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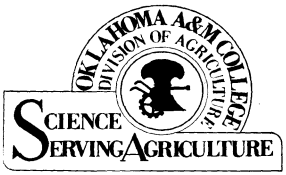


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**Oklahoma A. & M. College, Stillwater**
**and**
**Entomology and Field Crops Research Branches**
**U. S. DEPARTMENT OF AGRICULTURE**

# Reaction of Small-Grain Varieties and Hybrids To Greenbug Attack

By R. G. DAHMS, T. H. JOHNSTON
A. M. SCHLEHUBER, and E. A. WOOD, JR.*
Departments of Entomology and Agronomy

The greenbug [*Toxoptera graminum* (Rond.)] is one of the most serious pests of small grains in the Central and Southwestern States. It causes some damage every year, and several severe outbreaks have occurred. Since 1882, when it was first reported in the United States from Virginia, there have been 15 outbreaks, the most serious ones in 1907, 1942, 1950, and 1951. Each of these outbreaks caused a loss estimated at more than 50 million bushels of grain.

In recent years insecticides have been developed that will control the greenbug. However, this method of control is expensive and may not be practical in areas where yields are low because of drought, winter killing, or other hazards. Since control by cultural practices and by parasites and predators is not always dependable, it was necessary to seek a more satisfactory method. One of the most promising ones is the development of resistant varieties of small grains for areas that are frequently and heavily infested with the greenbug.

Although greenbug-resistant varieties of all small grains would be highly desirable, resistance in just one crop might greatly reduce the overall population. In some years heavy populations build up in the southern portion of the Great Plains during the winter and spread north early in the spring. Growing one or more resistant varieties in southern areas should therefore help protect susceptible crops growing further north.

In Oklahoma from 1947 to 1953 a study was made to find greenbug-resistant germ plasm for use in small-grain improvement. In the course of the work an effort was also made to obtain information on the inheritance of resistance.

## Review of Literature

Differences in reaction of plant varieties to insect attack have been recognized for more than a hundred years. Published records include information on resistance of nearly a hundred plant species to more than that number of insect species. Several reviews of the literature on insect resistance in plants have been issued and a thorough coverage of the field is presented by Painter (13).

* Dahms and Wood are entomologists of the Entomology Research Branch and Schlehuber is an agronomist of the Field Crops Research Branch, jointly employed by the U. S. Department of Agriculture and the Oklahoma Agricultural Experiment Station. Johnston is formerly an agronomist at the Oklahoma Station, now with the Field Crops Research Branch of the U. S. Department of Agriculture, stationed at Stuttgart, Ark.

Resistance of plants to aphids has been reported more frequently than that to any other group of insects. An outstanding example is the resistance of grapes to the grape phylloxera [*Phylloxera vitifoliae* (Fitch)], discussed by Bioletti *et al.* (3). Other plants resistant to aphids include apples to the wooly apple aphid [*Eriosoma lanigerum* (Hausm.)], Le Pelley (12); gooseberries to the gooseberry witchbroom aphid [*Myzus houghtonensis* now *Kakimia houghtonensis* (Troop)], De Long and Jones (6); corn to the corn leaf aphid [*Aphids maidis* (Fitch)], Snelling *et al.* (16), and the corn root aphid [*Anuraphis maidi-radicis* (Forbes)], Gernert (9); peas and alfalfa to the pea aphid [*Macrosiphum pisi* (Harris)], Searles (15) and Dahms and Painter (5); raspberry to the raspberry aphid [*Amphorophora rubi* (Kalt)], Huber and Schwartze (10); and cantaloupes and cotton to the cotton aphid [*Aphis gossypii* (Glov)], Ivanoff (11) and Dunnam and Clark (7).

Published data on the resistance of small-grain varieties to aphids have been confined to the greenbug. Patch (14) reported this aphid on 62 species of grasses (Gramineae), but observations on varietal resistance have been limited. Fenton and Fisher (8) noted differences in susceptibility to attack among oat varieties, Lee, Nortex, and Red Rustproof being more seriously damaged than Kanota, Coker Fulghum No. 4, or Columbia.

Walton (18), at the Southern Great Plains Field Station, Woodward, Okla., found a difference in the reaction of barley varieties to a greenbug infestation and also in their ability to recover from greenbug injury. However, he found no highly resistant barley varieties.

Atkins and Dahms (2) studied the reaction of several hundred varieties of wheat, barley, and oats to the greenbug outbreak of 1942 in nurseries at Denton and Chillicothe, Tex., and Lawton, Okla. The most resistant strains of wheat were selections from the cross Marquillo X Oro, which are resistant to the hessian fly [*Phytophaga destructor* (Say.)]. Denton, Early Blackhull, Wichita, and a few Chinese and Russian strains also showed some resistance. However, none of the wheat varieties tested appeared to have sufficient resistance to withstand heavy attacks. They found that several barley varieties, mostly from the Orient (chiefly China and Korea), showed high resistance to attack and were able to produce a crop when all surrounding varieties were killed. None of the oat varieties was highly resistant, although Fulwin and Tennex were somewhat less susceptible than Wintok.

Several workers have observed that greenbugs cause more injury in proportion to their numbers than do other grain aphids. Webster (19) noted the severe damage caused by small numbers of greenbugs, and indicated a belief that a pathological condition was associated with the aphid. Wadley (17) described the injury to oats and suggested that the reddening and discoloration of the plants was due to a chlorophyll-destroying enzyme that the greenbugs injected into the plant.

Chatters and Schlehuber (4) studied the mechanics of greenbug feeding and the difference in injury to plant cells of barley, oats, and wheat, and attempted to associate morphological plant characters with resistance or susceptibility. They found that greenbug damage varies from lysis in *Hordeum,* cell-wall modification in *Avena,* to a combination of lysis and cell-wall modification in *Triticum.* Greenbug stylets tend to enter tissues intercellularly and less frequently through the stomatal apparatus. The phloem appears to be the ultimate feeding site, and the injection

of saliva, rather than the intake of food, appears to be the primary cause of tissue damage. They found some evidence that resistance in barley was related to the thickness of the leaf and the length of the extended stylet. However, they stated that the evidence obtained was insufficient to substantiate such an hypothesis and concluded that resistance to greenbugs is probably physiological rather than morphological.

# Materials and Methods

## VARIETIES TESTED

Most of the tests for resistance to greenbugs were made with wheat, oats, and barley; however, some strains of rye, rye X wheat, and wheat X wheatgrass were included.

Since previous work [Atkins and Dahms (2)] had indicated that some barley varieties from the Orient appeared to be highly resistant to greenbugs, a special effort was made to test all available barley varieties that originated in that part of the world. However, the importance of testing the resistance of locally adapted and promising strains was not overlooked. Varieties that were known to be resistant to other insects, such as the hessian fly and chinch bug, also were tested. The world collection of small grains maintained by the Department of Agriculture's Field Crops Research Branch has been the source of supply for many varieties. Agronomists and plant breeders throughout the United States also have supplied seed.

Wheats from all sections of the world were tested. Special emphasis, however, was placed on Marquillo hybrids, Hope derivatives, and wheats of oriental origin. Locally adapted strains and varieties that showed some resistance to other insects, such as the hessian fly and the wheat stem sawfly, also were tested.

Oat varieties tested were primarily those of oriental origin and locally adapted strains.

Only common diploid varieties and one tetroploid variety of rye were tested.

Plants of otherwise susceptible commercial varieties of wheat, barley, and oats that survived heavy greenbug infestations in the field were selected and their progeny tested for resistance in the greenhouse.

In addition to the common bread wheat, *Triticum vulgare* Vill. *(T. aestivum* L.), other species of *Triticum* tested were *compactum, macha, spelta, vavilovi, durum, dicoccum, dicoccoides, persicum, polonicum, pyramidale, timopheevi, turgidum,* and *monococcum.* Some interspecific and intergeneric hybrids were also included.

The number of varieties of small grains tested for resistance to the greenbug from 1947 through 1953 are given in Table 1.

## SOURCE OF GREENBUGS

The greenbugs used for all the greenhouse tests were descendants from one greenbug collected near Stillwater in the fall of 1947. The cultures were compared frequently with greenbugs collected at random in Oklahoma, and no differences were noted in varietal reaction.

Cultures were propagated on Tenkow barley growing in 6-inch pots. Greenbugs usually were placed on the plants 10 to 14 days after seeding and were removed to uninfested plants as soon as a moderate amount of injury had occurred.

## GREENHOUSE TESTS

Resistance was determined in the greenhouse by separate tests for preference, tolerance, and fecundity. Greenhouse temperatures were regulated manually and usually ranged from 60° to 80° F.

For the preference and tolerance tests, varieties were planted in 6-inch pots. Eight varieties were planted in each pot, usually 7 of the test variety and 1 check, although sometimes there were 6 test and 2 check varieties. Three seeds of each variety were planted in rows radiating from the center of the pot. Generally 21 varieties were tested at a time with one check per pot, or 18 varieties with 2 checks. Thus, 3 pots were required for each replication. Six replications were planted, the varieties being randomized for each set. The planting design was, therefore, a form of randomized block with 3 pots constituting a block. The soil used was a Reinach sandy loam fairly high in organic matter, with physical properties suitable for greenhouse work. After the seed was planted, the pots were placed in a metal pan containing 2 to 3 inches of water and left until the moisture had reached the soil surface. This method of planting and watering prevented movement of the seed prior to germination, and usually excellent emergence was obtained within 4 to 6 days.

Three to four days after emergence the seedlings were thinned to 1 per row, or 8 per pot. An effort was made to select uniformly vigorous seedlings, and at the

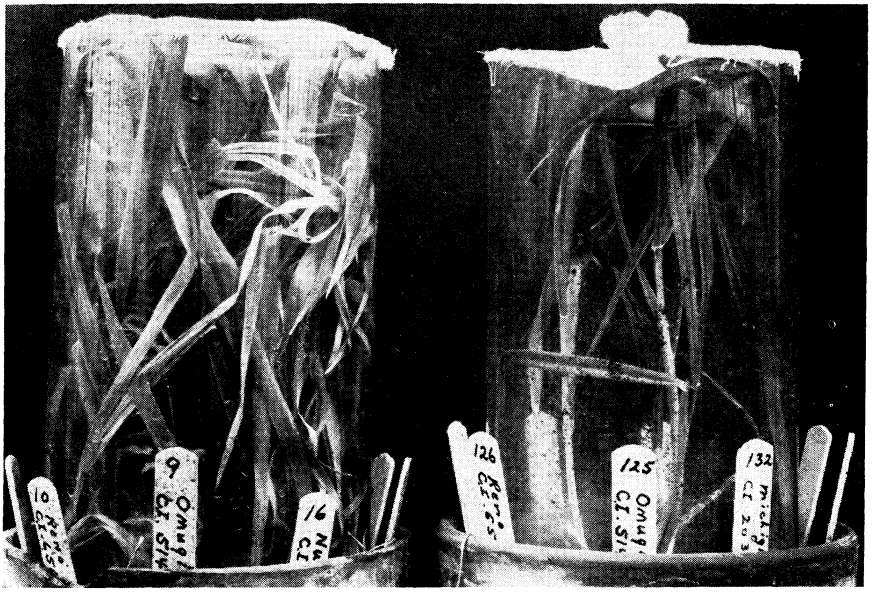


**Fig. 1.—Cages used to confine greenbugs for greenhouse tolerance tests. Infested plants are usually killed before they reach this stage.**

same time those that were in the same relative location within each pot. This usually resulted in the 8 plants forming a circle 3½ to 4½ inches in diameter in the pot. Two weeks after seeding, the plants were about 5 to 7 inches tall and of a suitable size for infestation.

The cages (Fig. 1) used in the preference and tolerance tests were made of transparent cellulose nitrate plastic 0.2 inch thick. A tube 12 inches long and 5 inches in diameter was constructed. One end was closed with coarse mesh cloth, and the other end was placed in the soil around the plants.

The height of each plant was recorded before infestation. All pots of five replications were infested with five 4- to 6-day-old nymphs per plant. In some of the 1947 tests 10 or 12 nymphs were used on each plant. Nymphs were counted on a sheet of paper and brushed off in the center of each pot, giving them an equal opportunity to go to any plant. Pots of the sixth replication served as uninfested checks. The check plants were measured and caged on the same day that the other plants were infested.

