A new midge gall of *Asphondylia* species (Diptera, Cecidomyiidae) from Okinawa*

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INTRODUCTION

The soybean pod gall midge, *Asphondylia* sp. (KANZAWA, 1918) has been noted as one of the serious pests of soybean, particularly in southwestern Japan. The life history and host plant range of the gall midge are, however, still partly unclear, and therefore this species has been left unnamed. In association with the taxonomic and ecological studies on the species, the author has devoted considerable time to detections of midge galls produced by other *Asphondylia* species on wild host plants in Japan, including those other than Leguminosae. At least 16 sorts of midge gall heve been so far recognized to be produced by the Japanese *Asphondylia* on 20 plant genera belonging to 13 families (YUKAWA, 1976, 1977, 1980, 1982; USUBA, 1980; SHIBUYA, 1981). They have chiefly been collected from Honshu or Kyushu where the field surveys have been extensively conducted, and only 2 sorts have been recorded in the southwestern islands of Japan on *Alpinia intermedia* GAGNEP. and *Ligustrum japonicum* THUNB. (YAMAUCHI *et al.*, 1982).

Recently, the present author had an opportunity to examine fruit galls produced on *Distylium racemosum* SIEB. et ZUCC. [Hamamelidaceae], and confirmed that they had been caused by an *Asphondylia* species. In this paper, these galls and the associated gall midge are briefly described together with the results of measurements, setal counts and dissections of the galls, in order to contribute to the knowledge of life histories and host ranges of the related species including the soybean pod gall midge.

MATERIALS AND METHODS

The fruit galls produced on *Distylium racemosum* were collected by Dr. Y. ITÔ and Mr. S. YAMAUCHI from Katsuudake, Okinawa prefecture on 22. XI. 1981, and were immediately forwarded to the author for identification. Both the galled and normal fruits were measured by slide callipers for comparison. Then, the galled fruits were dissected to confirm whether they were caused by a gall midge species. The numbers of larvae and larval chambers per gall were counted, and the developmental stages of the gall maker and other information concerning the status inside the galls were also recorded. When mature pupae were obtained, they were kept in a petri dish to rear adults.

Setal counts and measurements of wing, palpus, flagellomeres and legs were based on a single male mounted on a slide by the xylene-balsam method. The specimens

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examined here are kept in the collection of the Entomological Laboratory of the Kagoshima University, Japan.

RESULTS

By dissecting the fruit galls, they were confirmed to be caused by a gall midge species which belongs to the genus *Asphondylia*. The galls and the associated gall midge are described as follows.

Table 1. Measurements of normal fruits and galls produced by *Asphondylia* sp. on *Distylium racemosum* SIEB. et ZUCC.

	Normal fruit		Galled fruit		*t*-test (p=0.05)	
	No.	Mean ± s. d.	No.	Mean ± s. d.	*ts*	*t*
Height* (mm)	7	10.1 ± 1.2	56	4.6 ± 0.8	11.0 >	2.4
Maximum diameter	7	8.4 ± 1.0	56	4.4 ± 0.8	9.5 >	2.4

*Length of apical protuberances is excluded.

Table 2. Frequency distribution in number of larval chambers per gall.

No. of larval chambers / gall	Frequency
1	13
2	42
3	1
4	0

1. Gall: Subglobular or ellipsoidal swelling of fruit (Fig. 1 A), normally with 1 to 3 spine-like apical protuberances which are about 1.8 mm in length; galled fruits significantly smaller than normal ones (Table 1); surface pale greenish brown; oligothalamus, normally 2, sometimes 1 or 3 larval chambers per gall (Table 2); each chamber containing one midge larva or pupa. Japanese name of the gall: "Isunoki-mi-kogata-fushi" new name.

2. Host plant: *Distylium racemosum* SIEB. et ZUCC. "Isunoki" [Hamamelidaceae].

3. Gall maker: *Asphondylia* sp. "Isunoki-hario-tamabae" new name [Diptera, Cecidomyiidae, Asphondyliidi].

Male: Eye bridge 7 facets wide medially; palpus consisting of 1 + 2 segments; antenna with 2 + 12 segments; scape with dense dorsal and ventral setae; tarsomere 1 on all legs with an apical protuberance; claws of all legs simple, bent nearly at right angle on distal third; empodium nearly as long as claw. R_5 meeting with costa a little beyond wing apex. Results of setal counts and measurements are shown in Table 3. Genitalia showing a typical shape of *Asphondylia*. Otherwise practically as in the diagnosis of the genus *Asphondylia* (see YUKAWA, 1971 for the generic diagnosis and for the drawing of a typical male genitalia).

