

**Setal Counts and Measurements of the Apple  
Blossom Midge, *Contarinia mali* Barnes  
(Diptera, Cecidomyiidae)**

Junichi YUKAWA

(Entomological Laboratory)

Received for Publication August 18, 1983

**Introduction**

The apple blossom midge, *Contarinia mali* Barnes<sup>1)</sup> has been known since 1926 to attack flower buds of apple and was extensively studied by Tanabe<sup>7,8)</sup>, particularly in Nagano Prefecture in 1930s when its infestation was markedly severe<sup>6)</sup>. Thereafter, this species has received little attention as it has not caused prominent damage to the apple production (Sugawara, 1983, personal com.). It is, however, desirable to keep paying attention to a potential pest like this gall midge to make provisions against its sudden increase as has been noted for the Japanese citrus flower bud midge, *Contarinia okadai* (Miyoshi)<sup>5)</sup>. In such a sense, usual taxonomic studies are much needed for providing clear diagnostic characters of non-pest insects as well as of serious pest species.

At the time when this species was described, detailed measurements and setal counts were usually not given in describing new species. Therefore, species identifications were mainly based on the host data, particularly in case of the species of *Contarinia* which contains at least a hundred nominal species in the world. In recent years, however, results of measurements and setal counts have successively been utilized to separate closely related species of the genus<sup>4,12)</sup>.

The present paper is intended to redescribe *C. mali* chiefly by counting fronto-clypeal and mesoepimeral setae and by measuring antennae, palpi, wings, legs and an ovipositor in order to provide clear diagnostic differences separating the species from other relatives in Japan. The paper also describes the mature larva which was not mentioned in the original description<sup>1)</sup>.

**Materials and Methods**

The specimens examined here had been kept in the spirit collection of the Insect Taxonomy Laboratory in the National Institute of Agricultural Sciences in Tsukuba, Japan. The specimens were forwarded to the present author for further taxonomic studies through the courtesy of Mr. N. Fukuhara of the Laboratory and they were mounted on microscope slides by the xylene-balsam method. Their collecting data are as follows: 6 ♂♂, 4 ♀♀, 5 mature larvae; larvae collected from Nagano Pref. in 1935 (C. Tanabe leg.) and adults emerged in summer 1935, Cecid. Nos. C3601-3615. They are now kept in the collection of the Entomological Laboratory of the Kagoshima University in Kagoshima, Japan.

Drawings were made with the aid of a camera lucida. Wing length was measured from the basal end of costa to apex. Setal counts are of setal insertion rather than actual setae, since many setae come to be lost through the processes of collection, preservation and preparation. Mesopleural

setae could not be counted as their insertions were obscure probably due to the long term preservation in alcohol.

*Contarinia mali* Barnes

Fig. 1 (A–F); Tables 1 & 2

*Contarinia mali* Barnes, 1939. *Kontyû* 13, 126.

*Contarinia mali* Barnes: Barnes<sup>2,3</sup>), Sekiya & Hirose<sup>6</sup>), Yukawa<sup>10,11</sup>).

English name: Apple blossom midge<sup>1</sup>).

Japanese name. “Ringo-tsubomi-tamabae”<sup>9</sup>) (=“Ringo-tamabae”<sup>6–8</sup>).

Male: Eye bridge 5 to 7 facets wide medially. Post vertical peak relatively low, blunt, with two short setae. Fronto-clypeal setae relatively few in number. Palpus consisting of 4 segments, with scattered setae. Antenna with 2+12 segments; first and second flagellomeres fused; the former a little longer than the latter; all flagellomeres bifilar with intermediate and distal stems relatively long. Wing length about 2.6 times as long as wide. Mesepimeral setae moderate in number as compared with other relatives in Japan. Tibia on fore leg relatively long, nearly as long as femur; second tarsal segments on all legs markedly short, 0.6 to 0.7 times as long as respective femora. Terminalia of typical *Contarinia* form: dorsal cercal lobes widely incised by a V-shaped emargination; hypoproct narrower than cercal lobes, incised by a deep U-shaped emargination, forming a pair of relatively elongate lobes; gonostylus rather short, weakly arched, tapering distally, with a strong apical claw; gonocoxite relatively narrow, without a distinct lobe on inner basal angle;

Table 1. *Contarinia mali* Barnes: counts of eye bridge-ommatidia, fronto-clypeal and mesepimeral setae, and measurements of palpus, wing, flagellomere III and ovipositor

