Trap for Monitoring Adult Parasites of the Tea Pest

By KAZUO TAKAGI

Tea Agronomy Division, National Research Institute of Tea

It is well known that the natural control may be defined as the regulation of insect population within a certain range with more or less regular upper and lower limits over a period of time by any one or any combination of natural factors. A number of approaches have been adopted by entomologists to gain knowledge of natural enemies of insects. The most important approach up to date is the development of life tables. This method show the fact, in many cases. That the Hymenopterous parasites restrict the population density of many pests. Historically, the contribution of parasites to the mortality of tea pests has been evaluated by collecting immature insects in the field and rearing them in the laboratory to isolate parasites. Unfortunately, this method gives very variable estimates of the incidence of parasites because of differences in collection techniques and in the number of hosts collected. Other ways of evaluating the impact of parasites on the pests are needed. One methods, collecting adult parasites, could provide data on species composition and relative abundance, species distribution over space and time, adult density, dispersal patterns, species relationships with specific ecological variables, and establishment of exotic species in areas infested with tea pest insects. The objective of the present study was to determine how accurately the species composition and relative abundance of parasites were reflected in samples collected in sticky suction trap in the tea field during the year.

Sticky suction trap

Sticky suction trap consists of a fan (8 cm diam.) enclosed with a plastic box having a square opening (7 × 7 cm) at one end. Trap is suspended in a square frame on which a glass plate (20 × 20 cm) coated with the adhesive on its under surface is placed. The distance between trap opening and sticky plate was 10 cm. This device was placed among the rows of tea bush setting the fan side opening 5 cm above the plucking surface. (Fig. 1)

The suction traps sample the aerial population of flying insects and are equally effective by day or night. A fan sucks into the traps a constant volume of air (72 m^3) per hour.

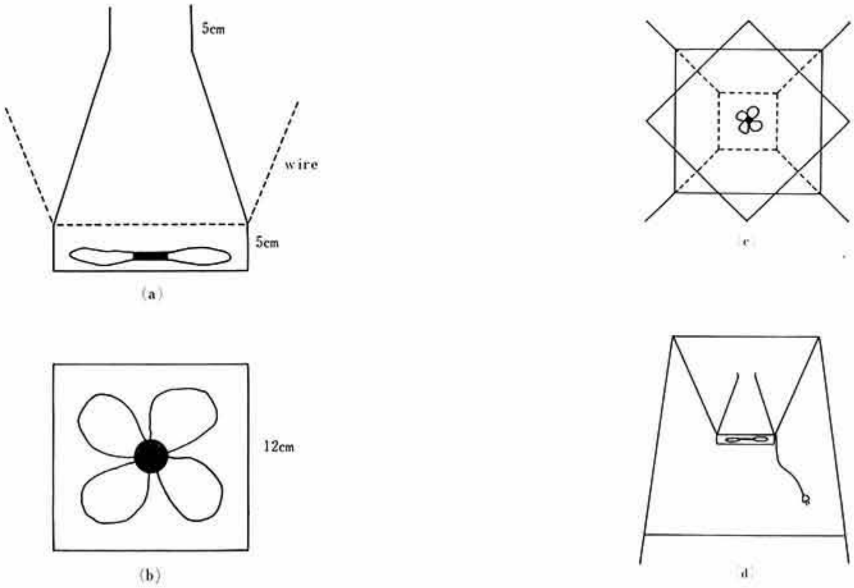
The number of parasites was determined from samples collected with the trap every other day. A binoculous microscope (× 8–40) was used for counting. The insects which could not be identified under the microscope were picked up by needle, soaked by benzen, and then kept in alcohol for identification.

Insect pests of tea fields

The major species of insects associated with the tea plant are found in nearly all tea-growing areas in Japan. The smaller tea tortrix (*Adoxophyes* sp.), tea tortrix (*Homona magnanima* Diakonoff) tea leaf roller (*Caloptilia theivora* Walsingham), tea green leaf hopper (*Empossca onukii* Matsuda), white each scale (*Pseudaulacaspis pentagona* (Targioni)), and Assam thrips (*Scirtothrips dorsalis* Hood) are the principal pests of tea.