Table 3. *Asphondylia* sp. (♀) emerged from the fruit gall on *Distylium racemosum*; fronto-clypeal and thoracic setal counts, and measurements of wing, palpus, flagellomeres and legs.

Fronto-clypeal setae		20	Fore leg	Fe (μm)	1050
Mesopleural setae		10		Ti	975
Mesepimeral setae		21		T_1	120
				T_2	820
Wing length (μm)		2325		T_3	460
Wing width		775		T_4	280
l/w		3.00		T_5	120
			Mid leg	Fe	900
Palpus 1 (μm)		60		Ti	825
2		115		T_1	110
				T_2	550
Flagellomere 3	ds* (μm)	10		T_3	325
	be	160		T_4	200
	w	45		T_5	120
	be/w	3.56	Hind leg	Fe	1100
				Ti	1050
Flagellomere 5	ds (μm)	10		T_1	110
	be	153		T_2	630
	w	43		T_3	410
	be/w	3.56		T_4	240
				T_5	110

*ds : distal stem, be : basal enlargement, w : maximum width of basal enlargement.

Mature larva : Second antennal segment short, conical, about 10.0 μm, 1.6 times as long as maximum width ; 2 ventral and 2 lateral cervical papillae each with a seta. Number and position of spiracles normal ; 4 of 6 dorsal papillae each with a seta ; 3 pleural papillae present on each side, each with a seta ; 2 dorsal papillae of eighth abdominal segment each with a seta ; 2 of 6 terminal papillae somewhat cone-shaped, other 4 terminal papillae each with a short seta. Sternal spatula about 220 μm, 2.7 times as long as maximum width, distally with 4 lobes which are normally pointed apically (Fig. 1 B) ; length of outer lobes about 22.5 μm ; length of inner lobes about 15 μm ; width between tips of 2 outer lobes about 52.5 μm ; sternal and inner pleural papillae each with a seta on all thoracic segments ; 3 inner and 2 outer lateral papillae each with a seta on all thoracic segments ; 2 anterior ventral papillae and 2 posterior ventral papillae each with a seta ; 2 ventral papillae of eighth abdominal segment each with a seta ; anal papillae without seta.

Pupa : Apical spine long, 300 to 310 μm, acutely pointed ; inner margin of apical spine not distinctly denticulate (Fig. 1 C) ; apical papillae with setae which are 60 to 65 μm long ; an anterior (upper) frontal spine present, strongly sclerotized ; 3 posterior (lower) frontal spines present, strongly sclerotized (Fig. 1 C) ; usually 1 of 2 posterior (lower) facial papillae and 1 of 3 lateral facial papillae each with a seta ; prothoracic horn relatively short, 75 to 90 μm long ; short spiracular tubercles present on second to eighth abdominal segments ; each abdominal segment, except first and terminal ones, dorsally with several transverse rows of spines which are successively longer and more regularly arranged posteriorly ; usually 4 of 8 dorsal papillae each with a seta.

Slide mounted specimens examined : 1 ♀, 1 mature larva, 2 puparia ; galls collected