No. of specimens examined	6♂♂		4♀♀	
	mean±s.d.	(range)	mean±s.d.	(range)
Eye bridge-ommatidia	5.3±2.7	(5–7)	6.5±0.6	(6–7)
Fronto-clypeal setae	6.2±0.8	(5–7)	8.3±0.5	(8–9)
Mesepimeral setae	6.0±0.9	(5–7)	8.3±0.5	(8–9)
Palpal segment 1 (μm)	37.3±2.0	(35–40)	44.0±4.2	(38–48)
2	49.8±2.7	(48–50)	54.0±6.2	(50–63)
3	64.8±6.8	(58–73)	66.5±5.0	(63–70)
4	86.7±4.3	(78–90)	102.3±5.4	(95–108)
Wing length* <sup>1</sup> (μm)	1713±230	(1550–1875)	1881±109	(1725–1975)
Wing width (μm)	650±43	(625–700)	763±18	(750–775)
Wing length/width	2.6±0.1	(2.5–2.7)	2.6±0.1	(2.5–2.6)
Flagellomere III ds* <sup>2</sup> (μm)	49.6±2.9	(45–53)	7.0±1.2	(6–8)
de	46.8±2.8	(43–50)	—	—
is	36.8±1.6	(35–38)	—	—
be	36.8±1.6	(35–38)	53.5±3.3	(50–58)
T	170.0±5.4	(165–177)	60.0±2.7	(58–64)
w	44.8±2.0	(43–48)	33.0±1.4	(31–34)
Ovipositor	—	—	1684±71	(1610–1775)

\*<sup>1</sup> base of costa to wing apex.

\*<sup>2</sup> ds: distal stem, de: distal enlargement, is: intermediate stem, be: basal enlargement, T: total length (ds+de+is+be), w: maximum width of basal enlargement.

Table 2. *Contarinia mali* Barnes: measurements of legs

No. of specimens examined		6 ♂♂		4 ♀♀	
		mean ± s.d.	(range)	mean ± s.d.	(range)
Fore leg	Fe (μm)	662 ± 28	(610–680)	640 ± 22	(620–670)
	Ti	665 ± 68	(560–720)	628 ± 22	(610–660)
	T <sub>1</sub>	77 ± 6	(70–85)	81 ± 3	(80–85)
	T <sub>2</sub>	458 ± 50	(370–500)	368 ± 13	(350–380)
	T <sub>3</sub>	208 ± 15	(180–220)	176 ± 11	(160–185)
	T <sub>4</sub>	124 ± 11	(110–135)	116 ± 5	(110–120)
	T <sub>5</sub>	83 ± 7	(70–90)	84 ± 3	(80–85)
Mid leg	Fe (μm)	667 ± 40	(600–720)	685 ± 25	(650–710)
	Ti	658 ± 34	(620–700)	653 ± 34	(620–700)
	T <sub>1</sub>	78 ± 4	(70–80)	84 ± 3	(80–85)
	T <sub>2</sub>	398 ± 18	(370–420)	338 ± 5	(330–340)
	T <sub>3</sub>	203 ± 19	(180–220)	181 ± 9	(170–190)
	T <sub>4</sub>	120 ± 16	(100–140)	115 ± 6	(110–120)
	T <sub>5</sub>	81 ± 10	(65–90)	86 ± 5	(80–90)
Hind leg	Fe (μm)	788 ± 62	(680–860)	815 ± 51	(750–860)
	Ti	702 ± 34	(660–730)	723 ± 66	(640–800)
	T <sub>1</sub>	83 ± 4	(80–90)	88 ± 6	(80–95)
	T <sub>2</sub>	487 ± 77	(390–570)	480 ± 12	(470–490)
	T <sub>3</sub>	247 ± 37	(210–300)	245 ± 24	(220–270)
	T <sub>4</sub>	147 ± 19	(120–170)	148 ± 10	(140–160)
	T <sub>5</sub>	89 ± 5	(80–95)	93 ± 5	(90–100)

aedeagus broad basally, tapering distally to a blunt point. (see Barnes<sup>1)</sup>, for other characteristics.)

Female: Eye bridge 6 to 7 facets wide medially. First and second flagellomeres fused, the former about 1.3 times as long as the latter; flagellomeres II to XI, each consisting of a basal cylindrical enlargement and a short distal stem; terminal flagellomere ending in a relatively short, blunt process. Tibia a little shorter than femur on fore and mid legs, distinctly shorter on hind leg; second tarsal segments on all legs markedly short, 0.5 to 0.6 times as long as respective femora. Ovipositor long, retractile, tapering to a pair of narrow terminal cerci. Otherwise almost as in male. (see Barnes<sup>1)</sup>, for other characteristics.)