The number of greenbugs per plant was determined daily for the first 4 days, and these results were used as a measure of preference.

To determine its tolerance to greenbugs each plant was rated daily as follows according to the estimated percentage of leaf area damaged:

| Rating | Percent damage |
|---|---|
| 0 | 0-10 |
| 1 | 11-20 |
| 2 | 21-40 |
| 3 | 41-60 |
| 4 | 61-80 |
| 5 | Beyond recovery |

The plants were not rated 1 until they had been damaged more than 10 percent, because a lesser amount of injury could not be attributed definitely to greenbugs. The number of days from the date of infestation until a rating of 5 was obtained was the main criterion used for tolerance. A few tests in which the plants were highly resistant and alive 35 days after infestation were then terminated. However, in 1947 some tests were not terminated until 50 days after infestation.

When any plant was rated 5, the height of the corresponding variety in the uninfested check was recorded. The height of infested plants was measured at the end of the test. From these measurements a tolerance value designated as "growth factor" was determined by the following formula:

$$\frac{A'-A}{B'-B} \times 100 = \text{growth factor (percent)}$$

where A = height of plant before being infested.
A′= height of infested plant when dead.
B = height of corresponding check plant when others were infested.
B′= height of corresponding check plant when infested plant was dead.

In the fecundity tests three plants of the variety to be tested were grown in a 6-inch pot and each plant was caged separately. An alate (winged) greenbug

having just reached the adult stage was placed on each plant. Two such pots (six plants) were used for each variety to be tested. The cages consisted of transparent cellulose nitrate plastic 0.1 inch thick made into tubes 6 inches long and 2½ inches in diameter. The number of nymphs produced by each alate female was determined at the end of 7 days. In recent tests the small cages were then removed and the larger tolerance cage was placed over the three plants. Injury ratings were recorded daily, and the plants were allowed to grow until killed by greenbugs. This constituted another type of tolerance test.

If an individual plant showed a high resistance or the rate of reproduction on it was extremely low, the plant was saved and allowed to produce seed.

## INHERITANCE STUDIES

In the inheritance studies, hybrid plants from four winter barley crosses were subjected to artificial infestation in the greenhouse in 1950 and 1951.[1] The parent varieties were Omugi (C. I. 5144)[2] and Dobaku (C. I. 5238), of Korean origin, an unnamed variety (C. I. 5087) of Chinese origin, Tenkow (C. I. 646), and Ward (C. I. 6007). The first three varieties were selected because previous workers had indicated their resistance to greenbugs, and the last two varieties, both highly susceptible, because they are the leading varieties grown in Oklahoma. All the varieties are 6-row types with covered seed. Omugi, Tenkow, and Ward have rough awns and lax heads. Dobaku also has rough awns but compact heads. C. I. 5087 is an intermediate hooded type with lax heads.

Most of the emphasis was placed on the reactions of the $F_2$ generations. Only limited numbers of crossed seed were available for $F_1$ reactions.

### $F_2$ Hybrid Tests

Four crosses were tested separately in the $F_2$ study. The barley crosses and planting dates were:

| | | |
|---|---|---|
| I | Dobaku X Ward | October 4, 1950 |
| II | Dobaku X C. I. 5087 | November 21, 1950 |
| III | Omugi X Tenkow | January 13, 1951 |
| IV | Omugi X Ward | February 27, 1951 |

Seed of the parents of crosses I and II was the progeny from parent plants. For crosses III and IV, however, seed of the actual parent plants was not available, so that parent checks were planted from bulk lots.

Three seeds of each parent and a check variety and single $F_2$ seeds were planted in each pot. The parents and checks were later thinned to one plant each. In crosses I and II Omugi was planted as a resistant check, so that only 5 $F_2$ seeds were included in each pot. In crosses III and IV Omugi was one of the parents, so that 6 $F_2$ seeds were planted in each pot.

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[1] William Henry McDonald, Jr., carried out these studies in partial fulfillment of the requirements for the degree of master of science, Oklahoma A. and M. College, 1952. Thesis entitled "Inheritance of Resistance to the Greenbug (*Toxoptera graminum* Rond.) in Winter Barley Hybrids."

[2] C. I. refers to the accession number of the Field Crops Research Branch.

In the inheritance studies the ratings were determined as follows from the estimated percentage of greenbug leaf damage:

| Rating | Percent damage |
|---|---|
| 10 | 0-10 |
| 7 | 11-35 |
| 5 | 36-60 |
| 3 | 61-80 |
| 1 | 81-99 |
| 0 | 100 |

Ratings were made for 46 days on cross I, 92 days on cross II, 34 days on cross III, and 40 days on cross IV. However, approximately 85 percent of the plants in cross II lived only 20 to 30 days.

Analysis of variance was used for the parental and check data from all four crosses from two aspects: (1) preference of greenbugs; and (2) tolerance of plants as measured by (a) accumulated ratings and (b) the amount of growth.

The preference of greenbugs for a given plant was determined from the number on the plant each day for the first 4 days. The accumulated rating is the total rating value given to each plant obtained by multiplying a given rating by the number of days the plant received that rating. The total value from all the ratings for the plant was then determined.

### $F_1$ Hybrid Tests

$F_1$ hybrid plants from three of the four crosses previously mentioned, their reciprocals, and parents were tested. $F_1$ plants were tested in the same manner as were the $F_2$ plants, but the $F_1$ data, because of low numbers, were not analyzed in the same way.

## INSECTARY TESTS

During the 1952-53 season approximately 300 varieties of small grains were tested for resistance in an insectary under artificial light. They were planted in rows in a wooden flat 17 by 21 by 4 inches, 10 varieties in each flat and 10 plants of each variety. A check variety was included in each flat. Fourteen days after seeding, the height of each plant was recorded and each flat was infested with greenbugs. The greenbugs used to infest each flat were not counted, but were those produced from the progeny of 100 4- to 6-day-old bugs caged on Tenkow barley for 14 days.

The condition of each plant was recorded at 48-hour intervals, and the height of plants was measured when they were killed. The criterion used for resistance were the days required for greenbugs to kill the plants and the amount of growth the plants made after being infested.

## FIELD TESTS

Each year except 1948 nursery plantings were made to determine the reaction of small-grain varieties to natural infestations of greenbugs. As a general rule, only varieties that had shown some resistance in the greenhouse were tested in

the field. However, agronomically adapted varieties were included regardless of their reaction in the greenhouse. All field tests were conducted at Stillwater, except in 1947 when tests were made at Lawton, Okla. Varieties were seeded in February or March in three-row plots, 5 or 10 feet long with 12-inch spacing between rows. Varieties were replicated three times in a randomized block arrangement. The seeding rate was 1 bushel per acre for wheat and 2 bushels for oats and barley. In order to obtain maximum greenbug injury, plants should be small at the time of infestation. Therefore, all varieties, including winter types, were seeded in the spring. Since many of them failed to produce seed, a fall-planted nursery also was necessary unless seed supplies were available from other sources. Field testing of certain varieties was therefore delayed for 2 to 3 years.

The criteria used for determining resistance under field conditions depended on the intensity of the infestation. The percent of leaves injured was the criterion most commonly used, based on examination of leaves from the center of the middle row of each plot. Where damage was severe, this percentage was estimated. The intensity of infestation was determined by counting the greenbugs on 1 foot of the middle row of each plot. This count also gave some indication of preference. In several cases visual greenbug injury ratings for the entire plot were made as follows: 0, none; 1, slight; 2, moderate; 3, severe; 4, very severe; 5, injured beyond recovery.

The visual injury ratings were usually continued after the termination of greenbug infestation and thus gave a measurement of the ability of a variety to recover from injury.

## PLANT CHARACTERS AND RESISTANCE

A study of barley varieties was made in 1947 to determine what agronomic characters, if any, are associated with greenbug resistance or susceptibility.[3] On March 17, 48 varieties were seeded in four-row nursery plots 10 feet long. The habit and rate of growth, number of culms per foot in the row, leaf characteristics, and height of plant were noted during the growing season.

Samples of 10 culms were collected from each of 35 varieties that produced heads under conditions of late-spring seeding. The 7 most resistant and the 6 most susceptible varieties (as indicated by greenhouse tests) were studied and classified morphologically by a method similar to that used by Aberg and Wiebe (1). Observations and measurements were made on the following characters:

Awns—persistent or deciduous, length, rough or smooth, awned or hooded, none or slight twist

Spike—average number of spiklet groups per head, length, erect or nodding

Hairiness—long or short hair on rachis edges, long or short rachilla hairs

Glume awns—length

Kernels—color, covered or naked

Leaves—shade of green, number, length, width, smooth or rough, waxiness, color of midrib

[3] U. J. Grant carried out some of these studies in partial fulfillment of the degree of master of science, Oklahoma A. and M. College, 1948. M. S. thesis title: "The Reaction of Certain Barley Varieties to Greenbug Attack."

Stems—anthocyamin absent or present, collar shape (open or closed) length of internode

Growth type, or the degree of prostrateness or erectness and height of plant, was determined on April 29, May 13, June 4, and June 21.

The lengths of rachilla and of rachis hairs appeared to be correlated with resistance of varieties of barley to greenbugs.

For more definite determinations exact measurements of 5 rachilla and 5 rachis hairs were made on each of the 35 varieties that produced heads in the field test. Measurements were recorded to the nearest 0.044 mm. with the aid of a 30-power binocular and a micron scale. Calculations were made to determine the correlation between the lengths of the rachilla and rachis hairs, and also the relationship between rachilla hair length and tolerance to greenbugs.

# Results and Discussion

## BARLEY

### Preference and Tolerance Tests

Many of the barley varieties tested in the greenhouse showed a high degree of resistance to the greenbug. Varieties that were as resistant as Seibaku C. I. 5229 in any one of the four criteria are given in Table 2. Each variety was compared with the check—Ward—in the same test. There were 16 varieties of which all the plants were alive at the end of the 50-day test period, and several varieties lived four times as long as Ward after being infested. All three recommended varieties —Ward, Tenkow, and Harbine—were very susceptible, and lived less than an average of 15 days. Kearney and Dicktoo, two varieties that show some promise for Oklahoma especially in rigorous winters, were highly resistant in these tests. They also had a very low preference rating.

The varieties that showed a high degree of tolerance were also less preferred than Ward. Generally, there was a fairly close relationship between tolerance and preference; that is, varieties with a low preference rating had a high degree of tolerance. However, in some cases, especially in several of the Suwon varieties, there appeared to be little relationship between these two factors.

A growth factor was not obtained on many of the varieties; however, where this information was available, the resistant varieties (except some Suwons and one or two others) that were infested grew from 50 to 90 percent as much as the uninfested checks. Infested plants of the three recommended varieties—Ward, Tenkow and Harbine—grew approximately 20 percent as much as uninfested check plants.

In one test with 30 Korean barleys for which information was available on both the growth factor and the length of life of plants after infestation (expressed in terms or percent of Ward in the same tests), a correlation coefficient of 0.85 was obtained. This might indicate that growth factor is a fairly good criterion of resistance or susceptibility. Some resistant varieties had low growth factors, but none of the susceptible varieties had high growth factors. Since this factor is calculated from only one check plant from each variety, no definite conclusions should be drawn from this figure alone.

**Fig. 2.—Resistance of barley varieties to attack of the greenbug in 3-row 10-foot plots: Left, Omugi C.I. 5144; center, C.I. 9174; right, Nandomugi C.I. 5234. Stillwater, Okla., 1951.**

The reproduction rate of greenbugs confined to resistant varieties was only about half that of greenbugs on the susceptible recommended varieties. Two varieties—Chae-yae-chang C. I. 7408 and Cha-dae-maec C. I. 7404—and some of the Omugi X Ward, Omugi X Tenkow, and Seibaku X Tenkow hybrids were unsatisfactory for greenbug reproduction.

All the varieties that showed a high degree of resistance, except Dicktoo and Kearney, originated in China, Korea, or Japan.

In 1950, 33 plant selections were made from areas of barley fields in which all but a few plants had been killed by greenbugs. When plants grown from these selections were tested in the greenhouse, none was found to be resistant.

