Greenhouse Studies on the Resistance of Corn and Barley Varieties to Survival of the Corn Leaf Aphid.[1]

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The corn leaf aphid, *Rhopalosiphum maidis* (Fitch), has been recognized as a serious insect pest of corn, sorghum and barley for many years. A recent outbreak in Indiana reported by Everly (1960), stimulated research on this insect.

Investigations on the control of this insect with insecticides has indicated several materials that will reduce infestations. However the difficulty in determining incipient outbreaks and the short period of time available for control applications after the infestations are exposed, limits the value of chemical control measures. In addition there is the probability that much of the injury to the corn plant occurs before the appearance of the tassels and exposure of the aphid infestation so that the value of insecticides for preventing loss of corn yield is still problematical.

A number of investigators have reported on the resistance of certain varieties of crops to this aphid. The earliest record of corn resistance was reported by Gernert (1917). McColloch (1921) reported the corn variety Minnesota 13 as very resistant to aphids. Snelling, *et al* (1940) reported on the resistance of crop varieties to the corn leaf aphid. Huber and Stringfield (1942) reported in detail on many inbred lines of corn and suggested a high correlation with the resistance of these lines to the European corn borer. Everly (1960) reported observations on differences in infestation among commercial corn hybrids and indications of tolerance to damage by the aphid.

Since the need for chemical controls is difficult to determine and timing is critical, resistance and tolerance of plant varieties to attack by the corn leaf aphid offers a continuous and easy way to avoid losses from aphid infestations.

All the earlier investigation and observations of aphid resistance by crop plants were made under heavy field infestations over a period of years. At the present time only few of the inbred lines of corn are rated on aphid resistance. There is a need for development of a method for infesting crop plants under controlled condition in early stages of growth, and before abnormal environmental conditions have influenced the physiology and development of the plants. This paper is a report of preliminary investigations on aphid infestations on seedling corn and barley plants in the greenhouse during the summer of 1961.

Methods and Materials

Corn tests. Seed of sixteen inbred lines of dent corn were obtained from Dr. A. M. Brunson of the U. S. D. A. and Dr. L. F. Bauman of the Purdue Department of Botany and Plant Pathology. These lines were in common use and/or were lines on which previous workers had reported aphid resistance or susceptibility. The seed of sorghum variety RS 610 used to build up aphid infestations for transfer to the corn varieties, was

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obtained from Dr. R. C. Pickett of the Purdue Department of Agronomy.

The experimental design consisted of six randomized replicate blocks. The inbred lines were planted in rows in greenhouse flats with a row of sorghum adjacent to each corn row. Each flat comprised five rows of sorghum and four rows of corn, with four flats making up a replicate.

The sorghum seed was planted first and when the plants had emerged the corn seed was planted. This allowed for sufficient time to build up aphid infestations on the sorghum before the corn had outgrown the seedling stage. The sorghum plants were infested and when sufficient build up of aphid populations had developed (about 10 days after infestations), the sorghum plants were cut off and laid in the rows. As these sorghum plants dried, the aphids migrated to adjoining corn plants. To insure infestation on all the corn the inbred lines of corn, two plants in each row of corn were manually infested with aphids. About a week after the corn plants were infested each plant was cut at the ground level and dissected and the aphids recorded as small and mature. A complete replicate was dissected each day.

Predators, particularly in flats near the open windows, were a factor in reducing the aphid infestations, and may have contributed to the high random variability of the corn tests.

Barley tests. Thirteen varieties of barley were obtained from Professor L. E. Compton of the U. S. D. A. and Purdue Department of Botany and Plant Pathology. These barley varieties along with sorghum RS 610 were planted in greenhouse flats with seven rows per flat, each row containing two entries. The flats were covered with cheesecloth to protect the germinating plants from bird damage. The cheesecloth covering also prevented random infestation by free aphids and reduced predator and parasite populations to a minimum. After germination the plants were thinned to six per half-row and infested with one mature aphid per plant. The following day the infestations were checked and plants with aphids missing were reinfested. A subsequent observation made two days later showed that some of the aphids were parasitized. These were removed and destroyed and replaced by other aphids. About two weeks later the barley plants were dissected and the small and mature aphids present on each plant were recorded.

Results

Corn. The data from the inbred lines of corn are shown in Table 1. Highly significant differences were shown for the numbers of small aphids per plant. Mature aphids and total aphids showed no significant differences. However the inbred alignment differs very little when based on immature aphids from that based on total aphids. Undoubtedly predators were an influence on this variability. In addition, the technque of migration from drying sorghum plants to the corn plants permitted any differences in attractiveness of the corn varieties to influence aphid migrations.

