SHORT COMMUNICATIONS

Seasonal Changes of Oviposition-Grass Preference in a Migrant Skipper

Parnara guttata guttata

(Lepidoptera: Hesperiidae)¹

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The rice skipper Parnara guttata guttata Bremer et Grey migrates every autumn in central and western Japan. Nakasuji (1986) has proposed a “habitat and/or host plant change hypothesis” as one possible explanation of the ecological significance of the migration. An apparent change in habitat and/or host grass actually occurs before and after the migration, i.e., annual grasses like rice plant Oryza sativa grow in wet lowland in the breeding seasons and perennial grasses like cogon grass Imperata cylindrica grow in dry uplands in overwintering seasons (Nakasuji, 1982). Masuza wa et al. (1983) reported that females of the 1st generation in summer strongly preferred a wet habitat to a dry one for egg laying when rice plants were growing in both habitats. In addition, when rice plant and cogon grass were growing in the same habitat, the females laid more eggs on the former than on the latter. However, females of the 2nd generation in autumn tended to lay eggs on various grasses, irrespective of habitat (Hiura, 1982).

To determine the physiological mechanism of habitat selection and/or host grass change, we compared the oviposition-grass preference between females of the 1st and 2nd generations.

Thirteen female adults of the 1st generation and 16 females of the 2nd were collected from fields. The females were marked individually and fed on a 10% honey solution in separate plastic cages (30×40×55 cm). Nishida (1977) proposed a simple method to test the oviposition stimulant of butterflies and this method was adopted here. Fresh leaves of rice plant or cogon grass (10 g) were soaked in 100 ml methanol for 24 hr. After filtration, the crude extracts of 0.1 g leaf equivalent solution were used for the oviposition bioassay. Each extract (approximately 0.1 ml) was applied to a one-sixth section of a piece of filter paper (9 cm in diameter, Toyo Filter Paper, No. 2) and allowed to dry. The filter papers were misted with distilled water just before bioassay.

When the filter paper treated with an oviposition stimulant was brought in contact with the foreleg tarsi of a gravid female, she curled her abdomen and eventually laid eggs on the paper. Three kinds of response were discriminated as follows: non-response, positive response (curling abdomen) without oviposition, and oviposition within one minute. Bioassay was always conducted in the

<table>
<thead>
<tr>
<th>Response</th>
<th>1st generation</th>
<th></th>
<th>2nd generation</th>
<th></th>
<th>χ²-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rice plant</td>
<td>Cogon grass</td>
<td>Blanka</td>
<td>Rice plant</td>
<td>Cogon grass</td>
</tr>
<tr>
<td>Oviposition</td>
<td>25</td>
<td>6</td>
<td>4</td>
<td>88</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>(16)</td>
<td>(2)</td>
<td>(0)</td>
<td>(7)</td>
<td>(17)</td>
</tr>
<tr>
<td>Positive response</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>without oviposition</td>
<td>9</td>
<td>4</td>
<td>10</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Non-response</td>
<td>22</td>
<td>46</td>
<td>98</td>
<td>38</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>56</td>
<td>112</td>
<td>135</td>
<td>135</td>
</tr>
</tbody>
</table>

a The number of blank tests was double those with rice plant and cogon grass.

b Frequency of the first oviposition each day.

order of blank paper (B), cogon grass (I), blank (B) and rice plant (O) at the room temperature of 25°C. Each isolated female was used for bioassay three to six times a day. The test was conducted on each of three consecutive days.

The results are shown in Table 1. The frequency of oviposition response shows that the females of the 1st generation greatly preferred the rice plant extract to the cogon grass extract or blank paper. Females of the 2nd generation also responded more to the rice plant extract than to the cogon grass extract or blank paper, however, the difference in the frequency of oviposition between the two extracts was considerably less. The females of the 2nd generation often laid eggs even on the blank filter paper. The frequency distribution of the response to each extract and blank was significantly different between the two generations \((p<0.005)\). The positive response without oviposition to the rice plant extract did not exceed the response to the cogon grass extract or the blank, especially in the 2nd generation, and \(\chi^2\)-test showed the response similar in the two generations.