During the 1952-53 season, a few barley varieties that had previously been checked for resistance in the greenhouse were tested in the insectary to determine whether comparable results would be obtained by the two methods. Results of these tests are shown in Table 3. Since several plants of some of the resistant varieties were alive when the insectary tests were terminated 40 days after infestation, the records do not indicate as much resistance when compared with Ward as in the greenhouse tests.

Natural field infestations of greenbugs were abundant enough to cause injury only in 1947 and from 1950 to 1952, inclusive. In 1947 the nursery was seeded at Lawton and the other 3 years at Stillwater. The infestation was very light in 1947 and very severe in 1951. The 1950 and 1952 infestations were of about equal intensity and could be classified as moderate. Figure 2 shows the reaction of susceptible and resistant varieties to a severe greenbug infestation in 1951. The leaf injury for each variety included in the barley nurseries during the 4 years is shown in Table 4. Additional injury records and some yield data for the 1951 nursery are shown in another section of this bulletin.

The resistant varieties had from one-third to one-fifth as much leaf injury as the susceptible varieties. The new variety Kearney was highly resistant in these tests, as were all varieties that had been highly resistant in the greenhouse tests.

Greenbug resistance records also were taken on unreplicated nursery plots that were sown for seed increase. Some of these varieties were resistant, but were never advanced to the replicated nursery. The reaction of 12 of the varieties is shown in Table 5. The unnamed varieties C. I. 5093, C. I. 4195, and Corbel especially were highly resistant in both tests.

The effect of a severe natural infestation of greenbugs on the yields of 30 barley varieties is shown in Table 6. They were grown in triplicated nursery plots at Stillwater in 1950 and 1951. In 1950 few, if any, greenbugs were on the plants, but in 1951 the seedlings were heavily infested when very small. Under the latter condition 14 varieties produced little or no grain, whereas several showed outstanding resistance and produced fairly good yields. The yields of any resistant variety were about the same in both years. In contrast, most of the highly susceptible varieties had little or no yield in 1951, but fair to good yields in 1950 in the absence of greenbugs. For example, C. I. 9174 and Quinn produced 32.2 and 27.4 bushels per acre, respectively, in 1950, but only 0.2 and 3.4 bushels in 1951. Fayette, Harbine, Tenkow, and Ward showed similar reductions in yield. Omugi, which was highly resistant, produced 28.6 bushels in 1951 compared with 19.3 bushels in 1950.

Typical winter and spring varieties as well as intermediate varieties were tested. Plantings were not made until early in February in both years, but this did not seem to favor the spring varieties. The highest yielding variety in 1950—Okla. No. 1005, Sel. C. I. 9174—is classed as a winter type as is Omugi, the highest yielding variety in 1951.

## Inheritance of Resistance

### $F_1$ Tests

Barley crosses were studied in the greenhouse in an effort to obtain information on the genetics of resistance to greenbugs. The parents, certain resistant and susceptible checks, and $F_1$ and $F_2$ populations were planted.

Although the numbers of $F_1$ and parent plants were small, in general the hybrid plants were considerably more resistant than the susceptible parent plants. The growth and the accumulated ratings are shown in Tables 7 and 8. In the cross Omugi X Ward both the average growth and the accumulated rating of the $F_1$ exceeded those of the resistant parent, Omugi. The $F_1$ of Dobaku X Ward was equal to the susceptible parent in average growth and was closer to it than to the resistant parent in average accumulated rating. There was a rather striking difference in reaction between the hybrids obtained from the two seedings of the Omugi X Tenkow cross, but no explanation can be offered at present.

#### Analysis of Parental and Check Data

Mean-square values from the analysis of variance of the parental and check data from each of the four crosses included in the $F_2$ study are presented in Table 9.

Data for crosses I and II are presented in relation to the Omugi check. In crosses III and IV Omugi was a parent of the cross; therefore, the data are presented on a direct basis.

In the preference test the data showed a highly significant difference at the 1-percent level between varieties for crosses I, II, and III, but for cross IV no

significant difference at the 5-percent level. The behavior of this cross appears to have been somewhat abnormal in the preference test.

The data for accumulated rating and for tolerance of barley to greenbug attack as measured by the amount of growth indicate that there is a highly significant difference at the 1-percent level between varieties in all four crosses.

### $F_2$ Tests

Distribution data for tolerance as measured by the accumulated ratings and by the amount of growth of the parent, check, and the $F_2$ plants of the four crosses are presented in Tables 10 and 11. As examples, the distribution of the Dobaku X Ward cross is given in Figures 3 and 4.

Classification of the $F_2$ plants for resistance in all four crosses, as measured by the accumulated rating and the amount of growth, was determined by using the point at which the lines representing the distribution of the two parents intersect. This point was determined in relation to the averages of the parent, check, and $F_2$ plants. There is, in general, a break in the distribution curve of the $F_2$ plants at this point, or where the line representing the $F_2$ distribution is approaching a natural breaking point.

Resistance as measured by the preference of greenbugs for certain barley plants did not show a satisfactory distribution of the parent plants. Consequently, the $F_2$ plants were not classified for resistance and susceptibility to greenbug attack on this basis.

There is some overlapping of the parents for the accumulated rating and amount of growth tests of each cross, but it could be assumed that the same pheno-

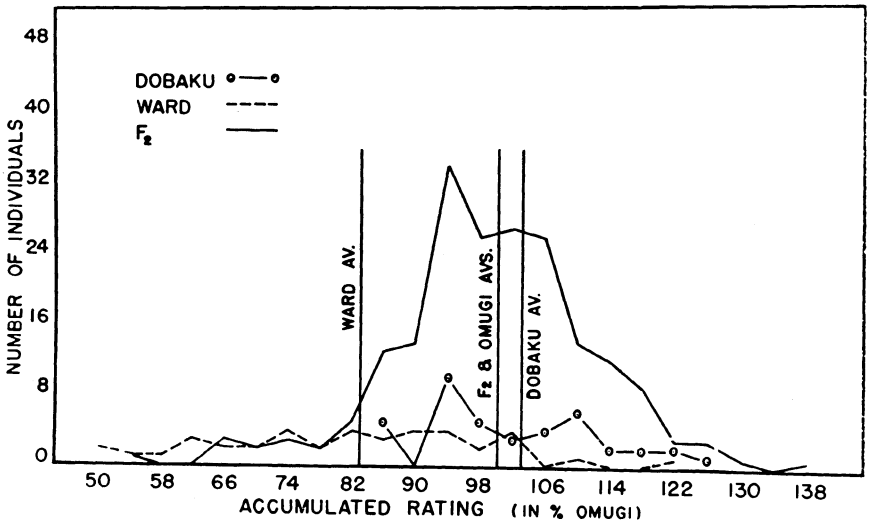


**Fig. 3.—Distribution of parent and $F_2$ plants of Dobaku x Ward by accumulated rating classes when tested under artificial infestation of greenbugs at Stillwater, Oklahoma, 1950-51.**

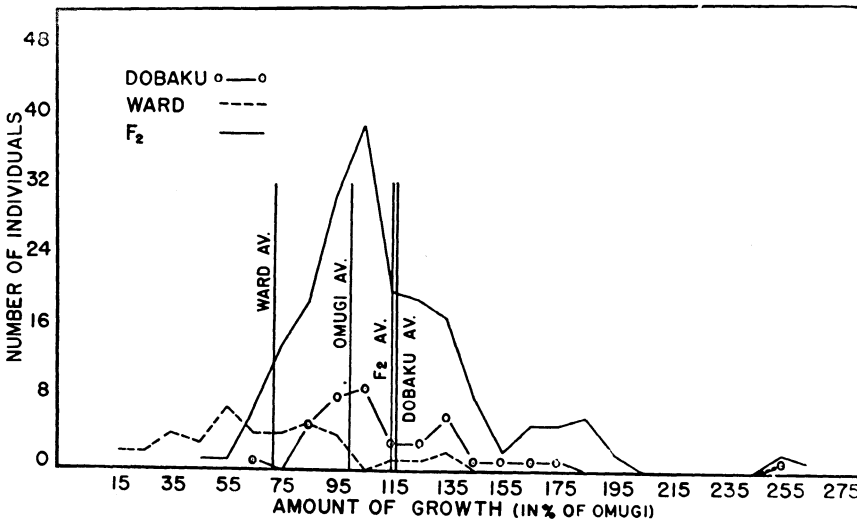


**Fig. 4.—Distribution of parent and $F_2$ plants of Dobaku x Ward by amount of growth classes when tested under artificial infestation of greenbugs at Stillwater, Okla., 1950-51.**

menon is taking place in the distribution of the $F_2$ plants. The fact that each test or measurement supports the other in all crosses indicates that the assumptions probably are correct for classification of plants as to resistance to greenbug attack.

In Figure 3 and Table 10 the data for the accumulated rating test with Dobaku X Ward show that the mean for the $F_2$ plants is between that of the two parents, although closer to that of the resistant parent. The average for the $F_2$ plants is 100 percent of the Omugi check, for Dobaku 103 percent, and for Ward 83 percent. All plants with a rating of 92 percent and less were classified as susceptible and those with higher ratings as resistant. Figure 4 and Table 11 show that there is very little difference between the mean amount of growth of the resistant parent and that of the $F_2$ plants. The average growth of the $F_2$ plants during infestation was 115 percent for Omugi and 116 percent for Dobaku. During the same period Ward showed an average growth of only 72 percent for Omugi. The $F_2$ plants were classified as susceptible if the amount of growth was 85 percent or less of the Omugi check.

On this basis the tolerance tests for the resistant and susceptible plants show an observed segregation ratio of 156:43 for the accumulated rating and 162:37 for the amount of growth. For a 13:3 ratio, totals of 160 resistant and 39 susceptible plants would be expected. The observed and expected ratios, along with the chi-square and P values, are shown in Table 12.

Segregations for observed and expected numbers of resistant and susceptible plants for the four crosses are also given in Table 12. The genetic symbols proposed to account for the ratios are as follows:

Dobaku (Grb Grb $grb_2$ $grb_2$) X Ward (grb grb $Grb_2$ $Grb_2$)

Dobaku (Grb Grb $grb_2$ $grb_2$) X C.I. 5087 (grb grb $grb_2$ $grb_2$)

Omugi (Grb Grb $Grb_3$ $Grb_3$) X Tenkow (grb grb $grb_3$ $grb_3$)
Omugi (Grb Grb) X Ward (grb grb)

Grb in Dobaku and in Omugi may or may not be the same gene. At present no evidence is available to determine this. However, crosses have been made to provide material for such a study.

## Plant Characters and Resistance

Although the infestation in the field in 1947 was not sufficient to show differences in the reaction of barley varieties to greenbugs, an analysis of the agronomic characters revealed that all seven varieties determined as most resistant in greenhouse tests had long-haired rachillas. These varieties were Omugi, Seibaku, Shumaki, Dobaku, Dorshu, C.I. 5087, and Kumflide. Furthermore, the six most susceptible varieties had short-haired rachillas. They included Fayette, Michigan Winter, Reno, Tenkow, Ward, and Oklahoma No. 1005. Although no significant correlation existed between the rachilla hair length and the tolerance to greenbug attack, all the outstanding resistant varieties had long rachilla and rachis hairs, and all the varieties showing the least resistance had short ones. However, later inspection revealed that some varieties of intermediate greenbug reaction also had long rachilla and rachis hairs. No other agronomic characters were found to be correlated with resistance to greenbugs.

In addition to the detailed inheritance study already discussed, other experiments were conducted with various generations of barley hybrids.

In the spring of 1947 the highly resistant Omugi and the moderately resistant varieties Seibaku and Shumaki were crossed with Ward, Tenkow, and a composite hybrid selection C.I. 7152, a spring variety having considerable disease resistance. $F_1$ plants from these crosses were grown at Sacaton, Ariz., in 1948.[4]

In a preliminary trial 4 $F_1$ plants of the cross Shumaki X Tenkow were tested in the greenhouse for greenbug resistance. Their reaction was similar to that of the susceptible parent plants (Tenkow), an indication that resistance may be recessive in this case. Shumaki was only moderately resistant. When a limited number of $F_2$ plants of the same cross were tested in the greenhouse in 1949, 12 of them were susceptible, 9 were intermediate, and only 3 were as resistant as Shumaki. Although the data are too meager to afford conclusions, these results tend to confirm the dominance of susceptibility observed in the $F_1$ plants of this cross.

