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A New Taiwanese Species of *Colophina* (Homoptera, Aphidoidea) Producing Large Soldiers

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Synopsis *Colophina monstifica* n. sp., occurring on *Clematis floribunda* in Taiwan, is described. Exules produce large 1st instar soldiers which are thought to attack potential predators and not to moult. Keys to species of *Colophina* based on sexupara and exule adults are given.

In previous papers (AOKI, 1977a, b, 1980) I reported the occurrence of soldiers in *Colophina clematis* and *C. arma*. There is a third species of *Colophina*, which produces large pseudoscorpion-like soldiers on *Clematis floribunda* in Taiwan.

Colophina monstifica n. sp.

Colophina sp.: AOKI, 1982: 155.

Normal 1st instar larva (Fig. 1B). Body 1.35–1.57 mm ($n=10$). Tergites weakly sclerotized. Abdominal tergites I–VI each with 3 pairs of long setae. Abdominal tergite VII with 2 pairs of long setae marginally. Abdominal tergite VIII and cauda each with a pair of short setae. Anal plate with 2 pairs of rather long setae. Wax plates composed of practically uniform cells, occurring on head, thorax and abdominal segments I–VIII; abdominal segments IV and VII with 24–29 ($n=10$) and 16–21 ($n=9$) wax plates respectively; abdominal segment VIII with 1 or 2 small wax plates. Antenna 5-segmented; 4th segment as long as or shorter than 5th segment. Rostrum long, reaching the end of body or extending beyond it; ultimate segment 0.220–0.255 mm long ($n=10$), with straight or rather convex sides, and with 6–8 accessory setae ($n=10$). Tarsus smooth, 2-segmented; 1st segment with a pair of long pointed setae; 2nd segment 0.196–0.221 mm long on hind leg ($n=10$), with 3 pairs of setae apically, of which dorsoapical ones are long and capitate, and with some setae mid-dorsally and mid-ventrally; empodial setae thin, not reaching the apices of claws. Cornicle pore-like, located between the rows of wax plates on abdominal segments V and VI.

Soldier (Fig. 1A). Much larger than the normal 1st instar larva, body 1.64–1.96 mm ($n=10$). Tergites wholly and strongly sclerotized. Wax plates absent, but sometimes reduced ones occurring on abdominal segments VI–VIII. Abdominal tergites I–VI each with 3 pairs of long setae, and tergites III–VI each with 1–3 additional setae. Abdominal tergite VII with 2 pairs of long setae marginally. Ab-

dominal tergite VIII with a pair of short setae spinally and sometimes with a long seta marginally. Cauda with a pair of short setae. Anal plate with 5 or 6 setae. Antenna 5-segmented; 3rd segment with an abortive division. Rostrum short, not reaching 1st abdominal segment; ultimate segment 0.142–0.152 mm long ($n=10$), with rather concave sides, and with 4–7 accessory setae ($n=10$). Fore and mid legs greatly thickened: femur a little longer and clearly thicker than that of hind leg; tibia thicker than that of hind leg and curved gently; tarsus thicker yet shorter than that of hind leg, with strongly curved claws, 1st segment compressed axially, with a pair of pointed setae, 2nd segment with a number of fine setae dorsally and ventrally, and 3 pairs of setae apically, of which ventroapical ones are rather stout and dorsoapical ones sometimes long and capitate; empodial setae thin and not reaching the apices of claws. Second segment of hind tarsus 0.274–0.304 mm long. Cornicle pore-like.

The soldier of this species is 1st instar. Main morphological differences between the soldier and the normal 1st instar larva are summarized in Table 1. Although observations on the behaviour of soldiers have not been made sufficiently, they are thought to play a defensive role because of their characteristic features. Also, I think that they do not moult, since in my examination of 114 mounted soldiers none had the next instar skin inside.

