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POPULATION FLUCTUATION OF *ZYGINIDIA QUYUMI* (AHMED) ON WHEAT IN PUNJAB-PAKISTAN*

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Zyginidia quyumi (Ahmed) is an important leafhopper part of wheat and maize in Pakistan (Ahmed & Jabbar, 1972). The species causes serious damage to the foliage of wheat in Punjab (Jabbar & Ahmed, 1975). Feeding of the leafhopper is directly proportional to the abundance of the species of plant *Z. quyumi* over winters in the Punjab in the egg stage, hatching starting in early February. The leafhopper population of the first generation is not very heavy on the crop. But in the 2nd and 3rd generations, the leafhoppers become extremely abundant and a serious threat to the crop. The present work was initiated to study the influence of the age of the crop, temperature and humidity on the leafhopper abundance.

Studies on the population of *Z. quyumi* on wheat were conducted at Tandlianwala, district Faisalabad. Population samples were collected as explained by Ahmed and Jabbar (1976). Five different locations around Tandliawala were selected for the collection of insects from wheat fields. From each location, six samples of insect populations were taken between 3 to 5 p.m. daily. Field temperature (°F), relative humidity, time and date, were also recorded with each population sample. Sampling was started on 9th February, when the first generation nymphs had not appeared. Samples were sorted and the results are presented in the present paper. Observations were stopped when the crop was ready for harvest, and no longer remained suitable for leafhopper feeding.

Observations and Results

Table 1 shows that population of *Z. quyumi* on wheat fluctuates in an irregular manner upto the beginning of March. Afterwards there is a considerable increase, a trend which is maintained till the crop nears the harvesting time. During this period *Z. quyumi* becomes highly abundant in the later half of April, indicat d by 14933 leafhopper caught from 18.IV to 27.IV. Such a high number of *Z. quyumi* feeding on the fol age of wheat can easily render serious damage to the yield of the crop. The fields which are harvested by the beginning of May are the usually early sown fields. The late sown fields are harvesetd late in May and suffer still more from the attack of leafhoppers. Of the total of different groups of leafhoppers collected during the wheat season, nearly 92% were *Z. quyumi* alone, an obviously dominating majority in the hoppers feeding on the crop.

Distribution by Temperature and Humidity

The field population of *Z. quyumi* on wheat remains very low during late winter up to the end of February, when the temperature is below 78°F. Soon after the temperature starts increasing steadily, and the catches of *Z. quyumi* also start increasing considerably (Table 1). Maximum number of leafhoppers collected at a temperature range of 84-88°F were 21420, which is the most prevalent temperature from the middle of March onward, as well as the most suitable for the life activities of the leafhoppers.

The relationship of *Z. quyumi* field population on wheat with humidity and temperature was studied during the wheat crop season of 1973 (Table 2).

TABLE 1. DISTRIBUTION OF *Z. QUYUMI* ON WHEAT BY TEMPERATURE AND CROP AGE AT TANDLIANWALA 1972

Date of collections	Temperature (°F) 59-63	64-68	69-73	74-78	79-83	84-88	88-93	Total
9.I-18.I	322							322
10.I-28.I	245							245
29.I-7.II	115							115
8.II-17.II	143							143
18.II-27.II		127	97					224
28.II-8.III		48	131					179
9.III-18.III			18	329	268			615
19.III-28.III					546	1610	841	2997
29.III-7.IV						6087		6087
8.IV-17.IV					1266	5596	1680	8542
18.IV-27.IV					3466	8127	3340	14933
28.IV-7.V							6022	6022
Total	825	175	246	329	5546	21420	11883	40424

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TABLE 2. DISTRIBUTION OF *Z. QUYUMI* ON WHEAT BY HUMIDITY AND TEMPERATURE AT TANDLIANWALA (1973)

Temperature °F	Humidity % 31-40	41-50	51-60	61-70	71-80	81-above	Total
64-68		25	1164	358	12	110	1669
69-73		39	356				395
74-78		112	1115	452			1679
79-83	905	2638	2969	1356			7868
84-88	2658	239	3270	1767		230	8164
89-above	1503	426	725		418		3072
Total	5066	3479	9599	3933	430	340	20847

Humidity in the wheat fields during the months of March and April ranged mostly from 41 to 70%. The maximum number of *Z. quyumi* specimens was collected at a combination of humidity range of 51-60% and temperature range of 84-88°F. Leafhoppers catches reduced at higher humidities. Lower humidities do not affect the leafhopper population adversly, if the temperature remains at 79°F or above.

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FIELD ASSESSMENT OF LOSSES IN THE YIELD OF WHEAT RESULTING FROM INSECT PESTS IN PAKISTAN *

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Contrary to the general impression that wheat in Pakistan remains safe from serious attack of insects, Ahmed and Jabbar (1972), and Yunus and Moosa (1971) observed that a leaf-hopper, *Zyginidia quyumi* becomes quite a serious pest of the crop in some parts of Pakistan. Yunus and Akram (1971) worked on the chemical control of the species in view of its economic significance. Ahmed *et al.* (1973, 1975) and Jabbar and Ahmed (1974) studied the biology, ecology and life history of *Z. quyumi* on wheat and maize. Jabbar and Ahmed (1975) stated that *Z. quyumi* is responsible for a large-scale destruction of foliage of wheat and maize. The present work was aimed at assessing losses rendered to wheat by *Z. quyumi* in particular and other insects in general in the typical wheat growing district of Faisalabad.