From 7 other crosses studied in the greenhouse 181 $F_2$ plants were tested. Of these, 163 plants were at least as resistant as the resistant parent, 9 were intermediate in reaction, and 9 were susceptible. After 30 days of testing, this experiment was discontinued to allow the resistant plants to mature. Ward and Tenkow were crossed with resistant $F_2$ plants of Omugi X Ward, and a resistant $F_2$ plant of Seibaku X Tenkow was backcrossed to Tenkow. Thirteen plants from this material gave a resistant reaction, an indication that resistance was dominant.

In 1950 approximately 75 $F_3$ hybrid plants resulting from resistant $F_2$ plants were grown in the field at Stillwater. Nearly all of them survived a natural in-

[4] This material was grown through the courtesy of G. A. Wiebe, Field Crops Research Branch, Beltsville, Md.

festation of greenbugs and other aphids, whereas more than half of the susceptible parent plants were killed. In 1951, 81 $F_4$ hybrids from the resistant $F_3$'s were grown at Stillwater in single plant rows along with appropriate parental checks. These hybrids were from the crosses Ward X Seibaku, Seibaku X Tenkow, Omugi X Tenkow, and Omugi X Ward. They were also exposed to a natural infestation of greenbugs, but little damage resulted. Of the plant rows grown, 40 were saved and harvested in bulk for further testing and selection. A total of 39 of these $F_5$ hybrids were grown at Woodward or Stillwater in 1952, and 14 were saved for further testing. All 14 are being retested in the greenhouse (1953); 10 have been included in the triplicate yield nursery and 4 have been continued in the observation nursery, both at Stillwater.

Most of the selections, now in the $F_6$ generation, are vigorous-growing, apparently well-adapted types with a high degree of greenbug resistance, but all have a somewhat weak straw like their parents. Additional crosses have been made to obtain greenbug-resistant selections with stiffer straw.

In 1952, 50 $F_2$ hybrids from individual $F_1$ plants were grown at Stillwater or Woodward, and 39 of them were harvested as bulk hybrids. A total of 50 $F_3$ bulk hybrids from individual $F_2$ plants also were grown, and 30 of them were saved. Each hybrid had as one parent one of the greenbug-resistant varieties Dobaku, Omugi, or an unnamed variety C.I. 5087. The other parent was usually an adapted variety (Harbine, Tenkow, Ward, or Missouri B400) or a variety with resistance to one or more races of loose smut *(Ustilago nuda)*. The last included North Carolina Hooded 26 and Dohadak. All the bulk hybrids that were saved are being tested in the greenhouse for reaction to greenbugs.

A number of crosses were made in 1952 in an effort to develop strains having combined greenbug resistance, winter-hardiness, stiff straw, and disease resistance. Some of the $F_1$ plants from these crosses are being grown in the field at Stillwater and others are being tested in the greenhouse.

## WHEAT SPECIES AND RYE

The reaction of some of the more resistant wheat varieties to greenbugs in greenhouse tests is shown in Table 13. Each variety was compared with the Pawnee check in the same test. All varieties had a growth factor above 80 or the percent of Pawnee was 30 or below for preference, 115 or above for tolerance, or 50 or below for fecundity. None of the varieties showed a high degree of tolerance. Two of the best—*Triticum vulgare* var. National No. 62 and *T. durum* var. Belagatch—were, respectively, 30 and 36 percent more tolerant than Pawnee. A few varieties of the other wheat species and intergeneric hybrids were less tolerant than the more resistant strains of *T. vulgare* and *T. durum*.

There was little relationship between results from the two tolerance tests. Usually this can be explained by the difference in fecundity of the greenbugs. Varieties on which there was a high rate of reproduction usually had rather poor ratings for tolerance when the initial infestation was one female per plant. For example, the highest fecundity shown for the *Triticum vulgare* group, Kang-To-Shin-Ryac P. I. 157568, was 36 percent above Pawnee. This variety had a tolerance rating (when the initial infestation was one female per plant) of 10 percent below Pawnee. In contrast, greenbugs feeding on Seu-seun No. 4 P. I.

157591 reproduced only 52 percent as fast as when feeding on Pawnee and the corresponding tolerance was 21 percent above that of Pawnee.

A few varieties had a very low preference rating and should receive more critical testing. Some of the rye X wheat hybrids had exceedingly low fecundity records. On rye X wheat Wd. 44h4-3 only about one-fifth as many bugs were produced as on the Pawnee check.

Several varieties showed ability to make good growth after being infested (growth factor). Six of the infested varieties of *Triticum vulgare,* two *durums,* three intergeneric hybrids, and one each of *persicum, pyramidale, turgidum,* and *monococcum* grew at least 90 percent as much as the non-infested check.

In 1950, 492 plant selections were made from areas of wheat fields in which all but a few plants had been killed by greenbugs. These selections, which included 8 varieties from 45 fields, were tested in the greenhouse during the 1950-51 season. There was only a slight difference in reaction between plants grown from these selections and from unselected seed.

During the 1952-53 season approximately 175 wheat strains that previously had been tested in the greenhouse were tested for resistance in the insectary. The reaction of varieties that lived at last 15 percent longer than Pawnee in the same test is listed in Table 14. In all tests some plants appeared to be rather susceptible. However, one variety of *Triticum durum,* Dickinson No. 485 C. I. 3707, showed a high degree of resistance. Seed of this variety planted in the field in 1953 and grown to maturity showed some "off-type" heads, an indication that the seed was mixed. Additional tests indicated that the true durum Dickinson was susceptible, but that plants grown from the off-type seed were highly resistant.

Only a few of the *Triticum vulgare* group showed resistance in the insectary test. Chiefkan X Oro-Tenmarq C. I. 12518 and New Chief were among the more resistant varieties.

The reaction of wheat varieties to greenbugs in field tests in 1947 and 1950-52 is shown in Table 15. Several of the varieties had less leaf injury due to greenbugs than the Pawnee check or than any of the adapted varieties grown in the hard red winter wheat area. However, the difference was not great and none of the varieties could be considered as being highly resistant. Several Nanking varieties, Hope, and a few Hope hybrids were the more resistant.

The reactions of a few wheat varieties tested in nonreplicated 3-row plots in 1947 are shown in Table 16. A Marquillo X Oro selection obtained from the Kansas rust nursery, Manhattan, Kans., was the most resistant in this group. This variety appeared to be as resistant as some of the better varieties from China.

## OATS

The reaction of some oat varieties to greenbugs in greenhouse tests is shown in Table 17. All varieties had a growth factor above 40 or, if below 40, the percent of Wintok in the same test was 50 or below for preference, or 115 or above for tolerance, or 60 or below for fecundity. None of the varieties showed a high degree of resistance. On an average the plants lived less than 20 days after being infested. Two spring varieties—Cherokee and Andrew—that are adapted to Oklahoma conditions were over 40 percent more tolerant than Wintok; however,

owing to the high susceptibility of Wintok, they cannot be considered as being resistant. Although there was considerable variation in preference and fecundity, none of the varieties indicated a high degree of resistance.

In 1950, 15 plant selections were made from areas of oat fields in which all but a few plants had been killed by greenbugs. When plants grown from these selections were tested in the greenhouse, none was resistant.

The reaction of some spring-seeded oat varieties to a natural greenbug infestation is shown in Table 18. None of the varieties showed a high degree of resistance, and most of them were more susceptible than Wintok. Andrew was the most resistant, but had only 13 percent less leaf injury than Wintok.

The effect of a moderate infestation of greenbugs on spring-seeded oat varieties grown at Stillwater in 1952 is shown in Table 19. There appeared to be some relationship between the amount of leaf injury and the yield per acre. Five of the highest yielding varieties were among the six varieties showing the least injury. One selection of Victoria-Hajira-Banner X Fulghum-Victoria had a very good test weight and good yield, but showed rather severe greenbug injury. Since this injury occurred in February and March, such a record might indicate the ability of a variety to recover.

## Summary

Several hundred varieties and hybrids of small grains were tested for resistance to the greenbug [*Toxoptera graminum* (Rond.)] in the greenhouse, insectary, and field. Resistance was determined in the greenhouse in separate tests for preference, tolerance, and fecundity, and in the insectary from the days required for the greenbugs to kill the plants and the growth made after being infested. Varieties that showed some resistance in the greenhouse were tested in the field to determine their reaction to natural infestations.

Many of the barley varieties showed a high degree of resistance. All highly resistant varieties except Dicktoo and Kearney originated in China, Korea, and Japan. Preliminary data on $F_1$ and $F_2$ hybrid populations of crosses between susceptible and resistant varieties indicated that the resistance to greenbugs was inherited. With few exceptions resistance appeared to be dominant to susceptibility and was probably governed by two or more genes. There was no apparent correlation between readily visable morphological characteristics of the barley plant and greenbug resistance, although all the resistant varieties studied had long rachilla and rachis hairs.

None of the wheat and rye varieties tested showed a high degree of resistance; however, several (especially some durums) were considerably more tolerant than varieties now grown in the hard winter wheat area. Plants grown from some "off-type" seed found in one durum variety, Dickinson No. 485 C. I. 3707, showed considerable resistance when tested in a special insectary.

Although there was some variation in the reaction of oat varieties to greenbug attack, none showed a high degree of resistance. Two spring varieties, Andrew and Cherokee, which are adapted to Oklahoma conditions, were less susceptible than Wintok.

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**Table 1.—Numbers of small grains tested for greenbug reaction, 1947-53.**

| Grain | Greenhouse (A) | Field (B) | Both greenhouse and field (C) | Insectary* (D) | Total* (A+B—C) |
|---|---|---|---|---|---|
| Wheat | | | | | |
| *Triticum vulgare* | 331 | 140 | 118 | 51 | 353 |
| *Triticum durum* | 207 | 0 | 0 | 200 | 207 |
| Other species | 23 | 0 | 0 | 14 | 23 |
| *Triticum* X *Agropyron elongatum* | 64 | 4 | 4 | 0 | 64 |
| Other intergeneric hybrids | 8 | 6 | 6 | 0 | 8 |
| Rye | 5 | 0 | 0 | 5 | 5 |
| Oats | 205 | 62 | 46 | 0 | 221 |
| Barley | 543 | 80 | 46 | 10 | 577 |
| Total | 1386 | 292 | 220 | 280 | 1458 |

* Previously tested in either greenhouse or field.

Table 2.—Resistance of barley varieties and hybrids listed in order of tolerance to greenbugs in greenhouse tests at Stillwater, Okla., 1947-53.

