein (Fig. 1. I).

Material examined. 20 ♂, 20 ♀, adults; Sachon, Prov., Kyeongnam, 20. X. 2003 (H.S. Lee) on *Glycine soja* Sieb. et Zucc.

Distribution. *F. acarisuga* is the most widely distributed species in the genus and is listed from the United States, Canada, Finland, Germany, United Kingdom, Switzerland, Italy, Morocco, Greece, Israel, India, Sri Lanka, Taiwan, Australia, New Zealand and Korea (newly reported). And Gagne (1995) regarded this species occurs also in Japan. It is the only species of *Feltiella* found throughout most of Europe and Asia.

Prey. This species prey on mites as: *Tetranychus*

urticae, *T. turkestanii*, *Tetranychus* sp., *Schizotetranychus celarius* and undetermined tetranychids. Predators reported in literature as *Feltiella* sp. that may also belong to *F. acarisuga* prey on *Tetranychus cinnabarinus* in Israel, *Panonychus citri*, *Tetranychus desertorum*, *Tetranychus kanzawai* and *Ologonychus hon-doensis* in Japan (Gagne, 1995). In our survey, we found larvae and pupae of *F. acarisuga* in colonies of *Tetranychus urticae*, *Tetranychus kanzawai* and *Panonychus citri*.

Biology. The adult do not feed and only live 3-4 days after emerging from the cocoon. Each female lays an average of 30 shiny yellow eggs near high densities of mites. The tiny eggs hatch in 5-7 days. The yellow or orange-brown midge larvae grow to about 1.2 mm long. Upon hatching they move to a prey, sink their mandibles in, and suck out the contents. They complete their development in about a week in the greenhouse. They then spin fluffy white cocoons on the underside of leaves, usually along a leaf vein, in which to pupate (Nakagawa, 1986; Opit et al., 1997; Ho and Chen, 1998).

Remark. The genus *Feltiella* is virtually cosmopolitan and contained eight species. Gagne (1995) revised and redescribed on genus *Feltiella*. In this paper, two generic names are synonymized, and the number of recognized species are reduced from 21 to 8: *F. acarisuga* (vallot) (worldwide, except for the Neotropical Region), *F. pini* (Felt) (North and Central America and West Indies), *F. curtistylus* Gagne (Brazil), *F. occidentalis* (Felt) (U.S. - California), *F. acarivora* (Zehnter) (Indonesia - Java), *F. insularis* (Felt) (eastern U.S., West Indies and Colombia), *F. reducta* Felt (northeastern U.S. - New York), and *F. ligulata* Gagne (Cape Verde Is.). *F. acarisuga* can be distinguished from another species by characters of the male genitalia. This species has gonocoxite with mesobasal lobe and mesobasal lobe of gonocoxite with soft hairs only.

Feltiella sp. in Japan (Yukawa, 1971; Kawano, 1969; Nakagawa, 1986) and *Feltiella minuta* (Ho and Chen, 1998) in Taiwan were reported. Gagne (1995) pointed out that these species from Japan and Taiwan might be *F. acarisuga* vallot judged from illustrations

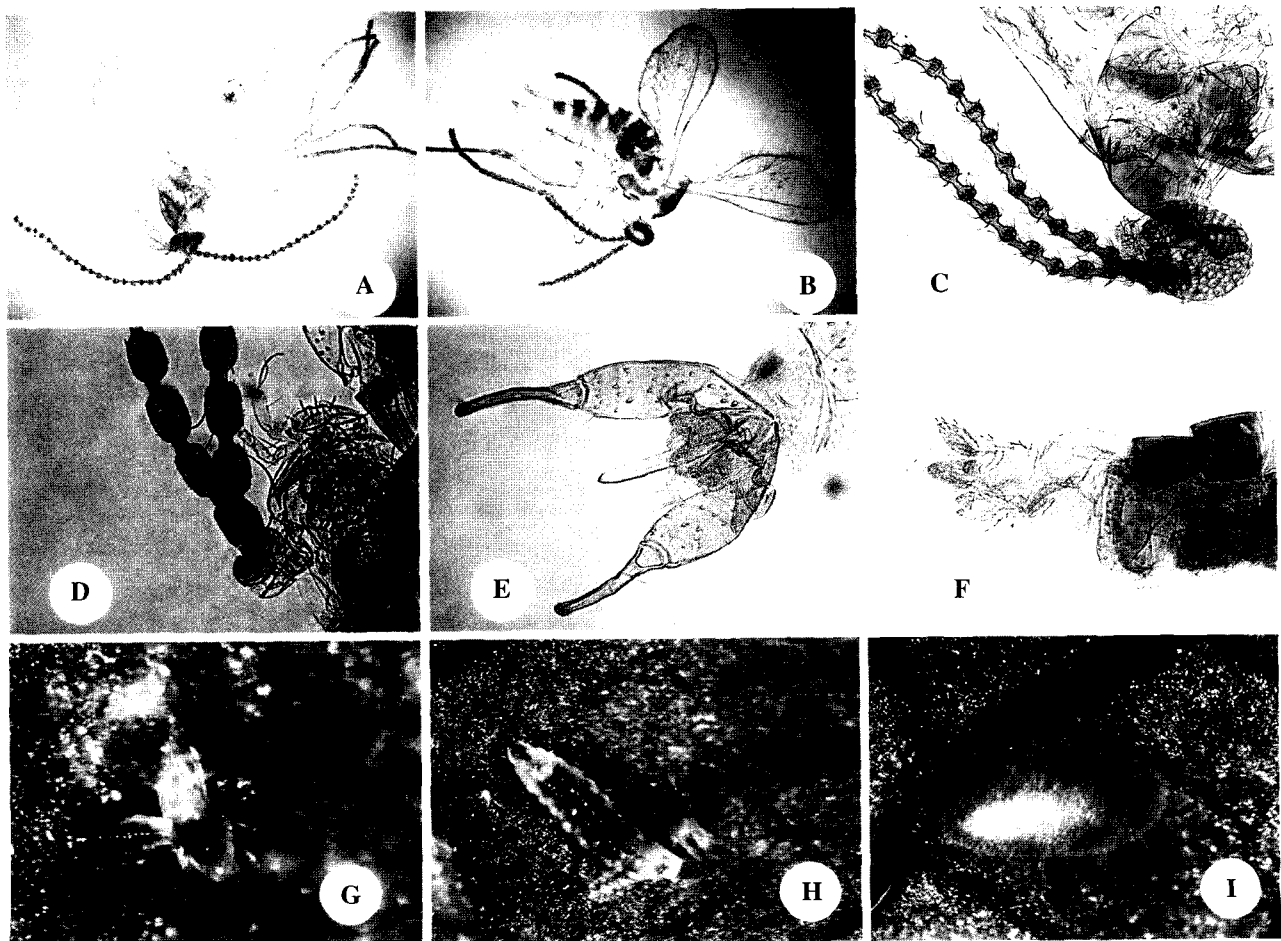


Fig. 1. *Feltiella acarisuga* vallot. A: Male adult, B: Female adult, C: Antenna (Male), D: Antenna (Female), E: Male genitalia, F: Female genitalia, G: 1st larva attacking mites, H: Full grown larva, I: Pupa along the leaf next to a vein.

of the male genitalia shown in various publications.

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