Mature larva: Second antennal segment very short. Cervical papillae not examined. Number and position of stigmata normal. Dorsal and pleural papillae all without setae; four pairs of terminal papillae present, of which three are provided with a minute seta; one pair of terminal papillae enlarged. Sternal spatula 135 to 175 μm long, with a distal V-shaped emargination forming a pair of lobes; number and position of inner and outer lateral papillae normal; sternal and inner pleural papillae all without setae; anterior and posterior ventral papillae without setae; anal papillae without setae.

Pupa: See Tanabe<sup>8)</sup>.

Host plant: *Malus pumila* Mill. “Seiyō-ringo”, Rosaceae.

Gall: Infested buds remaining closed; petals becoming thick, spotted with a darker pink. Whole flower bud enlarged, resulting in a loss of fruit<sup>3,8)</sup>. “Ringo-haname-fushi”<sup>11)</sup>.

Biological notes: There is one generation a year, the adults emerging in late March or early April<sup>1,3,7,8)</sup>. The eggs are laid in the flower buds, and the larvae rapidly develop to the third

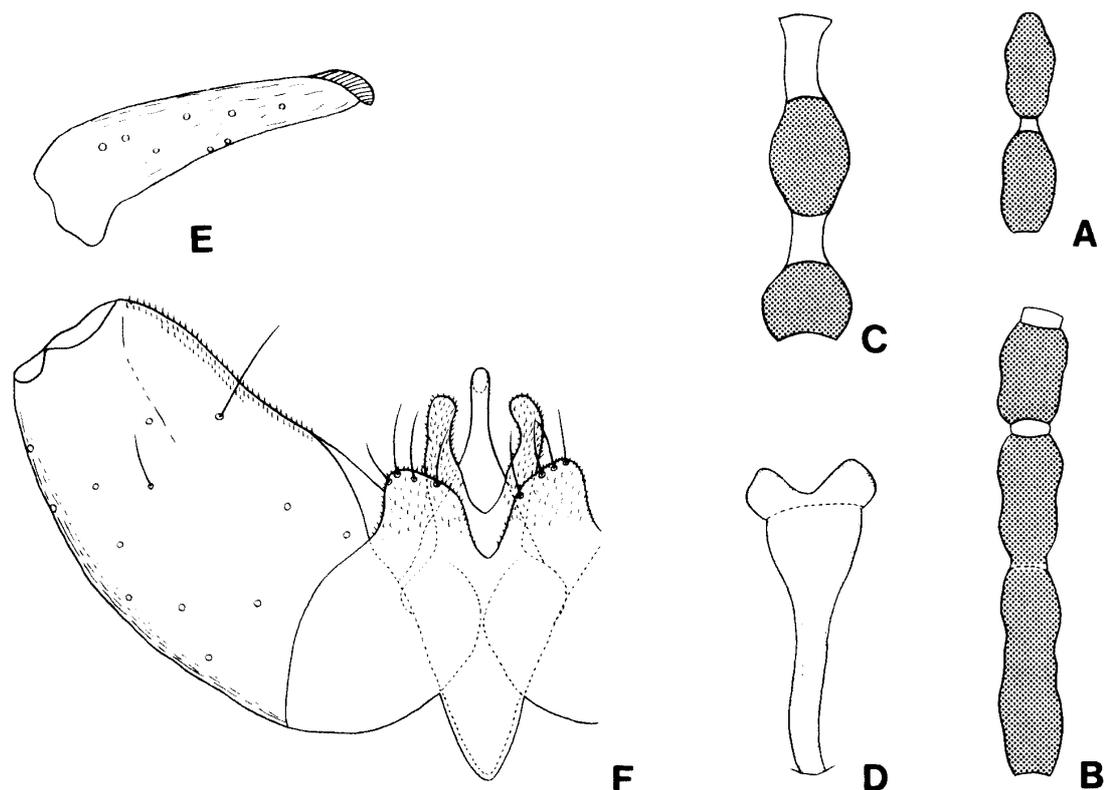


Fig. 1. *Contarinia mali* Barnes. A: Profile of female flagellomeres XI-XII; B: *ibid.* I-III; C: Profile of male flagellomere III; D: Sternal spatula of mature larva; E: Gonostylus of male genitalia; F: Male genitalia, gonostyli are removed.

stage. The larvae leave the buds for the ground, pass through the summer in cocoons and pupate in late September. The pupal period lasts for about 190 days<sup>8)</sup>.