The hymenopterous parasites

The important species of tea pest parasites collected during the study are listed in Table 1, which also shows their host associations and



(a) ventral view (b) frontal view (c) frontal view (d) suspended in a flame

Fig. 1. Structure of sticky suction trap

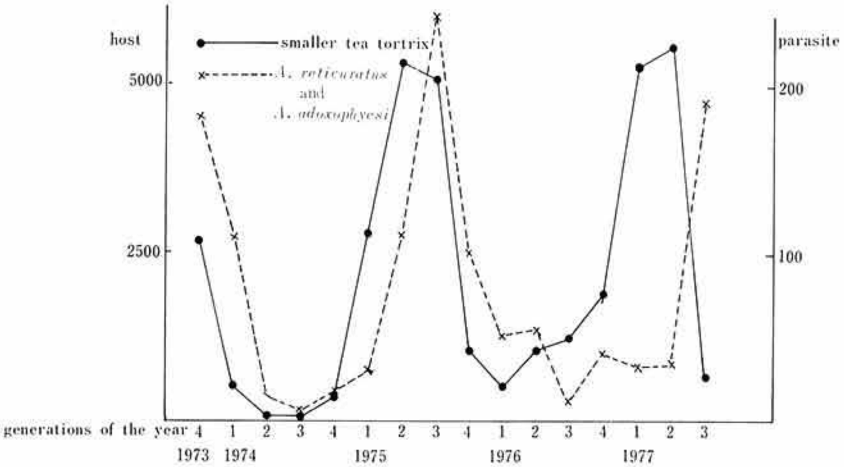


Fig. 2. Changes in the densities of smaller tea tortrix and its parasites. Adult moth caught by light trap

the developmental stages of host when the parasites attack.

1) Smaller tea tortrix

The smaller tea tortrix are active early in May and the female moths lay their scale like eggs on undersurface of the tea leaf. The newly hatched larva feeds young tea leaf and pupate among the older leaf. They have four generation in a year. The population density of two species belonging to the family Braconidae, *A. reticuratus* and *A. adoxophyesi* showed the pattern completely synchronized with that of the host population during the investigation period. (Fig. 2). The number of this tortrix changed dramatically from generation to generation. The regularity of some of the outbreaks is of great theoretical interest and the interpretation of these long-term records is still very much a matter for speculation.

2) Tea leaf roller

Adult tea leaf roller lays their eggs on the underside of the new leaf. The larva enters into the soft, green outer parenchyma from bottom of their egg. It eats away below the epidermis until a linear, regular mine is formed at edge of the leaf. Before it developes to the mature larva, the larva prepares a tri-angular room made by a single leaf. It pupates; mature larva makes a thin silky cocoon on the underside of the leaf. The most important parasite is *Sympiesis mikado* which attacks the moth larvae. The adult parasite inserts a single egg through the leaf cuticle on the body surface of a moth larva. The parasite larva feeds host larva and pupate in the triangular room made by host insect. This

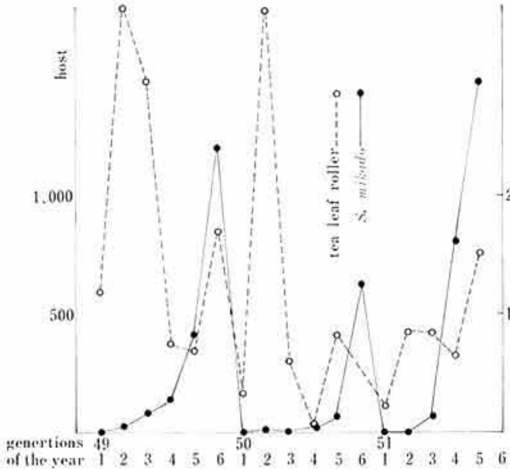


Fig. 3. Population trend of tea leaf roller and its parasite.

