

Preliminary Investigation on Ovipositional and Food Selection of *Palomena angulosa* MOTSCHULSKY (Hemiptera: Pentatomidae) in the Laboratory¹⁾

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Summary

The adult females of *Palomena angulosa* MOTSCHULSKY (Hemiptera: Pentatomidae) preferred hogweed and lilac leaves to the other plants tested as ovipositional sites, while they had no particular choice to wheat with ears and kidney bean fruits, although they were good foods for nymphal growth. Their vivid interest for oviposition was directed to artificial leaves made of filter paper.

The 2nd to 5th instar nymphs could select food plants suitable for their development: wheat ears, kidney bean fruits and hogweed fruits. Their choice for foods changed among instars and sometimes even within an instar.

Introduction

Palomena angulosa MOTSCHULSKY (Hemiptera: Pentatomidae) is known as a polyphagous insect which feeds on various plants and plant parts (KOBAYASHI, 1959; HASEGAWA, 1958, 1960; KAWASAWA and KAWAMURA, 1977) and as an insect pest which often invades crop fields to injure crop plants. KUGELBERG (1977a) reported that females of a seed-feeding bug *Lygaeus equestris* often laid their eggs on places so far from possible food plants for their offsprings that the nymphs were faced with difficulty in reaching their food plants. Therefore, the bugs must adapt in various manners for keeping pace with food resource

both in time and in distribution: polyphagous habit, synchronization of life cycle with food occurrence, and well-developed food-localizing ability (KUGELBERG, 1977b). *P. angulosa* is similar to this lygaeid bug: in many cases, nymphal *P. angulosa* seems to have to grow by selecting and alternating food plants from one to another in the field. In the present study, we investigated the adult ability for ovipositional selection and the nymphal ability for food selection in the laboratory to learn the life history strategy of *P. angulosa* in the field.

Materials and Methods

Insects used. Field-collected adults after

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hibernation were used for ovipositional selection test. Eggs laid by them in rearing cages were removed into petri-dishes with a sheet of filter paper at the bottom and kept until hatching under room condition. The first instar nymphs which hatched from the eggs were kept there without food until they developed to the 2nd instar. Nymphs were then reared with kidney beans. Nymphs from the 2nd to the 5th instar and the 1st-generation adults were used for food selection test.

Plants used for selection test. For ovipositional selection test, the following eight plants and an artificial leaf were used; (1) hogweed with leaves and flowers, (2) wheat with leaves and ears, (3) wheat with leaves alone, (4) wheat with ears alone, (5) kidney bean fruits, (6) alfalfa with leaves, (7) lilac with leaves, (8) sugar beet leaves, and (9) artificial leaves made of a sheet of filter paper imitating leaf of hogweed.

For food selection test, the following six plants were used; (1) kidney bean fruits, (2) wheat ears which had been kept in a refrigerator for the 2nd to 4th instar nymphs, and wheat ears which had been stored in a freezer for the 5th instar nymphs and adults, (3) sunflower peeled seeds, (4) stems, flowers and buds of potato plants, (5) young fruits of hogweed which had been kept in a refrigerator, and (6) flower parts of alfalfa.

Ovipositional selection test. Double choice method was used for the test: For example, wheat plants and alfalfa plants were pushed into two Erlenmeyer flasks (50 ml) with water and diagonally placed in a glass cage (24 cm in height, 18 cm in diameter) capped with a mesh. Ten females and four males were put in the test container, which was kept in an incubator set at 25°C and in the dark. The number of eggs laid was recorded at 16:00 every day. The test was repeated more than 5 times.

