

OBSERVATIONS ON THE PREY-PREDATOR RELATIONSHIP
BETWEEN PSEUDOREGMA BAMBUCICOLA (HOMOPTERA,
PEMPHIGIDAE) AND METASYRPHUS COIVFRA TER
(DIPTERA, SYRPHIDAE), WITH SPECIAL REFERENCE TO
THE BEHAVIOUR OF THE APHID SOLDIERS

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PSEUDOREGMA BAMBUCICOLA (HOMOPTERA, PEMPHIGIDAE)
AND *METASYRPHUS CONFRA TER* (DIPTERA, SYRPHIDAE),
WITH SPECIAL REFERENCE TO THE BEHAVIOUR OF
THE APHID SOLDIERS"

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Abstract

Some observations on the pseudoscorpion-like soldiers of a bamboo aphid, *Pseudoregma bambucicola* (Takahashi) are reported. The soldiers attack only the first instar larvae of *Metasyrphus confrater* (Wiedemann), which is a predaceous species of this aphid. The aphid soldiers can successfully attack the individuals in the early stage of the 1st instar larvae of the syrphid fly. However, all the soldiers that attacked the larvae died within a few minutes, probably due to a toxic chemical substance secreted by the latter.

Introduction

As reported earlier (Ôhara, 1985), the bamboo aphid, *Pseudoregma bambucicola* (Takahashi, 1921), shows defensive behaviour by its pseudoscorpion-like soldiers against its predaceous syrphid species, *Metasyrphus confrater* (Wiedemann, 1830). The latter is a specialized predator on *P. bambucicola*, at least in Kyushu (Ôhara, 1985). Aphid soldiers attack not only eggs but also the 1st instar larvae of *M. confrater*.

In the present paper, some observations on the attacking behaviour of the soldiers of *P. bambucicola* toward the 1st instar larvae of *M. confrater* are reported. Most observations and photography were made at Kaseda City, Kagoshima Prefecture, Kyushu, Japan. Several observations were also made with the assistance of Mr. T. Gotô at the Entomological Laboratory of Kyushu University in Fukuoka.

Observations

On October 22, 1981, I observed an individual of the 1st instar larva of *M. confrater*

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which was attacked by a pseudoscorpion-like soldier of *P. bambucicola*. The syrphid larva was feeding on an adult aphid while an aphid soldier was walking about on the culm of a slender bamboo. The aphid soldier detected the larva and approached. As soon as the legs of the soldier contacted the syrphid larva, the soldier clasped it with its enlarged anterior legs, and tried to pierce the larva with its frontal horns (Figs. 1 & 2).

At first, the syrphid larva struggled to escape from the soldier lifting the anterior part of its body and swinging rapidly from side to side. Soon the larva started to walk, but the soldier continued to clasp it. Surprisingly, 1 or 2 minutes later the aphid soldier died (Figs. 3 & 4).

I continued the observations and watched more than 10 similar soldier-larva encounters. In each case, the result was the same. However, if the soldier clasped the side or anterior parts of the body of the syrphid larva, it was killed by the larva with mouth hook.

On October 24, 1981, at Kaseda City in Kagoshima Prefecture, I cut off a slender bamboo on which a dense colony of *P. bambucicola* was found, and took it back to Fukuoka City the next day. Observations on the aphids were made in the Laboratory using a binocular microscope.

The soldier-larva encounters previously seen in the field were again seen in these microscopic studies in the laboratory. The soldiers did not use the stylets when they attacked the syrphid larvae, but, rather, tried to press their frontal horns into the body surface. Despite very strong pressing, however, the aphid soldiers could not pierce the skin of the syrphid with their horns.

On November 29, 1982, another series of observations was made. I put some individuals of the newly hatched larvae of *M. confrater* close to a small colony of *P. bambucicola*. Almost immediately they began to crawl on the surface of the culm as though looking for prey aphids. Whenever an aphid soldier contacted one of the larvae, it quickly clasped the larva with its anterior legs and lifted the victim (Fig. 5). The larva could not repel the attack because of its relatively light weight and small size (2-3 mm in length). Eventually, almost all of the aphid soldiers with larvae in their grasp, had fallen from the bamboo to the ground. Just as in the previous observations, in each case the soldiers died within a few minutes (Fig. 6).

Discussion

It was confirmed by observations that the pseudoscorpion-like soldiers of *P. bambucicola* attack the 1st instar larvae of *M. confrater*. However, the attack is effective only during the early stage of the 1st instar larvae. First instar syrphid larvae become enlarged after feeding on aphids. These individuals are distinctly larger than the newly hatched ones. After their enlargement they are too heavy for the soldiers to attack successfully.

