Jpn. J. Ent., 59 (1): 99–103. March 25, 1991

Role of the Teeth on the Abdominal End in *Praestochrysis shanghaiensis* (Hymenoptera, Chrysididae)

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Abstract The teeth on the abdominal end of *Praestochrysis shanghaiensis* are used for facilitating the making of an oviposition hole in the shell of the host cocoon.

Key words: *Praestochrysis shanghaiensis*; teeth; abdominal end; Chrysididae; oviposition.

Introduction

In *Praestochrysis shanghaiensis* (SMITH), a solitary parasitoid specific to the oriental moth, *Monema flavescens* WALKER (Lepidoptera, Limacodidae), the adult has sharp teeth on the posterior margin of the third tergum of the gaster. During the observation of the ovipositional behavior, PARKER (1936) and YAMADA (1987) remarked that using her sharp teeth as spikes the female adult pressed her body against the host cocoon while drilling an oviposition hole in the cocoon shell in front of her with her mandibles. In this report I analyze the role of the teeth by making the adult female drill an oviposition hole in preventing the use of her teeth as spikes. In addition, I examine the relationship between the presence of the teeth and the type of hosts in the three advanced subfamilies of the Chrysididae, Elampinae, Parnopinae, and Chrysidinae, which contains the genus *Praestochrysis*.

Materials and Methods

The experiments were carried out in an incubator at 25°C and under a 16L–8D regime in 1984 by using two adult females: one derived from a cocoon collected in Uji, Kyoto, and the other, in Konosu, Saitama. The females, mated within a few days after their emergence, were reared separately in a transparent plastic cage 10 cm in diameter and 8 cm in height. A piece of absorbent cotton soaked with honey containing fresh pollen and another piece of absorbent cotton soaked with water were placed on the floor of the cage. A cocoon was given to the wasp every other day 5 or 7 days after the emergence of the wasp. The cocoon was glued to the center of a twig of a plane tree, *Platanus* × *acerifolia* (AITON) WILLD., and the twig was placed against the cage wall with the cocoon up. The twigs used, 11–13 mm in diameter and about 12.5 cm long, consisted of two types. Twigs of one type had an aluminum sheet (16 × 10 mm) stuck to twig surface 6 mm away from each end of the cocoon, so that effectiveness of the teeth was eliminated by the presence of the sheets. The other type did not have aluminum sheets, and the two types were used alternately. After the oviposition or when the wasp did not start drilling an oviposition hole within an hour after the supply of a cocoon, the twig with the cocoon was removed. The teeth on the abdominal end were cut off 23 or 31 days after adult emergence, and an untreated twig with a cocoon was supplied every 3–7 days during the following few weeks. Observation was carried out throughout the period during which the cocoon was supplied. Time spent for each component of the entire sequence of oviposition—inspection, perforation of the oviposition hole, oviposition (from insertion of the ovipositor to drawing of it), sealing of the hole, and wandering on and around the cocoon after sealing till departure (see YAMADA, 1987)—was recorded. After the oviposition, the cocoon was dissected to observe whether an egg was actually laid in it. If the cocoon did not contain an egg, the data obtained from the observation of the oviposition into the cocoon were not used for the analysis.

Results and Discussion

When the aluminum sheets were stuck or the teeth were cut off, the wasp spent much more time for inspecting and drilling an oviposition hole (Table 1). On the treated twig it took more than twice as much time for the wasp to drill a hole as it did on the untreated twig. The time for perforation was longer in the case of the treated twig than in the case of the cutting of the abdominal teeth. This is because in the former the wasp was not able at all to brace itself with the abdominal end while in the latter pressing the abdominal end against the twig was more or less effective in steadying the body even though the teeth were lost. The reason for the long time spent for inspection before perforation is that the wasp tried to drill a hole many times, but gave up in a few seconds. Since the wasp did not use the teeth and often kept the abdomen away from the twig surface while sealing the oviposition hole (YAMADA, 1987), the time spent for sealing was not prolonged by sticking aluminum sheets or by cutting the teeth.