Food selection test. Double choice method was used for the test. A plastic petri-dish with a sheet of filter paper at the bottom was partitioned into four parts equal. One experimental plant was spread all over two opposite parts and the other all over the remaining two parts. Plastic petri-dishes 8.5 cm in diameter and 1.5 cm in height were used for the 2nd (20 bugs/dish), 3rd (10 bugs) and 4th instar nymphs (10 bugs), and those 15 cm in diameter and 7 cm in height were used for the 5th instar nymphs (5 bugs) and adults (5 bugs). The petri-dishes were kept in an incubator set at 20°C and in the dark. The number of bugs settling and feeding on each plant was recorded at 16:00 every day. Bugs inserting their stylets in plant tissue were regarded as "feeding". The test was repeated 10 times.

Results and Discussion

Ovipositional selection test

As shown in Table 1, the adult females preferred hogweed and lilac leaves to the other plants as ovipositional sites. Alfalfa tended to be preferred to wheat, though there was no statistically significant difference between them. The females had no particular choice to wheat with ears or kidney bean fruits, which are good food for nymphal growth. Fruits of hogweed and lilac are suitable foods for the nymphs, but it is questionable whether the females oviposited on the leaves by responding to some chemical stimulant (s) in the leaves or whether they recognized the plants as hosts for nymphal development, because the bugs laid their eggs rather willingly on the cages than the plants and took considerable interest in artificial leaves made of filter paper. On an average, 63.5% of eggs laid was on the parts other than plants (Table 2). It was inferred in the present laboratory experiment that the females selected ovipositional sites of physical rather than chemical nature. It is not clear if

Table 1. Number and percentage of eggs laid by *P. angulosa* on several different plants (in double choice test)

Plant group	Eggs laid	
	Number	%
Hogweed	249 ^a	60.1
Wheat	0 ^{ab}	0
Other places	165 ^b	39.9
Hogweed	290 ^a	39.8
Kidney bean	0 ^{ab}	0
Other places	438 ^b	60.2
Hogweed	117 ^a	36.0
Alfalfa	60 ^a	18.5
Other places	148 ^a	45.5
Wheat ear	0 ^a	0
Wheat leaf	59 ^a	14.1
Other places	360 ^a	85.9
Wheat	51 ^a	8.3
Alfalfa	107 ^b	17.3
Other places	459 ^{ab}	74.3
Wheat	38 ^{ab}	10.1
Lilac	146 ^a	38.8
Other places	192 ^b	51.1
Wheat	33 ^a	10.1
Sugar beet plant	28 ^b	12.0
Other places	215 ^{ab}	77.9
Hogweed	0 ^a	0
Artificial leaf	57 ^{ab}	80.3
Other places	14 ^b	19.7

^{a, b}Figures followed by the same letters in each group are significantly different at 5% level of *t*-test.

Table 2. Number and percentage of eggs laid by *P. angulosa* on plants and other places including artificial leaf

Place	Eggs laid	
	Number	%
Plant	1178	36.5
Other places	2048	63.5

this is also the case in the field, but the ovipositional selection of *P. angulosa* seems to be not so strict in nature, because they were often

found to lay eggs on walls of houses, firewood, withered trees, trunks of willow trees and sugar beet leaves.

Food selection test

The results are shown in Table 3. The 2nd instar nymphs were fonder of feeding on wheat ears and kidney bean fruits than on sunflower seeds, alfalfa flowers, potato leaves and stems, and hogweed fruits. Also in the 3rd instar, significantly high percentage of the nymphs selected wheat ears and kidney bean fruits for their food. When supplied with sunflower seeds and alfalfa flowers, a significantly large number of the nymphs preferred alfalfa for feeding. They preferred wheat ears to hogweed fruits in the early stage of 3rd instar, but tended to interchange their choice later. The 4th instar nymphs again fed more willingly on wheat ears and kidney bean fruits than other food plants except sunflower seeds on which they fed as well as on the former two foods. In the 5th instar, the choice of the nymphs changed greatly: (1) When supplied with wheat ears and kidney bean fruits, significantly large number of the nymphs selected the latter for their food. (2) There was no significant difference in the choice between wheat ears and potato plants and between wheat ears and sunflower seeds. (3) In the late stage of the 5th instar, the nymphs were fonder of feeding on hogweed fruits than on wheat ears. That is, on an average, the nymphs liked best both kidney bean and hogweed fruits, being followed by wheat ears and sunflower seeds. Few adults fed on plant food supplied.