Sexupara (or virginosexupara) adult. Measurements in Table 2. Body without wax plates. Abdominal tergites VII and VIII, and cauda faintly sclerotized. Antenna (flagellum: Fig. 2A) 6-segmented; 3rd segment very long, 4th segment clearly longer than 6th segment, processus terminalis ca. 0.02 mm long, not so acutely conical as in *C. clematis*, with 4 setae; secondary rhinaria narrow, ca 0.004 mm wide, sometimes nearly completely encircling the segment; primary rhinaria irregular in shape, partially ciliate. Ultimate rostral segment slender, 0.279–0.294 mm long ($n=5$), with rather concave sides and 6–9 accessory setae ($n=5$). Wing venation shadowed. Fore wing with media bifurcated. First tarsal segment with a spine-like seta between a pair of long pointed setae, but sometimes lacking the seta on hind leg. Second tarsal segment 0.246–0.299 mm long on hind leg ($n=4$), with many setae. Empodial setae thin, rather long and slightly widened at apex. Genital plate with a pair of setae anteriorly and 20–27 setae posteriorly ($n=5$). Cornicle ring-like, 0.053–0.062 mm in outer diameter ($n=5$), only faintly sclerotized around, with some setae around, located just anterior to the row of setae on abdominal segment VI.

Apterous exule adult. Measurements in Table 2. Body 3.6–5.4 mm ($n=10$). Tergites sclerotized on head and parts of thorax, membranous on abdomen but weakly sclerotized around the bases of some setae, with more setae than in the 1st instar. Wax plates usually composed of practically uniform cells (Fig. 2C), but some on abdominal segment VII composed of cells which greatly differ in size (Fig. 2D). Abdominal segment IV with 17–24 wax plates, of which the smallest and largest ones are composed of 1–3 and 9–39 cells respectively ($n=10$); abdominal segment

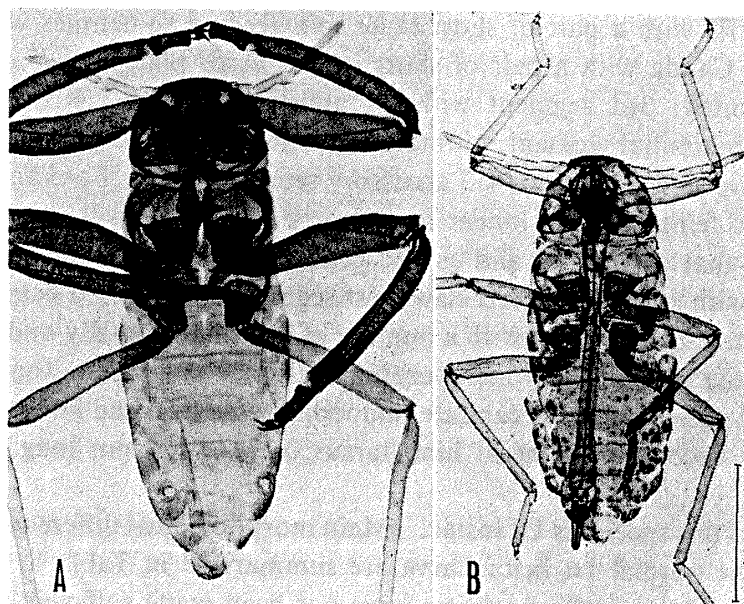


Fig. 1. *Colophina monstifica*. A, Soldier; B, normal 1st instar larva. Scale: 0.5 mm.

Table 1. Main morphological differences between the soldier and the normal 1st instar larva in *Colophina monstifica*.

Soldier	Normal 1st instar larva
Body large, 1.64–1.96 mm.	Body small, 1.35–1.57 mm.
Tergites strongly sclerotized.	Tergites weakly sclerotized.
Wax plates absent, but sometimes reduced ones occurring on 6th–8th abdominal segments.	Wax plates well developed, occurring on head, thorax and 1st–8th abdominal segments.
Rostrum short, not reaching 1st abdominal segment; ultimate segment 0.142–0.152 mm, with rather concave sides.	Rostrum long, reaching the end of the body or extending beyond it; ultimate segment 0.220–0.255 mm long, with straight or rather convex sides.
Fore and mid legs much thicker than hind one; 1st tarsal segment compressed axially; claws large and strongly curved.	Fore and mid legs as thick as hind one; 1st tarsal segment not compressed axially; claws normal.