The aphid soldiers could not pierce the larval skin with their frontal horns, even when attacking the 1st instar larvae. However, when newly hatched, unfed larvae were

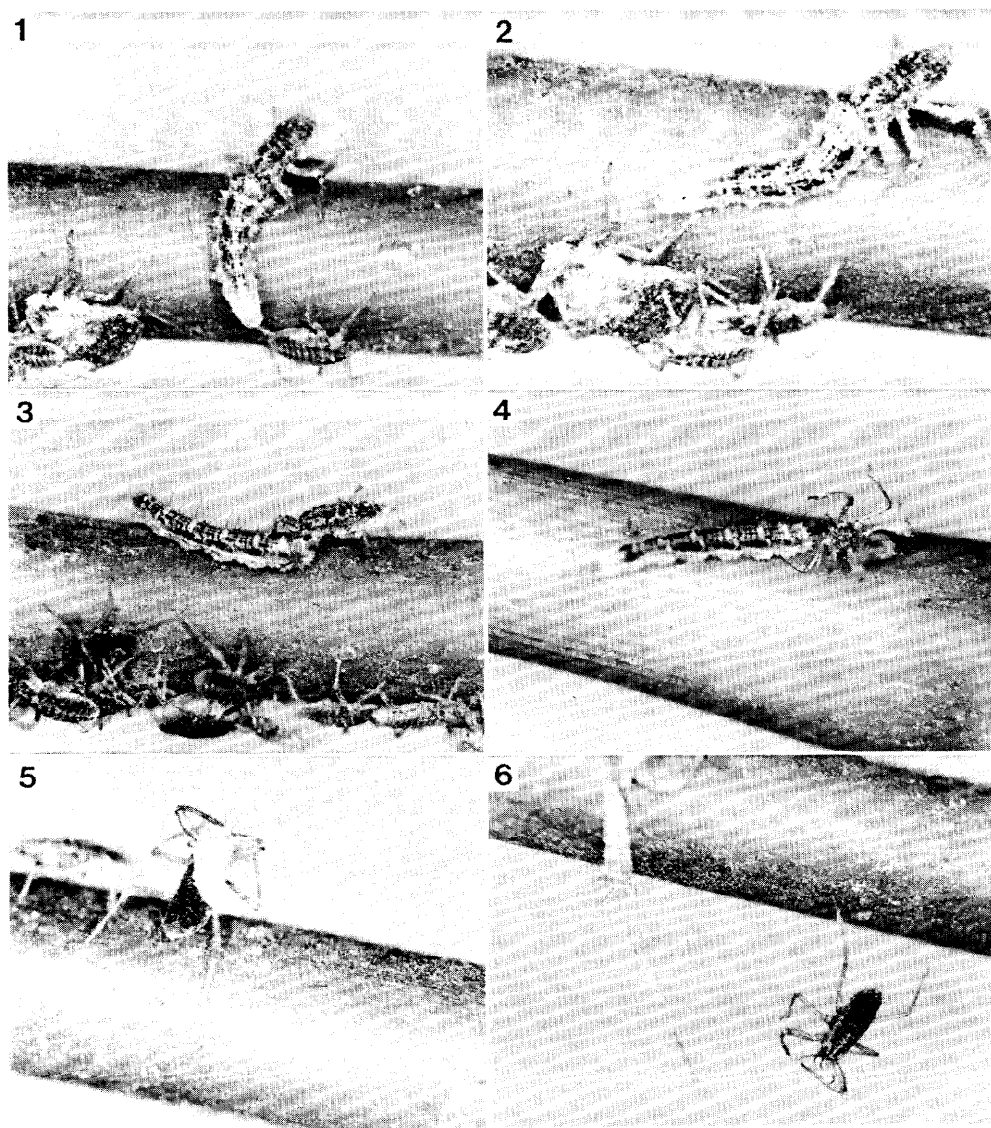


Fig. 1. Soldier of *P. bambucicola* attacking a 1st instar larva of *M. confrater*. Fig. 2. Ditto. Fig. 3. Ditto ; anterior legs of the soldier released. Fig. 4. Ditto ; the soldier died. Fig. 5. Soldier of *P. bambucicola* attacking and lifting up a newly hatched larva of *M. confrater*. Fig. 6. Dead soldier of *P. bambucicola*, just after attacking a larva of *M. confrater*.

attacked, the soldiers were able to hold the victims and fall with them from the bamboo to the ground. Once the syrphid larvae had fallen down from the bamboo, of course their food supply appears to be no longer available to them.

The soldiers of *P. bambucicola* clasp syrphid larvae with their enlarged anterior legs and butt it with their frontal horns during an attack. According to Aoki et al.

(1981), the soldiers of Taiwanese *P. alexanderi* (Takahashi) show a similar behaviour. They reported that the soldiers of *P. alexanderi* attacked a rather large syrphid larva (probably 2nd or 3rd instar) which was artificially placed in a colony of *P. alexanderi*. The soldiers of *P. bambucicola*, however, rarely attack the 2nd or 3rd instar larvae of *M. confrater*. When the attacks did occur, such attacks were of very short duration and always unsuccessful. The attacks had no effect whatever on the syrphid larvae. This was undoubtedly the result of their relatively large size.

In a further experiment I collected several individuals of 2nd instar larva of a pyralid moth and put them on a bamboo stem close to an aphid colony. This moth, *Cryptoblates aphidivora* Yoshiyasu et Ôhara, is one of the major predators of the aphid, specially in autumn and early winter. During this experiment many of the aphid soldiers were seen clasping and piercing the larvae immediately on contact. While maintaining a very tight hold with their legs, the soldiers also pressed their frontal horns firmly onto the pyralid larvae. The antagonists retained that posture for a considerable length of time and then both died 1 or 2 days later. In this case, the aphid soldiers were able to pierce the skin of the larvae with their frontal horns.

The question of why the soldiers that attack the syrphid larvae die so soon remains unanswered. It may be that the 1st instar larvae of *M. confrater* secrete a chemical substance from their body surface (probably from the base of segmental processes) which is toxic for the attacking soldiers.

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