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Ovipositional Preference of *Heliothis zea* (Hubn.) on Glabrous and Dense Soybean Genotypes

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ABSTRACT

Isogenic lines of 'Clark' and 'Harosoy' soybean varieties of differing pubescent types glabrous and dense, were utilized in studies to determine whether significant quantitative differences could be shown in ovipositional preference characteristics by the corn ear worm, *Heliothis zea* (Hubn). The results of the study revealed that irrespective of the variety and pubescent type, the upper region of the soybean plant was the most preferred area for oviposition. Leaf surface received about seven times more eggs than the rest of the plant. Clark variety received significantly more eggs than Harosoy independent of the pubescent type.

INTRODUCTION

In recent years there are numerous reports concerning the seriousness of the corn ear worm *Heliothis zea* (Hubn) as a pest of soybeans. Not only is this pest dangerous to the soybean crop, it was also predicted by Freeman et *al.* (1967) that due to the reduction of preferred hosts such as cotton and corn, and the continuing maintenance of populations of *Heliothis zea* in the South on soybeans, an environment conducive to the development of a specific soybean biotype is provided.

Initial studies on the resistance of soybean genotypes to damage by the corn earworm were conducted to determine the ovipositional behaviour of *Heliothis zea* on soybeans. As a part of this broader research problem it was important to know where the moths preferred to lay eggs on the plant. Hence the study was conducted under green house conditions in the Oilseed Insects Research Laboratory at the University of Missouri, Columbia, U. S. A.

MATERIALS AND METHODS

Two isogenic pubescent types each in the 'Harosoy' and 'Clark' varieties of soybeans were used in the ovipositional studies. They were the glabrous type having no trichomes on the leaves or stems, and dense types having very numerous trichomes on both leaves and stems.

Potted soybean plants grown in the Entomology greenhouse were demarked into 3 regions, not on the basis of any linear measurement but on the basis of leaf maturity. These regions were designated the upper, the middle and the lower regions. The upper region comprised the apical trifoliate leaf and the three tri-foliates

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immediately below the apical leaf. These leaves were the most succulent compared with the leaves of the remaining two regions. The second region consisted of 2 to 3 tri-foliate leaves just below the upper region. The lower region comprised the remaining basal leaves of the plant.

A culture of *H. zea* was maintained in the laboratory. Upon emergence, 10 adult females and 20 male moths were placed in 1 gallon ice cream cartons and provided with a beer food source. Normally oviposition starts on the second complete night after emergence night and usually at least one oviposition period occurs each night for about 10 nights (Callahan, 1958).

Mated moths were collected from the laboratory culture on the third complete night of moth emergence and kept in separate one gallon ice cream cartons. The moths were kept in this dark cage for 6 to 8 hours without food. The moths were released at dusk inside a Saran R screen-covered-ovipositional-preference-cage which measured 2.28 meter long by 1.70 meter wide by 1.70 meter high. The cage was located in a greenhouse at temperatures of 80 ± 3°F and 60 ± 2% relative humidity. In addition to the leaves, other plant parts such as flower buds, stems and pods were also evaluated for insect ovipositional preference. The location of the test plants inside the cage was changed at random every evening to give an equal opportunity for the moths to oviposit and to avoid a position effect.

RESULTS AND DISCUSSION

Results of studies to determine whether ovipositional preference is shown by the corn earworm moth for specific areas of the plant showed a highly significant difference in ovipositional preference in these regions. The mean separation for upper, middle and lower regions of the plant showed significant differences from each other. The upper region received the maximum number of eggs followed by the middle and lower regions in discending order (Table I). This regional ovipositional preference was shown irrespective of variety or pubescent type. In the interaction of type by region, a Duncan's New Multiple Range Test showed that the dense pubescent leaves in the upper region received significantly more eggs than any other region of either dense or glabrous types. There was a highly significant difference between oviposition on the glabrous and on the dense types irrespective of variety.

The record of eggs deposited on leaves, flower buds, leaf buds, pods and stems is given (Table II). The Table shows that irrespective of the variety and pubescent type the leaf surfaces received about seven times more eggs than the rest of the plant parts. Oviposition on the leaves accounted for 85.3% of all eggs laid on the soybean pods. Following the leaves, leaf buds accounted for 8.9% of the eggs oviposited, flower buds 4.5% and stems 1.3% of the total eggs laid.

There was no significant difference in the number of eggs laid on plant

TABLE I. Analysis[1] of variance of the number of eggs deposited in three replications on leaf surfaces of the upper, middle and lower regions of soybean varieties.

Source of variance	Mean square	Mean value	F. value
Plant region	133.352	...	13.77**
Upper (U)	...	6.333	...
Middle (M)		4.113	...
Lower (L)		1.621	...
Leaf Surface	1.390	...	0.14 n. s.
Pubescent type × region	36.857	...	3.80*
Dense × U	...	9.178	...
Dense × M	...	5.928	...
Glabrous × U	...	3.487	...
Glabrous × M	...	2.299	...
Dense × L	...	1.999	...
Glabrous × L	...	1.243	...

[1] Data transformed by $\sqrt{X + 0.5}$

TABLE II Mean number of eggs deposited in three replications on leaf surfaces, flower buds, leaf buds, pods and stems of soybean varieties.

Plant parts	Harosoy variety		Clark variety		Total
	Glabrous	Dense	Glabrous	Dense	
Leaves	28.00	197.66	53.33	556.33	835.32
Flower buds	4.66	22.33	0.00	16.66	43.65
Leaf buds	0.00	18.66	2.33	66.66	87.65
Pods	0.00	0.00	0.00	0.00	0.00
Stems	0.00	0.00	1.33	11.33	12.66

parts other than the leaves (Table III). Considering the leaf surfaces the lower surface of 'Harosoy' and 'Clark' received eggs to the extent of 1.8 and 1.6 times the number on the upper surface respectively, but such difference could be statistically detected only in the case of Harosoy (Table IV).

TABLE III. Analysis[1] of variance of the number of eggs deposited in three replications on leaf surfaces, flower buds, leaf buds, pods and stems of soybean varieties.

Variable	Mean square	F. value
Flower buds	12.6251	3.608 n. s.
Leaf buds	35.1830	2.323 n. s.
Stems	2.0404	1.227 n. s.
Leaves	432.3180	7.980*

[1] Data transformed by $\sqrt{X + 0.5}$ * P = 0.05

The results of the ovipositional preference of corn earworm moths prefer the more pilose plants for egg laying. It is believed that not only tactile, but also proprioceptive chemotactic and visual factors undoubtedly play a part in directing the insects to the proper environment for oviposition. The ultimate forces working at close range and operating in the final recognition of preferred plants are largely chemical (Detheir, 1953). Our unpublished data on the chemical factors in glabrous and dense leaves of soybeans and the subsequent feeding earworm larvae confirm this.

TABLE IV. Mean number of eggs deposited in three replications on the upper and lower leaf surfaces of Harosoy and Clark varieties irrespective of the pubescent types utilized.

Leaf surface	Harosoy	Clark
Lower	18.00	34.00
Upper	10.00	21.00
'F' Value	8.2046**	1.2617 n. s.

** P = 0.01 n. s = not significant

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