After the teeth were cut off, the average time for oviposition (from inserting the ovipositor to drawing it out) was significantly longer than that before teeth cutting. However, the prolongation of the time does not seem to be caused by the cutting of the teeth, because it was obvious in only one of the two individuals (values for one, 39.8, 54.5 min; values for the other, 18.3, 20.9, 23.0 min) and the teeth does not seem to have been used during the insertion of the ovipositor. In fact, in the supplementary experiment in which the ovipositional behavior of another wasp that had the teeth cut off was observed twice the time for oviposition was 16.1 and 11.0 minutes. Considering that the time for oviposition tended to increase

Table 1. Comparison of time (mean±S.D.) spent on laying an egg.

Treatment	n	Time spent (min)					
		Inspection	Perforation	Oviposition	Sealing	Time after sealing	Total
Control	7	3.6±3.5 a	45.7±10.4 a	14.0±3.6 a	14.5±2.4 a	1.0±0.7 a	78.8±12.2 a
Sheet stuck	9	10.0±7.9 b	117.0±31.1 b	15.3±5.4 a	14.6±2.6 a	0.8±0.6 a	157.6±30.8 b
Teeth cut	5	16.0±7.9 b	77.4±24.4 c	31.3±16.4 b	14.9±3.6 a	1.5±1.6 a	141.1±27.0 b

Means within a column with the same letter are not significantly different ($P>0.05$; DUNCAN's multiple range test for values after logarithmic transformation).

Table 2. Frequency of host genera classified by the mode of closure of the entrance of the nest[a].

Subfamily	Filled in with nonsticky materials such as sand		Closed with a plug made of a plastic material such as mud and plant resin	
	Wasp	Bee	Wasp	Bee
Elampinae	14	0	0	0
Chrysidinae	2[b]	0	18	5[c]
Parnopinae	4[d]	0	0	0

[a] Host genera listed by IWATA (1971), BOHART & KIMSEY (1980), and KIMSEY & BOHART (1980) were classified. Information about the nest structure was cited from IWATA (1971).
[b] *Ammophila* and *Sphex*, both of which are sand wasps.
[c] Some species of four genera, *Anthophora, Anthidium, Osmia and Hoplitis,* fill in their burrows with nonsticky materials such as sand, petals, and plant filaments.
[d] All the genera belong to the sphecid tribe Bembicini.

with the age of the wasp ($r=0.460$, $0.05<P<0.1$; data before teeth cutting were used), the prolongation of the time for oviposition found after the cutting of the teeth may have been related to the old age of the wasp.

Although the Elampinae and the Chrysidinae usually parasitize wasps or bees, the abdominal teeth are found only in members of the Chrysidinae (see BOHART & KIMSEY, 1982). This is closely related to the fact that the hosts of the Chrysidinae usually differ from those of the Elampinae in the mode of closure of the nest entrance (Table 2). Most of the hosts of the Chrysidinae make use of pre-existing holes or construct nests made of mud only, and they close their nest entrances with plugs made of plastic materials such as mud and plant resin. On the other hand, the hosts of the Elampinae dig nests in the ground, rotten wood, or pith of plants, or make use of pre-existing holes, and they fill in their nest entrances with sand, pebbles, debris, or plant materials. It is impossible to perforate in such host-protecting coverings a small hole for insertion of the ovipositor and to insert the ovipositor into the nest. However, it should be noted that not all the Chrysidinae have abdominal teeth. This is because some Chrysidinae have evolved an oviposition mode in which they oviposit in the host cell before it is sealed (YAMADA, 1987; see IWATA, 1971, 1978; BOHART & KIMSEY, 1982). This oviposition mode enables some Chrysidinae to parasitize sand wasps (*e.g.*, ROSENHEIM, 1987), which fill in the entrances of their nests with sand and pebbles. Although the Parnopinae parasitize sand wasps, they have teeth on the abdominal end. However, these teeth are small and numerous, and correspond to spines or notches (see BOHART & KIMSEY, 1982). The mode of use of the teeth is considered to be different from that of the Chrysidinae, although the oviposition behavior has not been fully documented in the Parnopinae.

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(Received May 25, 1990; Accepted December 26, 1990)