Table 1. The important parasites and their hosts

Parasites	Hosts	Developmental stage of host attacking parasites
Ascogaster reticuratus Watanabe	smaller tea tortrix	egg
Apanteles adoxophyesi Minamikawa		larva
Bracon adoxophyesi Minamikawa		larva (mature)
Trichogramma dendrolimi Matsumura		egg
Campoplex homonae Sonan	tea tortrix	larva
Trichogramma dendrolimi Matsumura		egg
Sympiesis mikado Ashmead	tea leaf roller	larva (mature)
Chirospilloides japonica Ashmead		larva
Elasmus sp.		larva
Arrhenophagus chionaspidis Aurivillis	white peach scale	larva
Archenomus bicolor Howard		larva
Thomsonica typica Mercet		larva (mature)
Anagrus sp.	tea green leaf hopper	egg

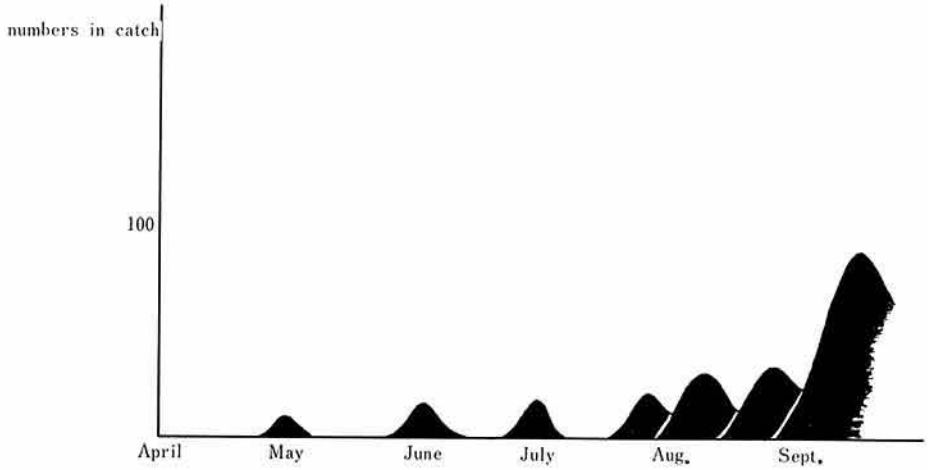


Fig. 4. Seasonal trend in population of the egg parasite (*Anagurs* sp.) of tea green leaf hopper, determined by the sticky suction trap method.

parasite, has a short developmental period (8–10 days), so that it can repeat two or three generations in a single generation of the host. Every years, they occurred abundantly in autumn at the last generation of the host. (Fig. 3)

3) Tea green leaf hopper

The eggs are laid singly embedded in the soft tissues of tea bushes, such as the veins of leaves and tender stems. The newly hatched nymph starts feeding soon after hatching. A species belonging to the family Mymaridae, *Anagrus* sp. was found to attack the egg. This egg parasit was found to parasitise the egg during the later part of the year. (Fig. 4)

4) White peach scale

The adult female deposites eggs under its abdomen in May and newly hatched larva disperses from mother scale in late May. Male of the scale emerged from white cocoon 30 days after and they copulate with immature female. Developmental period of female is about 60 days, so that the scale usually repeats 3 generations in a year. Many Hymenopterous parasites have been recorded, but during the investigations *A. chionaspidis* and *A. bicolor* were dominant. The former appeared in both periods of larva hatching and male emerging of the host. The latter was active in 2nd larval inster period of the host. (Fig. 5)