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Unnamed | 4240 | China | 5 | 41 | 43 | 422 | -- | 9 | 38 |
| " | 4205 | " | 6 | 50 | 42 | 418 | -- | 9 | 50 |
| Tongu | 5159 | Korea | 5 | 46 | 47 | 410 | -- | 8 | 36 |
| Unnamed | 4203-2 | China | 6 | 38 | 40 | 408 | -- | 11 | 62 |
| " | 4243-1 | " | 5 | 38 | 45 | 404 | -- | 7 | 33 |
| " | 4240-2 | " | 5 | 38 | 42 | 394 | -- | 7 | 32 |
| " | 4202-1 | " | 8 | 55 | 42 | 386 | -- | 12 | 64 |
| Suwon No. 31 | 7454 | Korea | 5 | 91 | 50 | 385 | 53 | 5 | 42 |
| Kido | 5145 | Korea | 6 | 43 | 44 | 382 | -- | 11 | 46 |
| Suwon No. 31 | 7453 | " | 6 | 89 | 48 | 379 | 29 | 5 | 41 |
| Koranbaku | 5253 | " | 6 | 60 | 43 | 375 | -- | 16 | 60 |
| Kedaka-Rokkaku | 7377 | Japan | 6 | 82 | 50 | 373 | 59 | 13 | 100 |
| Nandomugi | 5254 | Korea | 7 | 68 | 45 | 365 | -- | 11 | 51 |
| Unnamed | 4195-2 | China | 5 | 38 | 38 | 363 | -- | 10 | 56 |
| Hoku | 5179 | Korea | 5 | 46 | 39 | 362 | -- | 10 | 47 |
| Unnamed | 4227-1 | China | 5 | 42 | 42 | 357 | -- | 9 | 51 |
| Suwon No. 28 | 7450 | Korea | 5 | 75 | 50 | 357 | 48 | 8 | 59 |
| Tongpori | 5208 | " | 7 | 70 | 39 | 351 | -- | 14 | 68 |
| Unnamed | 2518 | China | 5 | 40 | 38 | 351 | -- | 8 | 41 |
| Unnamed | 7294 | Japan | 9 | 81 | 50 | 343 | 72 | 9 | 94 |
| Suwon No. 4 | 7431 | Korea | 5 | 79 | 50 | 343 | 69 | 7 | 64 |
| Gubori | 5248 | " | 7 | 75 | 39 | 342 | -- | 16 | 62 |
| Suwon No. 26 | 7448 | Korea | 4 | 64 | 50 | 338 | 64 | 6 | 55 |
| Suwon No. 8 | 7437 | " | 5 | 68 | 50 | 338 | 53 | 8 | 71 |
| Unnamed | 4202-2 | China | 6 | 41 | 35 | 338 | -- | 10 | 53 |
| Chae-rae-chang | 7408 | Korea | 5 | 47 | 50 | 333 | 96 | 3 | 15 |
| Unnamed | 5093 | " | 6 | 44 | 39 | 333 | -- | 11 | 50 |
| Dobaku | 5238 | " | 6 | 59 | 40 | 332 | -- | 13 | 55 |
| Chae-rae-chang | 7407 | " | 4 | 37 | 50 | 329 | 93 | 7 | 42 |

**Table 2.—Continued.**

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Dicktoo | 5529 | N. Dak. | 2 | 26 | 50 | 329 | 90 | 6 | 41 |
| Chae-rae-bac | 7406 | Korea | 4 | 34 | 50 | 329 | 79 | 4 | 21 |
| Kearney | 7580 | Nebraska | 2 | 23 | 50 | 329 | 91 | 9 | 62 |
| Unnamed | 5097 | Korea | 7 | 60 | 41 | 327 | -- | 13 | 58 |
| Cha-dae-maec | 7404 | " | 4 | 44 | 50 | 325 | 73 | 3 | 18 |
| " | 7405 | " | 5 | 53 | 50 | 325 | 95 | 5 | 31 |
| Suwon No. 4 | 7430 | " | 4 | 75 | 50 | 325 | 71 | 7 | 64 |
| Suwon No. 5 | 7432 | " | 6 | 69 | 50 | 325 | 91 | 8 | 75 |
| Zairai | 5153 | " | 7 | 50 | 40 | 313 | -- | 22 | 51 |
| Suwon No. 13 | 7439 | " | 5 | 64 | 50 | 313 | 71 | 10 | 88 |
| Changu | 5169 | " | 5 | 47 | 32 | 312 | -- | 8 | 35 |
| Bac-dong No. 38 | 7459 | " | 5 | 91 | 44 | 311 | 36 | 7 | 52 |
| Chosiz | 5227 | " | 6 | 56 | 38 | 209 | -- | 11 | 45 |
| Suwon No. 13 | 7440 | " | 6 | 83 | 50 | 309 | 58 | 9 | 80 |
| Raishu | 5214 | " | 5 | 42 | 34 | 307 | -- | 13 | 62 |
| Omugi | 5144 | " | 6 | 55 | 41 | 306 | 85 | 11 | 59 |
| Tori | 5246 | Korea | 6 | 56 | 42 | 306 | -- | 11 | 48 |
| Koso | 5134 | " | 6 | 50 | 39 | 305 | -- | 9 | 40 |
| Aizu No. 2 | 7364 | Japan | 6 | 90 | 47 | 303 | 89 | 6 | 51 |
| Huwan | 1080 | China | 8 | 54 | 24 | 300 | -- | 14 | 24 |
| Shokum | 5233 | Korea | 6 | 59 | 38 | 300 | -- | 10 | 45 |
| Corbel | 1113 | China | 7 | 52 | 26 | 298 | -- | 13 | 63 |
| Tongubori | 5252 | Korea | 6 | 54 | 35 | 297 | -- | 17 | 72 |
| Unnamed | 5095 | " | 6 | 47 | 34 | 287 | -- | 15 | 64 |
| Coolie | 1060 | China | 8 | 55 | 26 | 286 | -- | 11 | 53 |
| Kersho | 5232 | Korea | 6 | 57 | 38 | 285 | -- | 11 | 46 |
| Seibaku | 5229 | " | 8 | 72 | 39 | 284 | 35 | 9 | 42 |
| Gumish | 5228 | " | 6 | 58 | 37 | 284 | -- | 14 | 59 |
| Rokuben | 5135 | " | 7 | 56 | 39 | 284 | -- | 6 | 26 |
| Chang-mang-ryuc-kac | 7409 | " | 4 | 54 | 50 | 272 | 91 | 4 | 24 |

**Table 2.—Continued.**

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Bano | 2472 | China | 7 | 50 | 27 | 269 | -- | 16 | 91 |
| Seneca | 2245 | " | 10 | 63 | 23 | 267 | -- | 17 | 80 |
| Shonan | 5255 | Korea | 7 | 65 | 35 | 266 | -- | 13 | 57 |
| Unnamed | 5096 | " | 6 | 48 | 34 | 266 | -- | 12 | 55 |
| Suwon No. 6 | 7434 | " | 4 | 59 | 44 | 263 | 62 | 10 | 86 |
| Meimi | 5136 | " | 8 | 58 | 31 | 262 | -- | 15 | 63 |
| Suwon No. 29 | 7451 | " | 4 | 69 | 36 | 258 | 47 | 5 | 37 |
| Shonuru | 5251 | " | 7 | 76 | 35 | 257 | -- | 11 | 57 |
| Chinerme | 1079 | China | 8 | 49 | 22 | 252 | -- | 16 | 75 |
| Dorshu | 5154 | Korea | 8 | 43 | 29 | 252 | -- | 13 | 58 |
| Mizuho No. 12 | 7382 | Japan | 5 | 86 | 48 | 249 | 82 | 10 | 62 |
| Unnamed | 4195 | China | 6 | 46 | 23 | 239 | -- | 13 | 66 |
| Huwan | 2254 | " | 8 | 55 | 23 | 239 | -- | 14 | 81 |
| Bizen wase No. 36 | 7368 | Japan | 5 | 73 | 35 | 238 | 52 | 16 | 124 |
| Unnamed | 4236-1 | China | 8 | 56 | 22 | 235 | -- | 9 | 34 |
| " | 5087 | " | 8 | 63 | 29 | 229 | -- | 7 | 38 |
| Nando | 5108 | Korea | 8 | 69 | 30 | 228 | -- | 9 | 40 |
| Suwon No. 15 | 7443 | " | 6 | 85 | 38 | 228 | 42 | 8 | 75 |
| Chinese Awnless | 2278 | China | 9 | 61 | 21 | 226 | -- | 9 | 54 |
| Unnamed | 5092 | " | 6 | 49 | 29 | 224 | -- | 17 | 27 |
| Seibaku x Tenkow $F_5$ Stw. | 514615 | Okla. | 14 | 91 | 44 | 222 | 58 | 5 | 43 |
| Omugi x Ward $F_5$ Stw. | 514646 | " | 17 | 38 | 36 | 222 | 79 | 1 | 11 |
| Yong-wol-ryuc-kac | 7457 | Korea | 5 | 75 | 31 | 222 | 38 | 12 | 92 |
| Omugi x Ward $F_5$ Stw. | 514662 | Okla. | 11 | 31 | 42 | 221 | 66 | 6 | 52 |
| Unnamed | 4195-1 | China | 6 | 47 | 23 | 221 | -- | 11 | 63 |
| Omugi x Ward $F_5$ Stw. | 514651 | Okla. | 11 | 35 | 42 | 218 | 58 | 1 | 11 |
| Unnamed | 4236-2 | China | 8 | 62 | 24 | 217 | -- | 12 | 51 |

**Table 2.—Continued.**

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Chan-nam-shin No. 5 | 7410 | Korea | 5 | 54 | 36 | 217 | 38 | 13 | 76 |
| Omugi x Ward $F_5$ Stw. | 514650 | Okla. | 15 | 38 | 36 | 214 | 63 | 2 | 16 |
| " Stw. | 514667 | " | 13 | 35 | 37 | 214 | 89 | 2 | 13 |
| Blubak | 2445 | China | 8 | 58 | 20 | 213 | -- | 15 | 86 |
| Seibaku x Tenkow $F_5$ Stw. | 514609 | Okla. | 12 | 84 | 43 | 211 | 66 | 3 | 24 |
| Unnamed | 4242 | China | 8 | 76 | 19 | 211 | -- | 10 | 40 |
| Suwon No. 6 | 7435 | Korea | 5 | 72 | 31 | 211 | 53 | 8 | 70 |
| Unnamed | 5094 | " | 7 | 57 | 26 | 210 | -- | 19 | 79 |
| Kipo | 5242 | " | 8 | 62 | 26 | 210 | -- | 10 | 45 |
| Seibaku x Tenkow $F_5$ Stw. | 514605 | Okla. | 15 | 100 | 41 | 208 | 56 | 4 | 35 |
| Shimabara | 5196 | Korea | 17 | 84 | 23 | 207 | -- | 8 | 78 |
| Seibaku x Tenkow $F_5$ Stw. | 514610 | Okla. | 11 | 54 | 39 | 205 | 52 | 5 | 41 |
| Unnamed | 7296 | Japan | 10 | 100 | 21 | 201 | 43 | 11 | 113 |
| Omugi x Ward $F_5$ Stw. | 514658 | Okla. | 4 | 9 | 35 | 201 | 86 | 3 | 27 |
| Seibaku x Tenkow $F_5$ Stw. | 514604 | " | 13 | 93 | 41 | 201 | 54 | 4 | 35 |
| " Stw. | 514621 | " | 13 | 73 | 37 | 196 | 75 | 2 | 13 |
| " Stw. | 514614 | " | 11 | 59 | 39 | 196 | 61 | 6 | 52 |
| Omugi x Ward $F_5$ Stw. | 514660 | " | 14 | 41 | 36 | 196 | 79 | 3 | 22 |
| Chan-chon-chae-rae | 7412 | Korea | 6 | 64 | 32 | 195 | 45 | 8 | 46 |

**Table 2.—Continued.**

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Omugi x Ward $F_5$ | Stw. 514669 | Okla. | 8 | 16 | 32 | 195 | 81 | 3 | 26 |
| Seibaku x Tenkow $F_5$ | Stw. 514620 | " | 11 | 50 | 37 | 193 | 59 | 5 | 41 |
| Kosaba No. 2 | 7347 | Japan | 6 | 58 | 19 | 192 | 29 | 8 | 51 |
| Zenra | 5138 | Korea | 8 | 60 | 24 | 189 | -- | 24 | 92 |
| Seibaku x Tenkow $F_5$ | Stw. 514625 | Okla. | 13 | 77 | 35 | 185 | 63 | 3 | 22 |
| Kumflide | 730 | China | 10 | 54 | 24 | 184 | -- | 14 | 71 |
| Omugi x Ward $F_5$ | Stw. 514645 | Okla. | 9 | 56 | 35 | 183 | 26 | 9 | 16 |
| Seibaku x Tenkow $F_5$ | Stw. 514618 | " | 12 | 62 | 36 | 183 | 53 | 3 | 27 |
| Ward x Seibaku $F_5$ | Stw. 514580 | " | 17 | 71 | 40 | 180 | 68 | 5 | 40 |
| " | Stw. 514575 | " | 14 | 63 | 41 | 178 | 76 | 5 | 46 |
| Omugi x Ward $F_5$ | Stw. 514648 | Okla. | 9 | 27 | 33 | 177 | 50 | 2 | 20 |
| Borinuru | 5245 | Korea | 7 | 67 | 22 | 177 | -- | 9 | 41 |
| Omugi x Ward $F_5$ | Stw. 514655 | Okla. | 16 | 56 | 32 | 176 | 79 | 1 | 9 |
| Seki-tori | 7423 | Korea | 8 | 85 | 26 | 172 | 36 | 5 | 31 |
| Ward x Seibaku $F_5$ | Stw.514589 | Okla. | 16 | 76 | 39 | 170 | 77 | 4 | 35 |
| Kochi-Wasehadaka | 7346 | Japan | 7 | 59 | 17 | 168 | 51 | 16 | 102 |
| Suwon No. 18 | 7444 | Korea | 5 | 80 | 26 | 167 | 46 | 9 | 82 |
| Mecca | 1051 | China | 7 | 62 | 21 | 166 | -- | 18 | 91 |
| Ward x Seibaku $F_5$ | Stw.514587 | Okla. | 22 | 106 | 40 | 165 | 74 | 5 | 44 |
| " | Stw. 514573 | " | 14 | 73 | 38 | 163 | 65 | 5 | 44 |
| Santoku | 7389 | Japan | 4 | 77 | 31 | 163 | 91 | -- | -- |
| Zungu | 5158 | Korea | 8 | 60 | 18 | 161 | -- | 17 | 73 |
| Banando | 5210 | " | 8 | 65 | 20 | 161 | -- | 15 | 90 |
| Ward x Seibaku $F_5$ | Stw. 514578 | Okla. | 13 | 59 | 37 | 160 | 63 | 7 | 57 |

Table 2.—Continued.

