Effect of Host Age on Parasitism by
Trissolcus plautiae (WATANABE)
(Hymenoptera: Scelionidae),
an Egg Parasitoid of *Plautia*
stali SCOTT (Heteroptera:
Pentatomidae)¹

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Scelionid species show a high degree of variability in their ability to develop in host eggs of different ages (ORR et al., 1986). Parasitization capability of an egg parasitoid to a host of different ages should be examined from the following three aspects: (1) ability to discriminate suitable and unsuitable hosts; (2) variability of the degree of parasitism corresponding to host age; and (3) effect of the parasitoid attack on the development of a host embryo when the parasitoid fails to develop in the host. These are important not only when we attempt to use a natural enemy in biological control programs but also when we consider oviposition strategy of a parasitoid.

In the present study, I examined the parasitization capability of *Trissolcus plautiae* (WATANABE) attacking eggs of *Plautia stali* SCOTT of different ages. *T. plautiae* is a solitary parasitoid (OHNO, 1981) and the most dominant egg parasitoid of the brown-winged green bug, *P. stali* (YAMADA and MIYAHARA, 1979), which is an injurious pest of various fruits in Kyushu, southwestern Japan.

MATERIALS AND METHODS

The culture of *T. plautiae* was established from *P. stali* egg masses collected in the vicinity of Kyushu University, Fukuoka, in the spring of 1982, and maintained at 25°C and a L16-D8 photoperiod. The emerged parasitoids were reared individually in small glass tubes, 15 mm in diameter and 150 mm long, with honey. To obtain host egg masses, 150 pairs of *P. stali* adults were reared with raw peanuts in plastic containers (OHNO, 1985). Host eggs newly deposited in a mass were kept in an incubator at either 22 or 25°C until experiments.

Mated female parasitoids 3–4 days after emergence were confined individually in glass tubes, 21 mm in diameter and 200 mm long, in which one host egg mass was placed. Behavior of the wasps was observed using a dissecting microscope with a video tape recorder when necessary. When the parasitoid finished oviposition, usually 1.5 hr after introduction, each host egg mass was transferred into another glass tube and kept in an incubator controlled at either 22 or 25°C. Two weeks later, number and sex of emerged parasitoids were examined. Host eggs from which neither parasitoids nor host nymphs emerged were dissected to learn their contents. Experiments were replicated 5 to 14 times with hosts of different ages (1–7.5 days old) incubated at 22 and 25°C. Part of the data for 7.5 days old hosts was neglected because they hatched before or during the experiments.

RESULTS AND DISCUSSION

T. plautiae attacked the *P. stali* eggs through all stages of their development (Table 1). Similar behavior was observed in several scelionids (GERLING and SCHWARTZ, 1974; FEDDE, 1977), although some scelionids refrain from ovipositing into older hosts (AUSTIN, 1984) and prefer younger ones (ORR et al., 1986).

The ovipositing behavior of *T. plautiae* was ordinarily as follows. A female drummed the egg she touched first among those in an egg mass with her antennae for a while, and inserted her ovipositor into a lower part of it. She withdrew her ovipositor after about 2 minutes, and swept over the egg surface with her ovipositor, which presumably was the marking behavior. The oviposition continued until all the eggs of the egg mass were parasitized. However, when old host eggs ready to hatch were given to a *T. plautiae* female for oviposition, she repeatedly inserted her ovipositor into them without demonstrating the marking behavior.

Table 1 shows the percentage rate of successful parasitism and the hatch rate of host eggs when the parasitoids were exposed to host eggs of various ages. Both at 22 and 25°C, the rate of successful parasitism was very high except when old host eggs (more than 6.5 and 5.5 days old at 22 and 25°C, respectively) ready to hatch were given. For these old hosts, however, hatch rate was not so high. When all the parasitoids survived to the adult stage, the sex ratio of parasitoids emerged

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Table 1. Parasitization success of *Trissolcus plautiae* exposed to host eggs of different ages

Temperature (°C)	Age of host eggs (days)	No. of host egg masses	No. of host eggs	Rate of successful parasitism (%)	Rate of parasitoid mortality ^a (%)	Rate of host hatch (%)	Rate of host mortality ^b (%)	Oviposition response (+ or -)
22	1	10	140	100.0	0.0	0.0	0.0	+
	2	12	167	92.8	1.2	0.0	6.0	+
	3	9	122	100.0	0.0	0.0	0.0	+
	4 ^c	7	97	100.0	0.0	0.0	0.0	+
	5 ^c	12	161	96.3	3.7	0.0	0.0	+
	6 ^c	11	163	90.8	6.7	0.0	2.5	+
	6.5 ^c	9	115	54.8	13.0	5.2	27.0	+
	7 ^d	10	139	12.2	10.1	21.6	56.1	+
	7.5 ^d	5	68	8.8	29.4	25.0	36.8	+
25	1	14	196	100.0	0.0	0.0	0.0	+
	2	12	168	88.1	11.9	0.0	0.0	+
	3	11	165	100.0	0.0	0.0	0.0	+
	4 ^c	9	137	95.6	2.9	0.0	1.5	+
	5 ^c	9	147	87.8	2.7	0.0	9.5	+
	5.5 ^d	7	115	0.0	0.0	50.4	49.6	+
	control	13	195	0.0	0.0	100.0	0.0	

^a Includes unemerged adults and immature stages.

^b Host eggs did not hatch and signs of parasitism did not develop.

^c Tissue development visible.

^d Less than 1 day from hatch.

from each egg mass was female-biased.

In some scelionid species, the parasitization capability is restricted to the earlier stages of the host eggs (EBERHARD, 1975; AUSTIN, 1984; ORR et al., 1986). In other species, the parasitization is not strictly restricted, but the rate of successful parasitism is lower in old host eggs in the laboratory (HIDAKA, 1958; RABINOVICH, 1970; JUBB and WATSON, 1971; POWELL and SHEPARD, 1982). On the other hand, *T. plautiae* is able to parasitize old hosts that have developed to a stage near nymphal emergence (Table 1, 7.5 days old host at 22°C). Also, when the female parasitoid attacked a host on the verge of hatching, host nymphs did not hatch although signs of parasitism did not develop (Table 1, 5.5 days old host at 25°C).

In *Trissolcus basalis* (WOLLASTON) parasitizing *Nezara viridula* L., host egg mortality was high even though parasitoid emergence was lower when older host eggs were provided (POWELL and SHEPARD, 1982). FEDDE (1977) suggested that the sting by parasitoid females might kill the host embryos in old host eggs. Thus the attack of *T. plautiae* may cause cessation of host development and the death

of host nymphs, even if parasitoids fail to parasitize the old host eggs.

In conclusion, *T. plautiae* possesses good parasitization capability, by which it successfully parasitizes or kills host eggs at all developmental stages before hatching. Also, *T. plautiae* shows no tendency to avoid older hosts. This is reasonable because the parasitoid is able to parasitize host eggs of different ages. Moreover, present results indicate the difficulty of estimating the actual rate of parasitization in the field. Since host eggs are susceptible to parasitization for several days, the rate of parasitization may be underestimated when we sample the host egg masses before completion of a parasitoid attack. To avoid this we should attempt a careful sampling program by which to estimate the rate of parasitization.

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