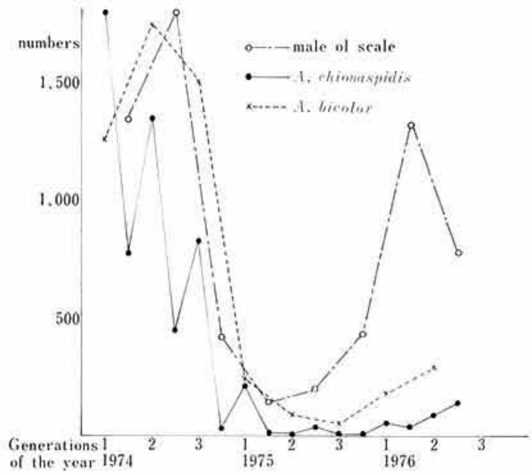


Fig. 5. White peach scale population expressed by male adults and the trends in population of two important parasites.

Another use of sticky suction trap

The sequential sampling of small insects such as thrips and the male of scale is a very

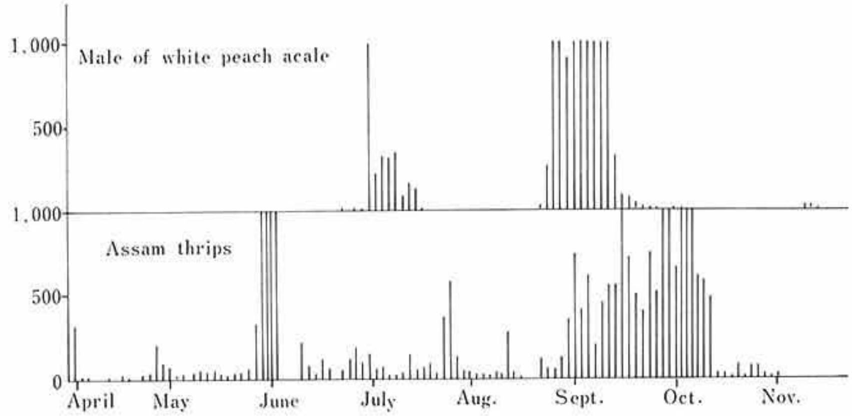


Fig. 6. Seasonal abundance of Assam thrips and male of white peach scale caught by sticky suction trap

difficult problem. The sticky suction trap was proved to be most useful for the quantitative and qualitative estimation of aerial small insect population, because the air is homogeneous and the insect is easily separated from other materials. (Fig. 6)

Conclusion

One of the major current problems is how to control tea pests without causing the disruption of the ecosystem and related environmental problems. One method of reducing the use of insecticides and of conserving the natural enemies is to employ regular monitoring of the numbers of tea pest. This may be done by periodic assessment using sequential sampling or other methods. Insecticides are then applied only when pest damage exceeds the established threshold level which may vary with different situations. Monitoring of populations of the natural enemies of the tea pests is also important and can also be done by sequential sampling. The sticky suction trap was one of the most efficient collector of Hymenopterous parasites in tea field. The sticky suction trap was also the most efficient collector of thrips and male of scale insects.

From the result of monitoring, it is to be noticed that the occurrence period of the parasite species is synchronized with their host occurrence and there are few differences in parasite fauna in the tea fields.

From the practical point of view, the following line of research has been recommended: For the integrated control of tea pests, the protection of the domestic parasites should be given more attention, because of their important role. For example, it is an urgent problem to find out the right time of chemical application for the maximum effect in insect pest control with minimum effect on parasites. There is not much chance for an efficient integrated control system if suitable chemicals are not available. As an example of a selective insecticide, it has been found that microbial insecticide, while controlling smaller tea tortrix and tea tortrix, is not harmful to parasitic Hymenoptera.

On the basis of this study it is concluded that the monitoring of Hymenopterous parasites by the sticky suction trap may be usefull for the study of pest management.

Reference

1) Takagi, K.: Monitoring of Hymenopterous parasite in tea field. *Bull. Natl. Res. Inst. Tea.*, **10**, 91–131 (1973) [In Japanese with English summary].