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Nigrate | 2444 | China | 9 | 54 | 16 | 159 | -- | 14 | 81 |
| Kogendo | 5262 | Korea | 7 | 72 | 23 | 159 | -- | 19 | 83 |
| Ward x Seibaku $F_5$ | Stw. 514588 | Okla. | 13 | 54 | 37 | 159 | 78 | 2 | 16 |
| Seibaku x Tenkow $F_5$ | Stw. 514624 | " | 11 | 57 | 32 | 156 | 70 | 8 | 66 |
| Omugi x Tenkow $F_5$ | Stw. 514635 | " | 11 | 67 | 32 | 156 | 50 | -- | -- |
| Ward x Seibaku $F_5$ | Stw. 514598 | " | 24 | 100 | 35 | 155 | 70 | 5 | 44 |
| Omugi x Tenkow $F_5$ | Stw. 514629 | " | 8 | 89 | 33 | 152 | 49 | 4 | 31 |
| " | Stw. 514640 | " | 14 | 70 | 33 | 152 | 63 | 2 | 20 |
| Ward x Seibaku $F_5$ | Stw. 514593 | " | 12 | 55 | 34 | 152 | 86 | 7 | 61 |
| Omugi x Tenkow $F_5$ | Stw. 514637 | Okla. | 9 | 91 | 32 | 151 | 58 | 3 | 24 |
| Mugish | 5213 | Korea | 6 | 48 | 13 | 151 | -- | 11 | 70 |
| Suwon No. 27 | 7449 | " | 8 | 65 | 30 | 151 | 27 | 6 | 58 |
| Omugi x Tenkow $F_5$ | Stw. 514630 | Okla. | 13 | 66 | 32 | 151 | 73 | 3 | 24 |
| Kobai-sai No. 1 | 7343 | Japan | 8 | 70 | 16 | 148 | 36 | 14 | 86 |
| Dang-baci No. 42 | 7416 | Korea | 6 | 59 | 24 | 148 | 40 | 8 | 51 |
| Sung-mac No. 126 | 7426 | " | 6 | 92 | 22 | 146 | 35 | 9 | 78 |
| Unnamed | 4244 | China | 7 | 54 | 12 | 145 | -- | 16 | 58 |
| Buchiang | 1043 | " | 9 | 63 | 16 | 144 | -- | 12 | 59 |
| Shigo-wasehadaka No. 6 | 7351 | Japan | 9 | 68 | 16 | 144 | 15 | 14 | 86 |
| Yokozuna | 7308 | " | 4 | 40 | 23 | 142 | 36 | 11 | 118 |
| Dang-baci No. 42 | 7417 | Korea | 7 | 91 | 22 | 140 | 46 | 12 | 74 |
| Bae-chi | 7401 | " | 6 | 84 | 25 | 140 | 39 | 10 | 58 |
| Wanhing | 6252 | China | 8 | 58 | 16 | 140 | -- | 17 | 84 |
| Suwon No. 25 | 7447 | Korea | 7 | 101 | 22 | 137 | 35 | 7 | 66 |
| Ward x Seibaku $F_5$ | Stw. 514597 | Okla. | 14 | 57 | 30 | 136 | 71 | 7 | 63 |
| Kotsu | 5161 | Korea | 8 | 59 | 15 | 135 | -- | 15 | 65 |
| Hakkoku | 7371 | Japan | 5 | 71 | 19 | 135 | 38 | 19 | 149 |
| Obaku | 5231 | Korea | 8 | 60 | 16 | 134 | -- | 15 | 71 |
| Amarillo | 1073 | China | 11 | 58 | 11 | 133 | -- | 16 | 76 |
| Gumshu | 5217 | Korea | 5 | 38 | 13 | 133 | -- | 14 | 84 |

**Table 2.—Continued.**

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Ward x Seibaku $F_5$ | Stw. 514595 | Okla. | 14 | 84 | 34 | 132 | 92 | 9 | 74 |
| Shiromugi No. 8 | 7358 | Japan | 7 | 86 | 19 | 132 | 38 | 13 | 106 |
| Rokakudo | 5197 | Korea | 7 | 59 | 14 | 128 | -- | 14 | 84 |
| Tanikaze No. 105 | 7394 | Japan | 5 | 121 | 28 | 126 | 64 | 14 | 99 |
| Envoy | 1045 | China | 9 | 56 | 16 | 126 | -- | 21 | 108 |
| Aizu No. 6 | 7303 | Japan | 10 | 91 | 24 | 124 | 36 | 11 | 119 |
| Omugi x Tenkow $F_5$ | Stw. 514636 | Okla. | 7 | 33 | 26 | 122 | 77 | 1 | 6 |
| Shimane-Omugi No. 1 | 7392 | Japan | 5 | 98 | 24 | 121 | 86 | 11 | 72 |
| Michigan Winter | 2036 | Indiana | 9 | 83 | 16 | 120 | -- | 18 | 91 |
| Ward x Seibaku $F_5$ | Stw. 514592 | Okla. | 17 | 73 | 24 | 118 | 62 | 10 | 86 |
| Sekitori-sai No. 1 | 7390 | Japan | 6 | 125 | 25 | 117 | 66 | 12 | 81 |
| Yokuzuna | 7400 | " | 4 | 90 | 22 | 114 | 69 | 12 | 85 |
| Wasebozu | 7397 | " | 6 | 107 | 22 | 113 | 53 | 15 | 102 |
| Hisein | 1053 | China | 9 | 67 | 14 | 113 | -- | 20 | 104 |
| Kogendo | 5204 | Korea | 9 | 67 | 10 | 113 | -- | 14 | 87 |
| Lompoc | 1312 | ----- | 5 | 62 | 15 | 112 | -- | 21 | 81 |
| Zehra | 5189 | Korea | 10 | 77 | 11 | 110 | -- | 18 | 77 |
| Keiroku | 5240 | " | 8 | 66 | 12 | 109 | -- | 19 | 87 |
| Bae-chi | 7402 | " | 7 | 86 | 17 | 109 | 46 | 10 | 63 |
| Heian | 5201 | " | 7 | 57 | 11 | 106 | -- | 14 | 84 |
| Kobinkatagi | 7344 | Japan | 9 | 92 | 12 | 105 | 51 | 21 | 128 |
| Raiden | 7387 | " | 4 | 99 | 25 | 105 | 74 | 15 | 103 |
| Bomnbori | 5243 | Korea | 6 | 47 | 13 | 105 | -- | 14 | 66 |
| Han River | 206 | China | 10 | 61 | 12 | 104 | -- | 15 | 75 |
| Reno | 6561 | Kansas | 14 | 97 | 13 | 104 | -- | -- | -- |
| Tenkow | 646 | Maryland | 10 | 97 | 14 | 103 | 21 | 46 | 94 |
| Omugi No. 4 | 7385 | Japan | 5 | 99 | 21 | 100 | 45 | 13 | 92 |
| Unnamed | 4901 | China | 7 | 49 | 11 | 100 | -- | 20 | 100 |
| Ward (check) | 6007 | Okla. | 9 | 100 | 14 | 100 | 20 | 66 | 100 |

**Table 2.—Concluded.**

| Variety | C.I. or selection No. | Source | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Ward (%) | Days Plant Lived (No.) | Comparison with Ward (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Ward (%) |
| Wasehadaka | 7361 | Japan | 5 | 62 | 13 | 96 | 14 | 11 | 85 |
| Yamato-Hadaka | 7362 | " | 7 | 93 | 13 | 93 | 36 | 20 | 158 |
| Harbine | 7524 | Okla. | 12 | 126 | 12 | 93 | -- | 19 | 98 |
| Omugi-Shin No. 1 | 7386 | Japan | 6 | 130 | 19 | 92 | 65 | 16 | 110 |
| Memesh | 593 | China | 6 | 46 | 10 | 77 | -- | 19 | 96 |

**Table 3.—Tolerance of barley varieties and hybrids to greenbugs in the greenhouse and insectary at Stillwater, Okla., 1952-53.**

| Variety | C.I. or selection no. | Greenhouse | | Insectary | |
|---|---|---|---|---|---|
| | | Plant life (Days) | Comparison with Ward (%) | Plant life* (Days) | Comparison with Ward (%) |
| Dobaku | 5238 | 40 | 332 | 32 | 151 |
| Omugi | 5144 | 41 | 306 | 40 | 192 |
| Seibaku | 5229 | 39 | 284 | 33 | 161 |
| Omugi X Ward $F_5$ | Stw. 514658 | 35 | 201 | 40 | 192 |
| Seibaku X Tenkow $F_5$ | Stw. 514604 | 41 | 201 | 40 | 192 |
| Omugi X Ward $F_5$ | Stw. 514669 | 32 | 195 | 40 | 192 |
| Ward X Seibaku $F_5$ | Stw. 514588 | 37 | 159 | 40 | 192 |
| Omugi X Tenkow $F_5$ | Stw. 514636 | 26 | 122 | 37 | 179 |
| Tenkow | 646 | 14 | 103 | 11 | 64 |
| Ward (check) | 6007 | 14 | 100 | 21 | 100 |

* Tests terminated after 40 days.

**Table 4.—Greenbug injury to spring-seeded barley varieties in natural infestations at Lawton and Stillwater, Okla., 1947, 1950-52.**

| Variety | C.I. or selection no. | Source | Leaves injured (percent) | | | | | Comparison with Ward (percent) |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | Average | |
| | | | 1947 | 1950 | 1951 | 1952 | | |
| Unnamed | 4240-2 | China | -- | -- | 15 | 13 | 14 | 18 |
| Hoku | 5179 | Korea | -- | -- | 19 | -- | 19 | 20 |
| Unnamed | 4240 | China | -- | -- | 14 | 17 | 16 | 20 |
| Kearney | 7580 | Neb. | -- | -- | 22 | 10 | 16 | 21 |
| Kido | 5145 | Korea | -- | -- | 21 | -- | 21 | 21 |
| Shokum | 5233 | " | -- | -- | 23 | -- | 23 | 23 |
| Gumish | 5228 | " | -- | -- | 23 | -- | 23 | 24 |
| Unnamed | 5097 | " | -- | -- | 24 | -- | 24 | 24 |
| Zairai | 5153 | " | -- | -- | 22 | 18 | 20 | 26 |
| Meimi | 5136 | " | -- | -- | 18 | 22 | 20 | 26 |
| Changu | 5169 | " | -- | -- | 14 | 27 | 21 | 27 |
| Unnamed | 4203-2 | China | -- | -- | 27 | -- | 27 | 27 |
| Nandomugi | 5254 | Korea | -- | -- | 21 | 23 | 22 | 29 |
| Zehra | 5189 | " | -- | -- | -- | 16 | 16 | 29 |
| Unnamed | 4227-1 | China | -- | -- | -- | 16 | 16 | 29 |
| " | 5096 | Korea | -- | 28 | 17 | 15 | 20 | 30 |
| Kumflide | 730 | China | -- | -- | 30 | -- | 30 | 31 |
| Omugi | 5144 | Korea | -- | 33 | 16 | 15 | 21 | 31 |
| Chosiz | 5227 | " | -- | 27 | 21 | -- | 24 | 32 |
| Kogendo | 5262 | " | -- | -- | 32 | -- | 32 | 32 |
| Lopat | 2477 | China | -- | -- | 32 | -- | 32 | 32 |
| Unnamed | 4202-1 | " | -- | 35 | 15 | 16 | 22 | 32 |
| " | 4202-2 | " | -- | 25 | 18 | 23 | 22 | 33 |
| Tongu | 5159 | Korea | -- | 31 | 18 | 18 | 22 | 33 |
| Ludwig | 7525 | Neb. | -- | -- | 32 | 19 | 26 | 33 |
| Tongpori | 5208 | Korea | -- | 33 | 17 | 22 | 24 | 36 |
| Koranbaku | 5253 | " | -- | 36 | 16 | 22 | 25 | 36 |
| Dicktoo | 5529 | N. Dak. | -- | -- | -- | 21 | 21 | 37 |
| Gatami | 575 | Manchuria | -- | 30 | 25 | -- | 28 | 37 |
| Dobaku | 5238 | Korea | -- | 38 | 20 | 19 | 26 | 38 |
| Unnamed | 4243-1 | China | -- | 33 | 24 | -- | 28 | 38 |