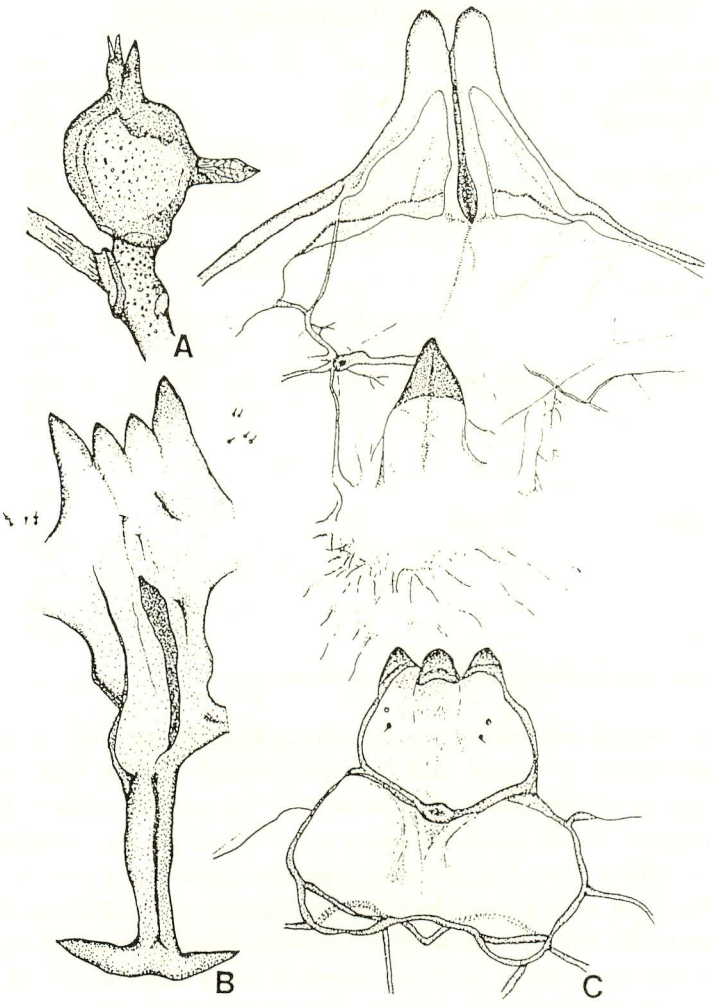

Fig. 1. *Asphondylia* sp. "Isunoki-hario-tamabae". A : Fruit gall produced on *Distylium racemosum* SIEB. et ZUCC., B : Sternal spatula of mature larva, C : Apical and frontal spines of pupa.

from Katsuudake, Okinawa pref., 22. XI. 1981, Y. ITÔ & S. YAMAUCHI leg., emerged on 28. XI. 1981, reared by J. YUKAWA, host plant : *Distylium racemosum*, Cecid. Nos. E 4801 - E 4804.

REMARKS

In Japan several sorts of aphid gall have been noted to be produced on *Distylium*

racemosum (SORIN, 1977), but no midge gall was previously found on that plant. Therefore, the present paper implies the first collecting record of a midge gall on the plant. The distribution range of the gall is, however, restricted only to the Okinawa main island at the moment, in spite of the fact that *D. racemosum* is commonly seen in southwestern Japan, particularly as hedge plants in southern Kyushu. The distribution pattern of the species do not coincide with that of the soybean pod gall midge which is widely distributed in Honshu, Shikoku and Kyushu north of Yaku Is. (NAITO, 1964).

The gall midge which emerged from the fruit gall is identified as a species of the genus *Asphondylia* as it is provided with many characteristics which are quite similar to the diagnosis of the genus described for the mature larva (MÖHN, 1955) and the adult (YUKAWA, 1971). This gall midge may be separable from the other known species of the genus in Japan by having the following remarkable features: fronto-clypeal and thoracic setae relatively small in number (Table 3); inner margin of apical spine of pupa not distinctly denticulate (Fig. 1 C); spiracular tubercles absent on first abdominal segment of pupa. This species is, however, left unnamed since the description is based on a single male and on a few larval and pupal specimens. The species identification, therefore, must await the collection of further material and more extensive study on its biological aspects.

Table 4. Results of dissection of the fruit galls produced by *Asphondylia* sp. on *Distylium racemosum* SIEB. et ZUCC.

Total no. of galls examined	56
No. of larval chambers examined	100
Exit holes produced by the gall midge and its parasitoids	69
Exit holes retaining puparium of the gall midge	4
Pupae (alive)	1
3rd instar larvae (alive)	5
2nd instar larvae (alive)	4
Failure in emergence	2
Pupae (dead; cause unknown)	4
3rd instar larvae (ibidem)	1
Pupae of a eurytomid parasitoid	2
Decayed larval chambers	5
Empty larval chambers (cause unknown)	3

On the date of collection, 22. XI. 1981, exit holes had been made in at least 70% of the galls by either the gall midge or its parasitoids, and only some surviving larvae or pupae were found in the galls (Table 4). The data indicate that a large majority of the gall midge had emerged before the collecting date. The percentage of emerged adult midges could not be exactly estimated, since some puparia of the gall midge had possibly been removed by a strong wind or heavy rain after emerging. However, the percentage of parasitism by the eurytomid parasitoid could not be high because the number of surviving midge larvae or pupae inside the galls was distinctly more abundant than that of the parasitoid pupae (10 : 2 in Table 4). The eurytomid species is quite

similar to that associated with the other *Asphondylia* species listed in YUKAWA *et al.* (1981). Mortalities caused by factors other than the parasitism were not severe, so far as the present data are concerned.

SUMMARY

The fruit galls produced by an *Asphondylia* species on *Distylium racemosum* SIEB. et ZUCC. [Hamamelidaceae] were collected from Okinawa. Both the fruit gall and the gall maker are briefly described together with the results of measurements, setal counts and dissection of the galls.

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