A comparison of these results with those reported by previous workers incidate a rather high degree of concurrence. Indiana WF9 was reported Snelling *et al* (1940), and Huber and Stringfield (1942) as highly susceptible under field conditions. In these test Indiana WF9 was the third most susceptible. Illinois A was reported as resistant in Illinois and Indiana [Walter and Brunson (1940)] and moderately susceptible in

Table 1—Populations of the corn leaf aphid developing on inbred lines of dent corn under greenhouse conditions. Lafayette, Indiana 1961.

Inbred Lines	Aphids Per Plant		
	Immature	Mature	Total
	No.	*No.*	*No.*
Oh 07	5.8	16.1	21.9
Os 420	6.9	12.0	18.9
WF 9	6.1	11.3	14.4
Oh 51	4.0	12.7	16.6
P 8	6.0	9.8	15.8
Oh 51A	4.5	11.1	15.6
Oh 43E	4.3	9.2	13.5
Ill. A	3.8	9.2	13.0
B 8	3.3	7.1	10.2
Oh 45	4.0	6.7	10.1
Oh 28	2.8	7.1	9.7
187 2	3.0	6.6	9.6
90	2.9	5.0	9.4
Hy	2.6	6.4	7.7
L 317	2.7	4.2	7.6
38 11	1.7	5.4	7.1
L S D 19:1	3.7	NS	NS
99:1	4.9	NS	NS

Ohio [Huber and Stringfield (1942)]. It has been intermediate in these tests. Ohio 51 was resistant in these tests and reported as resistant in one or more field tests. Data assembled by Painter (1951—table 9, p. 211) indicates that the consistency of field observations was high in some inbred lines and quite variable in others, which fact is supported by the data obtained in these tests. Iowa L317 was reported as resistant in Ohio and Pennsylvania (Huber *et al* 1948) and in hybrid combination in Illinos (Snelling *et al* 1940). In these tests it was the second most resistant. Indiana 38-11 was the most resistant in the greenhouse in these tests, but under field conditions tended to show susceptibility except in hybrid combinations in Illinois and Indiana [Snelling *et al.* (1940) and Walter & Brunson (1942). Illinois Hy was moderately resistant in Illinois [Snelling *et al* (1940)] as an inbred and moderately susceptible in Ohio [Huber and Stringfield (1942)]. In Pennsylvania [Huber *et al.* (1948)] it was relatively resistant. In these tests Illinois Hy was resistant.

From these comparisons it appears with refinement in techniques that further studies of seedling corn in the greenhouse offers a means of evaluating corn for aphid resistance.

Barley. The data obtained from the barley varieties are given in Table 2. An analysis of these data indicated highly significant differences among the varieties for all aphid categories. All varieties were less susceptible than Sorghum RS 610, although the higher populations on this crop might be due to morphological differences more favorable to aphid development and survival. Among the barley varieties Kenate CI 9570 was the most susceptible, having populations almost equal to those on the

Table 2—Populations of corn leaf aphids developing on varieties of barley and sorghum under greenhouse conditions. Lafayette, Indiana, 1961.

Varieties	Aphids Per Plant		
	Immature	Mature	Total
	No.	*No.*	*No.*
Sorghum			
RS610	12.7	14.5	27.7
Barley			
Kenate CI 9570	11.0	13.0	24.1
Hudson Sel 3	10.7	10.5	21.1
Dayton	9.7	9.2	18.4
Hard CI 6007	5.8	11.2	16.8
Kentucky #1	8.8	5.9	14.7
Meimi CI 5136	5.2	8.8	14.0
MoB 696 - 3	6.8	6.7	12.2
CI 9572 Decatur	5.2	6.2	11.4
MoB 475 CI 9168	4.6	3.5	7.4
Kearney CI 7580	3.5	4.0	7.1
Hooded 16 Sel 3323	4.0	4.6	6.6
Pictoo CI 5529	3.1	2.6	5.2
Utah Sel C 10,000	3.0	2.4	4.8
L S D 19:1	4.8	5.05	7.9
99:1	6.4	6.7	10.5

Sorghum. The most resistant variety was Utah Sel C 10,000. Based on total aphid count, MoB 475, CI 9168, Kearney CI 7580, Hooded 16 Sel 3323, and Pictoo CI 5529 were resistant to the corn leaf aphid. At the present time there is no information available as to the performance of these varieties under field conditions.

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