VII with 17–23 wax plates, of which the smallest and largest ones are composed of 1–8 and 14–62 cells respectively ($n=10$); abdominal segment VIII with only a pair of wax plates. Antenna (Fig. 2B) 6-segmented; primary rhinaria ciliate; processus terminalis not acutely conical, with 3 apical and 1 subapical setae. Ultimate rostral segment 0.274–0.314 mm long ($n=10$), with concave sides and 6–9 accessory setae ($n=7$). Tarsi 2-segmented; 1st segment with a spine-like seta between a pair of pointed setae, but sometimes lacking the seta on hind leg; 2nd segment 0.230–

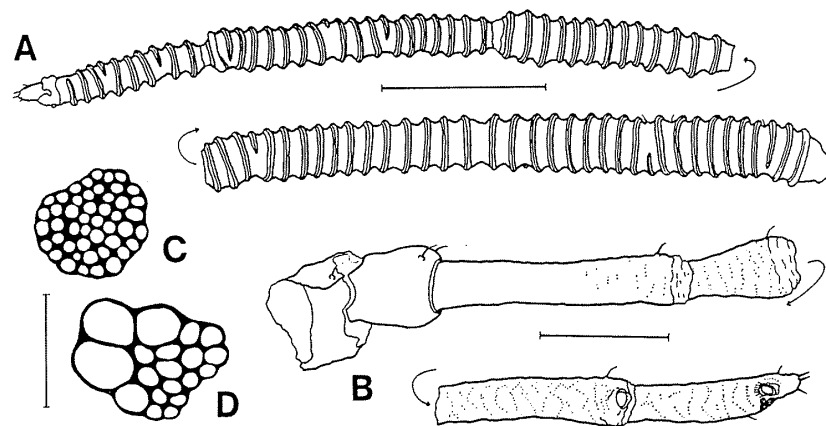


Fig. 2. *Colophina monstifica*. A, Flagellum of alate sexupara; B, antenna of apterous exile adult; C & D, abdominal wax plates of apterous exile adult. Scale: 0.2 mm (A), 0.1 mm (B) and 0.05 mm (C & D).

Table 2. Measurements of sexupara and exile adults of *Colophina monstifica*.

Indv.	BL	FL	Ant.				SRN (l/r)			
			III	IV	V	VI	III	IV	V	VI
1	3.6	1.62	0.73	0.28	0.36	0.23+0.02	35/40	14/15	20/18	?/9
2*	3.7	1.65	0.77	0.29	0.35	0.22+0.02	38/40	13/16	19/17	10/9
3	3.6	1.66	0.75	0.31	0.35	0.23+0.02	36/34	14/15	17/20	11/9
4	3.8	1.63	0.74	0.29	0.34	0.24+0.02	37/34	14/13	18/18	7/9
5*	3.8	1.60	0.73	0.28	0.34	0.23+0.02	33/34	12/13	17/14	9/9
6	4.5	0.70	0.26	0.11	0.18	0.14+0.01				
7	4.9	0.64	0.25	0.09	0.17	0.12+0.01				
8	3.9	0.64	0.24	0.09	0.16	0.14+0.01				
9	3.9	0.49	0.17	0.07	0.13	0.11+0.01				
10	3.8	0.57	0.19	0.09	0.15	0.12+0.02				
11†	3.7	0.53	0.18	0.08	0.14	0.11+0.02				

Individual 1–5: sexupara (*virginosexupara); 6–11: apterous exile († holotype). BL: length of body (mm); FL: length of flagellum (mm); Ant.: length of antennal segment (mm); SRN (l/r): number of secondary rhinaria on antennal segment (left/right).

0.290 mm long on hind leg; empodial seta thin. Cornicle between the rows of wax plates on abdominal segments V and VI, ring-like, not sclerotized around, with some setae around. Genital plate with a pair of setae anteriorly and 17–24 setae posteriorly (n=7).

As in *Colophina clematis* and *C. arma*, at least some apterous exiles contain embryos of both the normal 1st instar larva and soldier in the ovarioles.

Holotype. Apterous exile adult, Wenshan, Hualien Hsien, Taiwan, 21-x-1976, ex *Clematis floribunda*, M. KIUCHI & Sk. YAMANE leg., deposited in the collection of the Entomological Institute, Hokkaido University.