Materials and Methods

During the wheat season of 1972, two sets of experimental field areas were used, one at Tandlianwala and another at Faisalabad. The areas were divided into plots measuring 14′ × 8′ at Tandlianwala, and 11′ × 11′ at Faisalabad. Each plot was separated from the other by cropless strips of 1 ft., except that in the middle, there were 4 ft. wide strips separating equal numbers of plots in all blocks. The experimental plots at both places were surrounded by wheat fields. There were 36 plots at each location plus a row of 6 extra plots at Tandlianwala. The wheat plants were counted in each plot, both at Faisalabad and Tandlianwala. The plots were numbered serially. Insecticides A (Ethion), B (Phosvel), C (Metasystox), D (Sevin) and E (Disyston) were sprayed twice in the plots of wheat at the rate of 1, 1, 2, 1.5, and 20 lb. per acre respectively. F indicates fields which were not sprayed. The lating square design of spraying insecticides A to E, and leaving F as unsprayed, was adopted. Based on studies by Ahmed and Jabbar (1973), it was considered that two sprays will keep the population of leafhoppers and other insects fairly low, compared to the unsprayed fields, and help in assessing the effect upon the yield of crop. Wheat in each plot was separately harvested, thrashed and yield measured in kg.

The experimental design of large field plots of wheat consisted of 4 plots of ½ acre each. Each plot was divided into two halves of 1/4 acre each. In each plot of 1/4 acre, wheat was treated with

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insecticide to eliminate the insect pests including the leaf-hoppers. The other half (1/4 acre) was untreated. Conditions of watering, manuring, etc., were the same for each half of the plot. The yield of the treated and untreated halves was separately assessed at the end. The quantity of the insecticide per acre and frequency of treatment was the same as for smaller plots. The ratio between the commercial grade of insecticides and the water was kept 50 : 50. Disyston was, however, evenly spread with hand before watering.

Results and Discussion

Small Field Experiments. The average yields of treated and untreated plots have been shown for Tandlianwala and Faisalabad in Table 1. Although the number of plants per plot varied, yet there appears no significant difference in yield. This may be due to varying number of sprouts per plant and better nourishment due to less crowding.

It has been observed that in the experimental plots at Faisalabad, the highest yield of 5.51 kg. in sprayed plots was only 3.5% more than the yield in unsprayed plots. Similar results have also been shown by the experiment at Tandlianwala, where treatment B rendered a yield of 5.90 kg. as compared to 5.57, and 5.12 kg. in two sets of unsprayed plots. The variation is 5.6% and 13.2% respectivety.

Large Field Experiments. Large field experiments were conducted on wheat at Tandlianwala. The yield of wheat in each large plot was weighed after harvest, statistically analyzed, and has been presented in Table 2. Variation in the yield of treated and untreated fields is assumed mainly due to insects, particularly *Z. quyumi.*

Mean square error	= 480.54
Standard error per plot	= 21.92
Standard error treatment	= 10.96
Standard error difference	= 15.50
t*	= 3.51

TABLE 1. COMPARATIVE YIELD OF SMALL EXPERIMENTAL PLOTS.

Insecticide sprayed	Plots at Tandlianwala		Plots at Faisalabad	
	Average yield (kg.)	Average No. of plants/plot	Average yield (kg.)	Average No. of plants/plot
A. Ethion	5.53	941	5.42	1202
B. Phosvel	5.90	951	5.51	1212
C. Metasystox	5.76	1107	5.21	1611
D. Sevin	5.12	973	5.51	1213
E. Disyston	5.82	1070	5.43	1210
F. Unsprayed	5.57	981	5.32	1253
Unsprayed addition row	5.12	969	—	—

TABLE 2. LOSS PERCENTAGES IN UNTREATED LARGE PLOTS.

Experiment	Yield in treated plot (kg.)	Insecticide used	Yield in untreated plot (kg.)	Loss (kg.)	Loss (%)
1	161.42	Disyston	118.50	42.92	26.60
2	144.62	Phovel	116.63	27.99	19.40
3	216.47	Ethion	121.30	95.17	44.00
4	170.75	Metasystox	125.96	44.79	26.00
Mean	173.31		120.60	52.71	30.41

Total S. S.=8441.49 ; S. S. Treatment=5558.27 ; S. S. error=2883.22

TABLE 3. AVERAGE NUMBER OF VARIANCE FOR LARGE PLOTS.

S.V.	df.	S.S.	M.S.	F. calculated	F. theoretical
Treatment	1	5558.27	5558.27	11.57*	5.99
Error	6	2883.22	480.54		

The results show that insecticides exercise a significant effect on the yield as compared with control. All the treatments have been combined to show its difference from the untreated plots.

On the application of t-test it was found that the table value at 5% is 2.45 as compared to the calculated value of 3.51, which shows the significance of the treated and untreated plots.

The yield due to the feeding of insects was on the average 30.41%, but may have been as high as 44.00%. Because *Z. quyumi* dominates the insect fauna of wheat (Ahmed 1973), it is, therefore, assumed that a greater percentage of this loss is due to leaf-hoppers. The species, therefore, appears of high economic significance.

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