Figure 1 shows the pattern of oviposition response of six randomly chosen individuals from each generation. The oviposition of females in the 1st generation seemed to be more restricted to rice plant extract, but the preference in the 2nd generation was rather ambiguous. Some individuals, e.g., no. 4 of the 1st generation and nos. 1, 2 and 4 of the 2nd tended to lay eggs continually irrespec-

tive of source once they had begun. Therefore, the stimulant chosen at the first oviposition seemed to show the true preference. The first oviposition preference in each test is also presented in Table 1 (in parentheses). The difference in frequency distribution between the two generations is more apparent than that in the total response of oviposition. Most females of the 1st generation laid eggs on the filter paper treated with the rice plant extract as their first choice, whereas those of the 2nd generation rather preferred the cogon grass extract to the rice plant extract or the blank, and some laid eggs even on the blank filter paper \((p<0.001)\).

It is often observed in the fields that females of the 2nd generation lay eggs not only on various grasses but also on non-host weeds and even on the ground surface \((HIURA, 1982)\). The unrestricted host preference of the 2nd generation females as shown in the present study confirms this aberrant behavior and their tendency to lay eggs on leaves of dry upland grasses such as cogon grass and eulalia Miscanthus sinensis rather than on those of wet lowland grasses such as rice plant and barnyard grass Echinochloa Crus-gali \((NAKASUJI, 1982)\). The latter grasses usually wither in winter in temperate areas. The leaves of the former are generally tougher for the larvae of the skipper to digest than those of the latter. In order for offspring to survive when food is low procurable in winter, females of the 2nd generation lay larger-sized eggs than those of the overwintering and 1st generations \((NAKASUJI and KIMURA, 1984)\). The change of host grass preference of the females might induce this seasonal polymorphism of egg size.

This species also exhibits other seasonal polymorphic traits, i.e., in adult morphology \((ISHII and HIDAKA, 1979)\), oviposition characteristics and flight activity \((ONO and NAKASUJI, 1980)\). As discussed in NAKASUJI and KIMURA (1984), all of these traits are considered to have evolved in relation to its migratory behavior.

REFERENCES


Toxicity of Pesticides Commonly Used in Japanese Apple Orchards to the Predatory Mite Typhlodromus pyri Scheuten (Acari: Phytoseiidae) from New Zealand

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Integrated mite control programs have been established in many fruit growing regions overseas (CROFT, 1975; HOYT, 1969; WEARING et al., 1978). Their success in providing an effective and less costly control of mites has largely been the result of the widespread development of resistance to pesticides in predatory mite species. In New Zealand, for instance, a strain of Typhlodromus pyri Scheuten resistant to azinphos-methyl was first found at Nelson in 1967. The distribution and resistance of this strain has increased since that time and with it its potential for use in an integrated mite control program (WEARING et al., 1978). Two other species, T. occidentalis NESBITT and Amblyseius fallacis GARMAN, have also been evaluated in commercial orchards (THOMAS and CHAPMAN, 1978). Both of them originated from the United States and are resistant to azinphos-methyl to varying degrees.

In Japan, as no predators resistant to pesticides have been recovered in apple orchards, mite control has relied solely on miticide application. Should resistant predatory mites be introduced to Japan in order to establish an integrated control system, it would be desirable to check all pesticides in advance so that applications for the control of other pests and diseases could be replaced if necessary to improve the survival chance of the predatory mites.

While studying at Entomology Division, DSIR, Auckland, I investigated the toxicity of pesticides which are commonly used in the apple orchards of Japan. As it is the most important phytoseiid predator on pipfruit in New Zealand, T. pyri was chosen for the present tests.

MATERIALS AND METHODS

The predatory mite, T. pyri, was collected on the DSIR Appleby Research Orchard in Nelson. Whole leaves infested by predator and prey were air-freighted in polyethylene bags to Entomology Division, DSIR, Auckland, for testing once a week from December 20, 1984 to January 29, 1985. The test was performed within a few days of the mites arrival, and only vigorous active females were selected. As the number of live predators recovered varied considerably depending on the time of collection, the number of pesticides tested in a day varied accordingly.

Depending on availability, 10 to 20 adult females were stuck on their backs on double-sided adhesive tape attached to a microscope slide. Each slide was dipped for five seconds in a prepared suspension of one of the pesticides. All pesticides tested were wettable powder formulations and they were diluted according to the Aomori prefectural standard spray programs. After treatment the slides were air-dried for 15 min to remove excess liquid, and then they were held for 24 hr at 28°C and 80% RH. Mortality was assessed by examination under a stereoscopic microscope. Mites which failed to move their appendages when touched by a fine brush were counted as dead.

Each test was replicated four or five times on different days. The percentage mortality for each sample was corrected by Aomori’s formula using the result of untreated control carried out on each treatment date.

RESULTS AND DISCUSSION

Average percentage mortalities are presented in Table 1, with the dilutions of the pesticides and the

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