Parasitoid: A hymenopterous parasitoid was recorded in Tanabe<sup>8)</sup>, but has not yet been identified.

Distribution: Japan (Honshu).

Remarks: *C. mali* resembles the citrus flower bud midge, *C. okadai*<sup>5)</sup> in morphological features and in a symptom of infestation on the host buds. However, this species differs from *C. okadai* by the following characteristics: distinctly fewer numbers of eye bridge-ommatidia and of fronto-clypeal setae, larger wings, shorter distal stems of female flagellomeres, markedly shorter second tarsal segments on all the legs and a relatively longer ovipositor. This species is also distinguishable from other related Japanese species by comparing a wide spectrum of the characteristics examined in Yukawa<sup>12)</sup>. It is remarkable that *C. mali* pupates in late September<sup>8)</sup> while the majority of gall midge including *Contarinia* species generally passes through the winter in a cocoon as a third instar. Thus, the species has a unique life history.

### Summary

The apple blossom midge, *Contarinia mali* is redescribed by counting fronto-clypeal and mes-epimeral setae and by measuring antennae, palpi, wings, legs, and an ovipositor in order to provide clear diagnostic differences separating the species from other relatives. The mature larva is also described.

### Acknowledgements

The author would like to express his hearty thanks to Prof. A. Nagatomi (Kagoshima Univ.) for his critical reading of the draft. The specimens were forwarded to the author for redescription through the courtesy of Mr. N. Fukuhara (Nat. Ins. Agr. Sci.), to whom the author is deeply indebted. His thanks are also due to Mr. H. Sugawara (Tohoku Branch, Japan Plant Prot. Assoc.) for his kind information about the pest status of the species.

### References

- 1) Barnes, H. F.: *Contarinia mali* n. sp. The apple blossom midge, with notes on the more common gall midges attacking apple and pear. *Kontyû*, **13**, 126–132 (1939)
- 2) Barnes, H. F.: Two new pests of apple and black currant. *Bull. ent. Res.*, **31**, 85–86 (1940)
- 3) Barnes, H. F.: Gall midges of economic importance. III. Fruit. Crosby Lockwood & Son, London, 184 pp. (1948)
- 4) Harris, K. M.: Gall midge genera of economic importance (Diptera, Cecidomyiidae) Part 1: Introduction and subfamily Cecidomyiinae; supertribe Cecidomyiidi. *Trans. R. ent. Soc. Lond.*, **118**, 313–358 (1966)
- 5) Harris, K. M. and Yukawa, J.: The taxonomic status of the Japanese citrus flower-bud midge, *Contarinia okadai* (Miyoshi) comb. n., and of the citrus blossom midge, *C. citri* Barnes (Diptera: Cecidomyiidae). *Bull. ent. Res.*, **70**, 277–285 (1980)
- 6) Sekiya, I. and Hirose, K.: “Ringo-tamabae”. in Nagano Pref. Plant Protection Association (eds.), [History of plant protection in Nagano Prefecture]. p. 569–575, Nagano Pref. Plant. Prot. Assoc., Nagano (1972) (in Japanese)
- 7) Tanabe, C.: [On the new insect pest, apple blossom midge, I]. *Jour. Plant Prot.*, **23**, 509–518 (1936) (in Japanese)
- 8) Tanabe, C.: [On the new insect pest, apple blossom midge, II]. *Jour. Plant Prot.*, **23**, 596–604 (1936) (in Japanese)
- 9) The Japanese Society of Applied Entomology and Zoology: Major insect and other pests of economic plants in Japan. *Japan. Plant Prot. Assoc.*, Tokyo, 307 pp. (1980)
- 10) Yukawa, J.: A revision of the Japanese gall midges (Diptera: Cecidomyiidae). *Mem. Fac. Agr. Kagoshima Univ.*, **8**, 1–203 (1971)
- 11) Yukawa, J.: Check list of midge galls of Japan, with descriptions of newly recorded galls I. Chori-petalae. *Mem. Fac. Agr. Kagoshima Univ.*, **12**, 109–123 (1976)
- 12) Yukawa, J.: Setal counts and measurements of the sorghum midge and its relatives in Japan. *Proc. Assoc. Pl. Prot. Kyushu*, **25**, 70–72 (1979) (in Japanese with English summary)