**Table 4.—Continued.**

| Variety | C.I. or selection no. | Source | Leaves injured (percent) | | | | | Comparison with Ward (percent) |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | Average | |
| | | | 1947 | 1950 | 1951 | 1952 | | |
| Composite Cross Sel. | 7530 | Neb. | -- | 38 | 18 | 23 | 26 | 38 |
| Unnamed | 5087 | China | 23 | 28 | 25 | -- | 25 | 40 |
| Rokuben | 5135 | Korea | -- | -- | 21 | -- | 21 | 42 |
| Dobaku Sel. | ---- | Okla. | -- | -- | -- | 24 | 24 | 43 |
| Seibaku | 5229 | Korea | 19 | 32 | 25 | 30 | 27 | 44 |
| Unnamed | 4195-1 | China | -- | 24 | -- | -- | 24 | 47 |
| Colonial | 7570 | N. Car. | -- | 34 | 48 | -- | 41 | 56 |
| Kersho | 5232 | Korea | -- | 30 | -- | -- | 30 | 60 |
| Koso | 5134 | " | -- | 31 | -- | -- | 31 | 61 |
| Unnamed | 4195-2 | China | -- | 31 | -- | -- | 31 | 63 |
| Gubori | 5248 | Korea | -- | 33 | -- | -- | 33 | 67 |
| Tongubori | 5252 | " | -- | 34 | -- | -- | 34 | 67 |
| Abyssinian | 1231 | Ethiopia | 27 | -- | -- | -- | 27 | 68 |
| Son | 5148 | Korea | -- | 34 | -- | -- | 34 | 69 |
| Dorshu | 5154 | " | -- | 35 | -- | -- | 35 | 69 |
| Unnamed | 5092 | China | 27 | -- | -- | -- | 27 | 70 |
| Nu Er Ta | 741 | " | 29 | -- | -- | -- | 29 | 74 |
| Quinn | 1024 | Australia | -- | -- | 78 | -- | 78 | 80 |
| Lochink | 2460 | China | 32 | -- | -- | -- | 32 | 81 |
| Sunrise | 6272 | N. Carolina | -- | 41 | -- | -- | 41 | 82 |
| Sonbaku | 5151 | Korea | 33 | -- | -- | -- | 33 | 83 |
| Wong | 6728 | China | 33 | -- | -- | -- | 33 | 85 |
| Borido | 5236 | Korea | 34 | -- | -- | -- | 34 | 87 |
| Luth | 908 | Minn. | 35 | -- | -- | -- | 35 | 89 |
| Shumaki | 5222 | Korea | 35 | -- | -- | -- | 35 | 89 |
| Peru | 707 | N. Africa | 35 | -- | -- | -- | 35 | 90 |
| Michigan Winter | 2036 | Indiana | 39 | 43 | -- | -- | 41 | 92 |
| Fayette (Okla. Str.) | 245 | Okla. | 31 | -- | 96 | -- | 64 | 93 |
| Harbine | 7524 | " | -- | 43 | 97 | -- | 70 | 95 |
| Nassau | 7022 | New Jersey | 37 | -- | -- | -- | 37 | 95 |
| Besert 13 | 3899 | Tunis | -- | -- | 94 | -- | 94 | 96 |
| Tenkow | 646 | Maryland | 39 | 42 | 95 | 59 | 59 | 96 |
| Lico | 6279 | Colorado | -- | -- | 94 | -- | 94 | 97 |

**Table 4.—Concluded.**

| Variety | C.I. or selection no. | Source | Leaves injured (percent) | | | | | Comparison with Ward (percent) |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | Average | |
| | | | 1947 | 1950 | 1951 | 1952 | | |
| Tucker | 7039 | W. Va. | 38 | -- | -- | -- | 38 | 98 |
| Atlas | 4118 | Calif. | -- | -- | 97 | -- | 97 | 100 |
| Composite Cross Sel. | Wd. 35h10-2 | Okla. | -- | -- | 97 | -- | 97 | 100 |
| Okla. No. 1005 Sel. | 9174 | " | 40 | 47 | 100 | -- | 62 | 100 |
| Ward (check) | 6007 | " | 39 | 50 | 98 | 56 | 61 | 100 |
| Dinar | 729 | Tunis | -- | -- | 99 | -- | 99 | 101 |
| Besert 14 | 3900 | " | -- | -- | 99 | -- | 99 | 101 |
| Flynn I | 5911 | Oregon | 40 | -- | -- | -- | 40 | 102 |
| Calif. Mariout | 1455 | Egypt | -- | -- | 100 | -- | 100 | 102 |
| Black Smyrna | 191 | Asia Minor | -- | -- | 100 | -- | 100 | 102 |
| Composite Cross Sel. | 8061 | Okla. | -- | 52 | -- | -- | 52 | 104 |
| Smooth Awn 86 | 6268 | Virginia | 41 | -- | -- | -- | 41 | 104 |
| Reno | 6561 | Kansas | 42 | -- | -- | -- | 42 | 106 |
| Brier | 7157 | W. Virginia | 44 | -- | -- | -- | 44 | 112 |
| Beecher | 6566 | Colorado | 44 | -- | -- | -- | 44 | 113 |

**Table 5.—Greenbug injury to some of the more resistant spring-seeded barley varieties grown in unreplicated nursery plots at Stillwater and Lawton, Okla.**

| Variety* | C.I. No. | Source | Leaves injured (percent) | Comparison with Ward (percent) |
|---|---|---|---|---|
| Unnamed | 5093 | Korea | 20 | 21 |
| " | 4195 | China | 9 | 22 |
| Corbel | 1113 | " | 25 | 26 |
| Unnamed | 2269 | " | 30 | 31 |
| " | 5094 | Korea | 15 | 37 |
| " | 5095 | " | 16 | 39 |
| Shonuru | 5251 | " | 16 | 39 |
| Huwan | 1080 | China | 40 | 41 |
| Nunca | 2473 | " | 28 | 42 |
| Karubori | 5259 | Korea | 18 | 44 |
| Mignon | 999 | Russia | 24 | 58 |
| Arlington Awnless | 702 | _____ | 25 | 60 |

* Nunca, Mignon, and Arlington Awnless grown at Lawton in 1947, all others grown at Stillwater in 1950 or 1951.

**Table 6.—Yields of spring-seeded barley varieties grown in the absence of greenbug in 1950 and under a severe greenbug infestation in 1951 at Stillwater, Okla.**

| Variety | C.I. No. | 1950 | | 1951 | | 1951 | |
|---|---|---|---|---|---|---|---|
| | | Bushels | Rank | Bushels | Rank | Percent of leaves injured | Rank |
| Atlas | 4118 | 17.0 | 23 | 1.8 | 22 | 97 | 24 |
| Besert 13 | 3899 | 16.2 | 25 | 0.1 | 25 | 94 | 19 |
| Besert 14 | 3900 | 17.4 | 21 | 0.1 | 25 | 99 | 27 |
| Black Smyrna | 191 | 22.1 | 17 | 0.0 | 27 | 100 | 30 |
| Calif. Mariout | 1455 | 10.3 | 29 | 0.0 | 27 | 100 | 28 |
| Chosiz | 5227 | 25.0 | 9 | 20.1 | 6 | 21 | 10 |
| Colonial | 7570 | 19.7 | 18 | 14.6 | 15 | 48 | 17 |
| Composite Cross Sel. | 7530 | 17.2 | 22 | 19.8 | 8 | 18 | 6 |
| Dinar | 729 | 13.7 | 26 | 0.0 | 27 | 99 | 26 |
| Dobaku | 5238 | 22.5 | 16 | 23.4 | 4 | 20 | 9 |
| Fayette (check) | 245 | 25.4 | 7 | 5.9 | 17 | 96 | 22 |
| Gatami | 575 | 23.7 | 11 | 19.9 | 7 | 25 | 14 |
| Harbine (check) | 7524 | 26.3 | 5 | 5.8 | 18 | 97 | 23 |
| Koranbaku | 5253 | 23.1 | 13 | 21.8 | 5 | 16 | 2 |
| Kumflide | 730 | 13.2 | 27 | 9.1 | 16 | 30 | 15 |
| Lico | 6279 | 10.2 | 30 | 0.0 | 27 | 94 | 20 |
| Lopat | 2477 | 25.3 | 8 | 17.8 | 12 | 32 | 16 |
| Okla. No. 1005 Sel. | 9174 | 32.2 | 1 | 0.2 | 24 | 100 | 28 |
| Omugi | 5144 | 19.3 | 19 | 28.6 | 1 | 16 | 3 |
| Quinn | 1024 | 27.4 | 3 | 3.4 | 20 | 78 | 18 |
| Seibaku* | 5229 | 25.5 | 6 | 3.4 | 20 | 25 | 12 |
| Tenkow (check) | 646 | 26.4 | 4 | 5.7 | 19 | 95 | 21 |
| Tongpori | 5208 | 28.3 | 2 | 23.8 | 3 | 17 | 4 |
| Tongu | 5159 | 23.7 | 11 | 24.8 | 2 | 18 | 6 |
| Unnamed | 4202-1 | 17.8 | 20 | 18.2 | 11 | 15 | 1 |
| " | 4202-2 | 23.0 | 15 | 18.3 | 10 | 18 | 8 |
| " | 4243-1 | 12.5 | 28 | 15.7 | 13 | 24 | 11 |
| " | 5087 | 16.5 | 24 | 14.9 | 14 | 25 | 12 |
| " | 5096 | 23.1 | 13 | 19.7 | 9 | 17 | 4 |
| Ward (check) | 6007 | 24.7 | 10 | 1.2 | 23 | 98 | 25 |

* Poor emergence in 1951.

