Effects of Food Plants of the First Generation Nymph on the Growth and Reproduction of *Lygus disponsi* LINNAVUORI (Hemiptera, Miridae) [1) 2)]

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Summary

The nymphs of *Lygus disponsi* could reach the adult stage when fed any one of shepherd's purse, wheat, alfalfa and sugar beet, but the mortality was very high in the case of sugar beet. The nymphal period was shorter when fed sheperd's purse or wheat than the case of alfalfa or sugar beet, while the number of eggs laid by adults developing from the nymphs was significantly fewer in the group fed wheat than in the groups fed shepherd's purse or alfalfa. The difference in the food plant of the first generation nymph did not affect the growth of the second generation nymph in the case of shepherd's purse, wheat and alfalfa.

Introduction

The bug *Lygus disponsi* LINNAVUORI (Hemiptera, Miridae) is an insect pest which injures sugar beet plants causing leaf malformations (HORI 1967; HORI, 1971 a). Its main food is cruciferous plants (HORI and HANADA, 1970; HORI, 1971 b), but the first generation nymphs are sometimes found on wheat, red clover, alfalfa and sugar beet in the field and the adults often suck plant sap from flower buds of various plants. When the hibernating adults cannot find the main food plants, they may oviposit on plants other than cruciferous plants. Then nymphs which hatched from the eggs may feed on the plants and, if the plants are crops, they may turn into a serious insect pest. It has not been investigated how such substitutional foods influence the life of the bug. In the present study, effects of food plants of the first generation nymph on the growth of the first- and second-generation nymphs and on the fertility of the first generation adult were investigated. A similar investigation on heteropteran insects is found only in the work of AI-MUNSHI *et al.* (1982)

Materials and Methods

Insects used. Hibernating adults were collected in the field and were put into petri-dishes (3.5cm in diameter and 6.0cm in height), in which several pieces of cruciferous plants were

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placed for feeding and oviposition. Nymphs which hatched from the eggs laid were used for the rearing experiments.

Rearing experiments. First generation nymphs were divided into 5 groups each with 30 bugs. The nymphs of each group were reared individually in a plastic petri dish (4 cm in diameter) in natural daylight and at room temperature, being fed respectively flower parts of shepherd's purse, ears of wheat, new leaves of sugar beet, flower parts of alfalfa, and undeveloped leaves of mugwort. The food plant was replaced every day. In order to prevent the nymphs from drying, 0.1 ml of distilled water was added to a sheet of filter paper laid at the bottom of petri-dish once a day. The instar and death of the nymphs were recorded daily.

First generation females and meles (adult) which developed from the nymphs of each group were placed in a pair in plastic petri-dishes (8.5cm in diameter) with a sheet of filter paper at the bottom and fed seed pods of rape. The food plant was replaced and 0.3ml of distilled water was added to the filter paper every day. The numbers of surviving bugs and of the eggs laid were recorded.

Second generation nymphs which hatched from the eggs were placed in individual plastic petri-dishes (4cm) and fed flower buds or seed pods of rape. Each 30 bug of those 3 gorups which were reared respectively shepherd's purse, wheat and alfalfa in the first generation was used for the experiment. The number of surviving bugs belonging to the other 2 groups was zero so that they dropped out of use in further investigation. The food was replaced and 0.1ml of distilled water was added to the filter paper every day. The death and instar of the nymphs were recorded.

The second generation adults were reared by the same method as used in the first generation. The logevity was recorded.

Results and Discussion

Effects of food plants on growth of first generation nymphs

Table 1 shows the survival rate of the bugs fed different food plants at the end of each instar (or at the beginning of following instar). Nymphs fed mugwort all died before the 3rd instar. The nymphs could survive up to the adult stage when fed shepherd's purse (84.6%), wheat (70.8%), alfalfa (52.4%) and sugar beet (14.0%), but, in the case of sugar beet, the mortality was very high in the 2nd instar.

As shown in Table 2, the nymphal period of the bug was significantly shorter in shepherd's

Table 1. Survival rate of first generation nymph of *L. disponsi* fed different food plnats.

Food plant (Group)	Survival rate (%)				
	Instar				
	Ist	2nd	3rd	4th	5th
Shepherd's purse	96.2	84.6	84.6	84.4	84.5
Mugwort	43.5	3.5	0	0	0
Sugar beet	48.1	22.2	22.2	22.2	14.8
Alfalfa	82.1	76.2	76.2	66.7	52.4
Wheat	88.9	80.8	76.0	70.8	70.8

Table 2. Nymphal period of first generation nymph of *L. disponsi* fed different food plants.

Food plant (Group)	Nymphal period (Day)					
	Instar					
	1st	2nd	3rd	4th	5th	Total
Shepherd's purse	6.6	5.7	4.6	4.6	6.1	27.6
Mugwort	9.4[b]	11.0[b]	–[a]	–	–	–
Sugar beet	10.1[b]	8.0[b]	7.5[b]	6.8[b]	6.8	39.2[b]
Alfalfa	8.5[b]	5.8	6.1[b]	6.9[b]	7.4[b]	34.7[b]
Wheat	7.0	5.6	4.9	4.8	6.8	29.1

[a] The nymphs could not reach the 3rd instar.
[b] The values were significantly different from those of shepherd's purse (control) at 1 % level (t-test).

purse group (27.6 days) and wheat group (29.1) than in alfalfa group (34.7) and sugar beet group (39.2). Moreover, the latters usually spent longer time in all instars than the formers.