In the present study, it was found that the nymphs from the 2nd to 5th instar could select food plants suitable for their growth; they can complete the nymphal stage by feeding on wheat ear, kidney bean and hogweed fruits (HORI et al., 1985). Such selection ability of the nymphs may be important for their life in

Table 3. Percentage of *P. angulosa* feeding on different two plants in double choice test

Plant group	Nymphal stage				Adult		
	2nd	3rd	4th	5th			
Kidney bean	32.2	25.9	11.4	38.0 ^a	45.0		
Wheat	35.1	30.5	36.4	6.0	5.0		
Non-feeding	32.7	43.6	52.2	56.0	50.0		
Kidney bean	46.5 ^b	75.7 ^a	42.0 ^a	26.5 ^a	15.0		
Potato plant	9.9	6.6	8.0	6.1	0		
Non-feeding	43.6	17.7	50.0	67.4	85.0		
Kidney bean	38.0 ^a	39.4 ^a	20.2	44.0 ^a	15.0		
Sunflower	18.0	11.2	15.5	14.0	15.0		
Non-feeding	44.0	49.4	64.3	42.0	70.0		
Wheat	55.4 ^a	45.2 ^b	47.5 ^a	18.4	0		
Potato plant	9.5	26.1	7.5	8.2	5.0		
Non-feeding	35.1	28.7	45.0	73.4	95.0		
Wheat	48.1 ^a	40.3 ^a	23.1	18.0	15.0		
Sunflower	16.2	16.8	29.3	14.0	15.0		
Non-feeding	35.7	42.9	47.6	68.0	70.0		
Wheat	49.2 ^b	41.0 ^a	44.2 ^a	44.9 ^a	0		
Alfalfa	14.2	17.9	4.7	2.0	0		
Non-feeding	36.6	41.1	51.1	53.1	100		
Wheat ^c	40.7 ^b	54.1 ^b	15.2	41.0 ^a	16.0	4.0 ^a	10.0
Hogweed	27.6	19.4	37.4	15.4	12.0	56.0	30.0
Non-feeding	31.7	26.5	47.4	43.6	72.0	40.0	60.0
Potato plant	34.7	28.7	13.8	8.0	8.0	5.0	
Alfalfa	27.5	33.3	8.5	2.0	2.0	0	
Non-feeding	37.8	38.0	77.7	90.0	90.0	95.0	
Sunflower	22.2	18.1 ^a	25.6	25.6	25.6	0	
Alfalfa	28.1	42.2	23.2	8.0	8.0	0	
Non-feeding	49.7	39.7	51.2	78.0	78.0	100	

^a Significantly different between two plants at 1% level of *t*-test.

^b Significantly different between two plants at 5% level of *t*-test.

^c In the group of wheat and hogweed, the 3rd and 5th instar were divided into two stages, early and late.

the field, because ovipositional selection of the adult females seems to be random. The present investigation indicated that their choice for foods changed among instars and sometimes even within an instar. This may be due to exogenous (difference in food quality supplied) and/ or endogenous factors (difference in the physiological state of nymphs).

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室内におけるエゾアオカメムシの産卵
および食物選択に関する予備研究

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摘 要

エゾアオカメムシの雌成虫は試験された植物の中で、ライラックとハナウドの葉に好んで産卵したが、幼虫生育により食物である小麦(穂を含む)やインゲンマメの種子莢にはあまり産卵しなかった。また産卵場所としてろ紙で作った人工葉を好んで選んだ。

幼虫(2齢から5齢)は自分の生育に良い食餌植物を選んだ: 小麦の穂, インゲンマメの種子莢, ハナウドの種実。幼虫の食物選択は齢の間で, また時々一つの齢期内でさえ変化した。