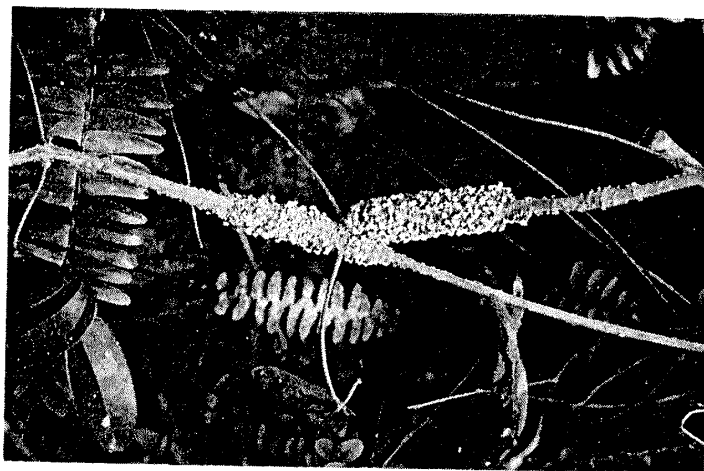


Fig. 3. A colony of *Colophina monstrifica* on *Clematis floribunda*.

Secondary host. *Clematis floribunda*.

Distribution. Taiwan.

Biological notes. A large colony of this species was found on the stem of *Clematis floribunda* (Fig. 3) by Messrs. KIUCHI and YAMANE at Wenshan (575 m alt.), Hualien Hsien, Taiwan on October 21st, 1976. There were many pseudoscorpion-like soldiers in the colony. They observed that, when they placed a moth larva on the colony, a soldier immediately clutched at the larva and they fell from the colony together. Although not confirmed, the soldiers of this species probably sting potential predators with their stylets. Messrs. KIUCHI and YAMANE cut the *Clematis* stem into pieces and deposited some of the pieces with aphids in alcohol. Of 6,231 aphids contained in this sample, 647 (10.4%) were soldiers.

The sample also contained many apterous adults, many larvae with or without wing pads, and five alates. Three of the alates were pure sexuparae, which contained only arostrate embryos (i. e. sexuales). The other two were virginosexuparae, which each contained a rostrate embryo in addition to arostrate ones. What kind of 1st instar larvae these rostrate embryos become is, however, uncertain.

The life cycle of this species is supposed as follows: Apterous exule adults parthenogenetically produce normal 1st instar larvae and soldiers on the stem of *Clematis floribunda*. The normal 1st instar larvae become apterous exule adults, or, in autumn, become alate sexuparae which migrate to the unknown primary host. The soldiers play a defensive role and do not moult.

Key to Species of *Colophina*

Alate Sexupara

1. Sixth antennal segment about as long as 4th segment; processus terminalis acutely conical; cornicle located just posterior to the row of setae on 5th abdominal segment, sclerotized around.....*clematis* (SHINJI)

- Sixth antennal segment shorter than 4th segment; processus terminalis not acutely conical; cornicle located just anterior to the row of setae on 6th abdominal segment, hardly sclerotized around.....2
- 2. Processus terminalis very short, ca. 0.01 mm long; flagellum ca. 1.11–1.21 mm long..... *arma* AOKI
- Processus terminalis not so short, ca. 0.02 mm long; flagellum ca. 1.60–1.66 mm long..... *monstrifica* n. sp.

Apterous Exule Adult

- 1. Cornicle located just anterior to the row of wax plates on 5th abdominal segment, sclerotized around; 4th abdominal segment with ca. 10–14 wax plates; on *Clematis apiifolia* and *C. gouriana*¹⁾..... *clematis*
- Cornicle located between the rows of wax plates on 5th and 6th abdominal segments, hardly sclerotized around; 4th abdominal segment with ca. 17–24 wax plates.....2
- 2. Body ca. 2.4–3.3 mm; wax plates composed of practically uniform cells, even on 7th abdominal segment; on *Clematis stans*..... *arma*
- Body ca. 3.6–5.4 mm; some wax plates on 7th abdominal segment composed of cells which greatly differ in size (Fig. 2D); on *Clematis floribunda*..... *monstrifica*

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1) TAKAHASHI (1924), OKAMOTO and TAKAHASHI (1927), and AOKI (1976) erroneously referred to this plant as *C. “fouriana.”*

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