It was confirmed that among the food plants used wheat (ear) was suitable for nymphal growth just like cruciferous plants. Alfalfa (flower part) also could support fairly well nymphal development. For nymphal growth in the field, therefore, these plants may be able to function as a substitute for cruciferous plants (main host). On the other hand, mugwort seems not to be used as a food by the nymphs and sugar beet may not satisfactorily serve as a substitutive plant for nymphal growth, though they invade in the sugar beet field from neighbouring fields owing to their overpopulation and attack the plant.

Effects of food plants in nymphal period of first generation on fertility and longevity of first generation adults

Table 3 shows the longevity of the first generation adults which had been fed different food plants during the nymphal period. Adults of all groups were supplied with the same food (seed pods of rape). Adults of wheat group tended to be shorter in the longevity than the others, but there was no statistically significant difference.

Table 3. Longevity of first generation adult of *L. disponsi* when nymphs in first generation were fed different food plants.

Food plant (Group)	Number of bugs tested	Mean longevity (Day)
Shepherd's purse	19	19.3
Sugar beet	4	19.0
Alfalfa	11	20.4
Wheat	16	16.7

As shown in Table 4, the pre-oviposition time tended to be longer in adults of sugar beet and wheat groups than in those of shepherd's purse and alfalfa groups (but with no statistically significant difference between them). The egg period was not much different among the groups. The egg production was the largest in adults of shepherd's purse group, followed by alfalfa group, wheat group and sugar beet group in order. There was a statistically significant difference between the former two groups and the wheat group.

It was found in the present study that wheat suitable for the growth of the nymphs did not prove to be suitable as well for the fertility of the adults (fed seed pods of rape) developing from the nymphs. This reason is not clear and left for future investigation.

Effects of food plants in nymphal period of

Table 4. Number of eggs laid, pre-oviposition time, egg period of first generation adult of *L. disponsi* when first generation nymphs were fed different food plants.

Food plant	Number of bugs tested	Pre-oviposition time (Day)	Egg period (Day)	Number of eggs laid/ bug/day	Total number of eggs laid/ bug
Shepherd's purse	10	9.7	7.8	3.3	100.6
Sugar beet	2	16.0	—[a]	0.6	32.0
Alfalfa	6	9.2	8.4	2.6	72.2
Wheat	8	13.3	8.7	1.0[b]	41.3[b]

[a] The eggs laid never hatched.
[b] The values were significantly different from those of shepherd's purse (control) at 5% level (t-test).

first generation on growth of second generation numphs

Table 5 shows the survival rate of the second generation bugs originating from three groups (fed shepherd's purse, alfalfa or wheat in the first generation). All bugs of the second generation were provided with the same food plant (seed pods of rape). No statistically significant difference was found in the survival rate among the three groups. As shown in Table 6, the nymphal period was not different among the three groups (13.9 days for shepherd's purse, 13.2 for alfalfa and 13.4 for wheat). These results suggest that the growth of the second generation nymph is not affected by the difference of food in the first generation nymph. The longevity of the second generation adults also seems not to be affected by the difference (Table 7), because no statistically significant difference was found for the longevity among the three groups.

Table 5. Survival rate of second generation nymph of *L. disponsi* when first generation nymphs were fed different food plants

Food plant (Group)	Survival rate (%)				
	Instar				
	1st	2nd	3rd	4th	5th
Shepherd's purse	89.3	89.3	89.3	82.1	82.1
Alfalfa	89.7	89.7	89.3	82.1	82.1
Wheat	90.0	90.0	90.0	80.0	75.0

Table 6. Nymphal period of second generation of *L. dispinsi* when first generation nymphs were fed different food plants

Food plant (Group)	Nymphal period (Day)					
	Instar					
	1st	2nd	3rd	4th	5th	Total
Shepherd's purse	3.8	2.2	1.9	2.4	5.8	13.9
Alfalfa	3.4	1.9	2.3	2.3	3.4	13.2
Wheat	3.5	1.9	1.9	2.4	3.6	13.4

Table 7. Longevity of second generation adult of *L. disponsi* when first generation nymphs were fed different food plants

Food plant (Group)	Number of bugs tested	Longevity (Day)
Shepherd's purse	22	14.0
Alfalfa	22	18.0
Wheat	21	12.9

Al-Munshi *et al.* (1982) investigated the effect of switching hosts on the longevity and fertility of *Lygus hesperus* and suggested that the effect could be carried over into the next generation. In the present study, it was found that wheat was a food plant suitable for the nymphal growth but not for the fertility of the adults grown from the nymphs fed wheat, whereas alfalfa was not such a suitable food plant for the nymphal growth as wheat and shepherd's purse but was a host plant suitable for the fertility of the adults which developed from the nymphs. This suggests that the difference of food plant in the first generation may have a great effect on the population density in the following generation of *L. disponsi* in the field, though the effect of host-switching will not be carried over into the next generation.

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マキバメクラガメの生育と繁殖に及ぼす第一世代幼虫の食草の影響

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摘　　要

マキバメクラガメの幼虫は食物としてナズナ，小麦，アルファルファあるいはてん菜を与えると成虫まで生育した。ただしてん菜の場合，死亡率が非常に高かった。幼虫期はナズナや小麦を与えたグループで，アルファルファやてん菜グループでより短かった。一方，それらの幼虫から生育した成虫の産卵数はナズナやアルファルファグループよりも，小麦グループで有意に少なかった。第一世代幼虫の食物の違いは第二世代幼虫の生育に影響しなかった。

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