Table 7.—Distribution of individual $F_1$ hybrid and parent barley plants according to amount of growth during the period of infestation with greenbugs in the greenhouse at Stillwater, Okla., 1951. Figures indicate number of plants.

| Parent or cross | 2 cm. | 5 cm. | 8 cm. | 11 cm. | 14 cm. | 17 cm. | 20 cm. | 23 cm. | Total | Average (cm.) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Seeded on March 3** | | | | | | | | | | |
| Cross III: | | | | | | | | | | |
| Omugi | 1 | – | 3 | -- | -- | -- | -- | -- | 4 | 6 |
| Tenkow | 3 | 1 | – | -- | -- | -- | -- | -- | 4 | 2 |
| $F_1$ | 1 | 9 | 5 | -- | -- | -- | -- | -- | 15 | 5 |
| **Seeded on October 27** | | | | | | | | | | |
| Cross I: | | | | | | | | | | |
| Dobaku | – | – | – | -- | -- | 1 | 1 | -- | 2 | 18 |
| Ward | – | – | 1 | -- | 1 | -- | -- | -- | 2 | 11 |
| $F_1$ | – | 1 | 1 | 1 | 3 | -- | -- | -- | 6 | 11 |
| Cross III: | | | | | | | | | | |
| Omugi | – | – | – | 1 | 3 | -- | 1 | -- | 5 | 14 |
| Tenkow | – | 1 | 2 | 1 | 1 | -- | -- | -- | 5 | 9 |
| $F_1$ | – | – | – | 3 | 3 | 6 | 2 | 4 | 18 | 17 |
| Cross IV: | | | | | | | | | | |
| Omugi | – | – | – | -- | -- | 2 | 1 | -- | 3 | 18 |
| Ward | – | 1 | – | 2 | -- | -- | -- | -- | 3 | 9 |
| $F_1$ | – | – | – | 2 | 1 | -- | 4 | 8 | 15 | 20 |

Table 8.—Distribution of individual $F_1$ hybrid and parent barley plants according to accumulated tolerance rating during the period of infestation with greenbugs in the greenhouse at Stillwater, Okla., 1951. Figures indicate number of plants.

| Parent or cross | Accumulated rating class | | | | | | | | | | | | | | Total | Avg. rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 55 | 65 | 75 | 85 | 95 | 105 | 115 | 125 | 135 | 145 | 155 | 165 | 175 | 185 | | |
| **Seeded on March 3** | | | | | | | | | | | | | | | | |
| Cross III: | | | | | | | | | | | | | | | | |
| Omugi | – | – | – | – | 1 | – | – | – | 2 | 1 | – | – | – | – | 4 | 128 |
| Tenkow | – | – | 2 | – | 1 | 1 | – | – | – | – | – | – | – | – | 4 | 88 |
| $F_1$ | 2 | 2 | 1 | 1 | 2 | 4 | 2 | 1 | – | – | – | – | – | – | 15 | 91 |
| **Seeded on October 27** | | | | | | | | | | | | | | | | |
| Cross I: | | | | | | | | | | | | | | | | |
| Dobaku | – | – | – | – | – | – | – | 1 | – | – | 1 | – | – | – | 2 | 140 |
| Ward | – | – | 1 | – | 1 | – | – | – | – | – | – | – | – | – | 2 | 85 |
| $F_1$ | – | – | 2 | – | 1 | 1 | – | 1 | – | 1 | – | – | – | – | 6 | 103 |
| Cross III: | | | | | | | | | | | | | | | | |
| Omugi | – | – | – | – | – | 1 | 1 | – | 1 | 1 | – | 1 | – | – | 5 | 133 |
| Tenkow | – | – | 1 | – | 1 | – | 3 | – | – | – | – | – | – | – | 5 | 103 |
| $F_1$ | – | – | 2 | – | – | 1 | 2 | 4 | 2 | 4 | 2 | 1 | – | – | 18 | 128 |
| Cross IV: | | | | | | | | | | | | | | | | |
| Omugi | – | – | – | – | – | – | – | – | – | – | 3 | – | – | – | 3 | 155 |
| Ward | – | – | – | – | 2 | – | – | – | – | 1 | – | – | – | – | 3 | 112 |
| $F_1$ | – | – | 1 | – | – | – | 1 | – | – | – | 4 | 2 | 3 | 4 | 15 | 160 |

**Table 9.—Analyses of variance of parental and check data for each of the four crosses of the preference and tolerance tests at Stillwater, Okla., 1950-51. Unless noted otherwise, the mean squares for all varieties were significant at the 1-percent level.**

| Variation | Degrees of freedom | Mean squares | | |
|---|---|---|---|---|
| | | Preference | Accumulated rating | Amount of growth |
| **Cross I — Dobaku, Ward, and Omugi check** | | | | |
| Total | 119 | | | |
| Varieties | 2 | 4,727 | 19,128 | 1,182 |
| Errors | 78 | 429 | 542 | 26 |
| **Cross II — Dobaku, C.I. 5087, and Omugi check** | | | | |
| Total | 116 | | | |
| Varieties | 2 | 1,404 | 4,851 | 557 |
| Errors | 76 | 164 | 221 | 12 |
| **Cross III — Omugi and Tenkow** | | | | |
| Total | 77 | | | |
| Varieties | 1 | 6,647 | 17,490 | 786 |
| Errors | 38 | 207 | 248 | 17 |
| **Cross IV — Omugi and Ward** | | | | |
| Total | 73 (71)[1] | | | |
| Varieties | 1 ( 1) | 1,386[2] | 16,501 | 879 |
| Errors | 36 (35) | 429 | 289 | 14 |

[1] Degrees of freedom for the preference test. Because Omugi in one pot had no greenbugs on it during the 4-day period, this pot was omitted in the analysis.

[2] Not significant.

Table X. --Tolerance of Parent, Check, and $F_2$ Plants of Four Barley Crosses to Artificially Induced Greenbug Attack as Measured by the Accumulated Rating Test at Stillwater, Okla., 1950-51. Figures Indicate Number of Plants.

| Variety or cross | Accumulated rating classes | | | | | | | | | | | | | | | | | | | | | | | Total | Average rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 54 | 58 | 62 | 66 | 70 | 74 | 78 | 82 | 86 | 90 | 94 | 98 | 102 | 106 | 110 | 114 | 118 | 122 | 126 | 130 | 134 | 138 | | |
| Cross I: | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omugi (ck.) | - | - | - | - | - | - | - | - | - | - | - | - | (40) 1/ | - | - | - | - | - | - | - | - | - | - | 40 | 100 |
| Dobaku | - | - | - | - | - | - | - | - | - | 5 | - | 10 | 5 | 3 | 4 | 6 | 2 | 2 | 2 | 1 | - | - | - | 40 | 103 |
| Ward | 2 | 1 | 1 | 3 | 2 | 2 | 4 | 2 | 4 | 3 | 4 | 4 | 2 | 4 | - | 1 | - | - | 1 | - | - | - | - | 40 | 83 |
| $F_2$ | - | 1 | - | - | 3 | 2 | 3 | 2 | 5 | 13 | 14 | 34 | 26 | 27 | 26 | 4 | 2 | 9 | 3 | 3 | 1 | - | 1 | 199 | 100 |
| Cross II: | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omugi (ck.) | - | - | - | - | - | - | - | - | - | - | - | - | (40) 1/ | - | - | - | - | - | - | - | - | - | - | 40 | 100 |
| Dobaku | - | - | - | - | - | - | - | - | - | - | 1 | 4 | 10 | 6 | 10 | 5 | 2 | - | - | - | 1 | - | - | 39 | 104 |
| C.I. 5087 | - | 1 | - | - | - | - | 1 | 1 | 1 | 6 | 10 | 6 | 8 | 2 | 3 | - | - | - | - | - | - | - | - | 39 | 92 |
| $F_2$ | - | 1 | | - | - | 1 | 1 | - | 3 | 8 | 14 | 27 | 40 | 41 | 39 | 13 | 9 | 1 | 1 | 1 | - | - | - | 200 | 100 |

| Variety or cross | 102 | 106 | 110 | 114 | 118 | 122 | 126 | 130 | 134 | 138 | 142 | 146 | 150 | 154 | 158 | 162 | 166 | 170 | 174 | 178 | 182 | 186 | 190 | 194 | 198 | 202 | 206 | 210 | 214 | 218 | 222 | 226 | Total | Average rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cross III: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omugi | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 6 | 4 | 2 | 4 | 4 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 39 | 164 |
| Tenkow | 1 | - | 1 | - | 4 | 1 | 8 | 5 | 1 | 8 | 2 | 1 | 1 | 5 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 39 | 134 |
| $F_2$ | - | 2 | 2 | 1 | 1 | 2 | 2 | 5 | 12 | 13 | 17 | 19 | 21 | 22 | 22 | 18 | 18 | 12 | 13 | 9 | 4 | 2 | - | 3 | 1 | - | - | 1 | - | - | 1 | 4 | 227 | 156 |

| Variety or cross | 120 | 124 | 128 | 132 | 136 | 140 | 144 | 148 | 152 | 156 | 160 | 164 | 168 | 172 | 176 | 180 | 184 | 188 | 192 | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 | 240 | 244 | 248 | Total | Average rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cross IV: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omugi | - | 1 | - | - | 1 | - | 2 | 1 | 1 | - | 1 | 3 | 6 | 2 | 5 | 3 | 1 | 4 | 2 | - | - | 1 | - | 1 | - | - | - | - | - | - | 1 | - | 1 | 39 | 176 |
| Ward | 4 | 1 | 1 | 8 | 4 | 4 | 1 | - | 1 | 2 | 3 | 2 | - | 1 | 1 | - | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | 38 | 146 |
| $F_2$ | - | 1 | 1 | - | 2 | 2 | 4 | 8 | 8 | 11 | 15 | 13 | 12 | 27 | 30 | 20 | 21 | 13 | 11 | 3 | 9 | 1 | 3 | 2 | - | 1 | - | 1 | 2 | 2 | 1 | 3 | 6 | 233 | 178 |

1/ In percent of Omugi.

Table XI.--Tolerance of Parent, Check, and $F_2$ Plants of Four Barley Crosses to Artificially Induced Greenbug Attack as Measured by the Amount of Growth (in Percent of Omugi) During Infestation at Stillwater, Okla., 1950-51. Figures Indicate Number of Plants

| Variety or cross | Growth classes in centimeters | | | | | | | | | | | | | | | | | | | | | | | | | Total | Average growth (cm.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 15 | 25 | 35 | 45 | 55 | 65 | 75 | 85 | 95 | 105 | 115 | 125 | 135 | 145 | 155 | 165 | 175 | 185 | 195 | 205 | 215 | 225 | 235 | 245 | 255 | 265 | 275 | | |
| Cross I: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omugi (ck.) | - | - | - | - | - | - | - | - | (40) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 40 | 100 |
| Dobaku | - | - | - | - | - | 1 | - | 5 | 8 | 9 | 3 | 3 | 6 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | 1 | - | - | 40 | 116 |
| Ward | 2 | 2 | 4 | 3 | 7 | 4 | 4 | 5 | 4 | - | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | 40 | 72 |
| $F_2$ | - | - | - | 1 | 1 | 7 | 14 | 19 | 31 | 39 | 20 | 19 | 17 | 8 | 2 | 5 | 5 | 6 | 2 | - | - | - | - | - | 2 | 1 | - | 199 | 115 |
| Cross II: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Omugi (ck.) | - | - | - | - | - | - | - | - | (40) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 40 | 100 |
| Dobaku | - | - | - | - | - | 1 | 1 | 4 | 5 | 2 | 4 | 9 | 2 | 3 | 2 | 1 | - | 3 | - | - | - | 1 | - | - | 1 | - | - | 39 | 126 |
| C.I. 5087 | 1 | 1 | 1 | 1 | 5 | 10 | 8 | 3 | 4 | - | 1 | 1 | - | - | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | 39 | 78 |
| $F_2$ | - | - | - | 7 | 9 | 9 | 20 | 27 | 32 | 20 | 24 | 19 | 8 | 7 | - | 2 | 2 | 2 | 1 | 1 | 3 | 6 | - | - | - | - | 1 | 200 | 107 |

| Variety or cross | 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 | Total | Average growth (cm.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cross III. | | | | | | | | | | | | | | | | | | |
| Omugi | - | 1 | 1 | 1 | 2 | 2 | 6 | 6 | 6 | 5 | 4 | 1 | 1 | 2 | - | 1 | 39 | 17 |
| Tenkow | 1 | 2 | 3 | 6 | 8 | 13 | 1 | 2 | 1 | 1 | - | 1 | - | - | - | - | 39 | 10 |
| $F_2$ | 1 | 2 | 9 | 14 | 40 | 43 | 35 | 26 | 15 | 16 | 4 | 11 | 3 | 3 | 3 | 2 | 227 | 14 |
| Cross IV | | | | | | | | | | | | | | | | | | |
| Omugi | - | - | - | - | 2 | 2 | 4 | 4 | 10 | 6 | 2 | 1 | 2 | 3 | 1 | - | 37 | 18 |
| Ward | - | 1 | 4 | 3 | 8 | 9 | 3 | 5 | 3 | 1 | - | - | - | - | - | - | 39 | 11 |
| $F_2$ | - | 1 | 1 | 2 | 6 | 15 | 35 | 32 | 34 | 44 | 27 | 14 | 11 | 8 | - | 3 | 233 | 18 |

**Table 12.—Inheritance of resistance in four winter barley crosses to manual infestation of greenbugs at Stillwater, Okla., 1950-51.**

| Test | Resistant plants (no.) | | Susceptible plants (no.) | | Chi square | P value |
|---|---|---|---|---|---|---|
| | Observed | Expected | Observed | Expected | | |
| **Cross I — Dobaku X Ward (13:3)** | | | | | | |
| Accumulated rating | 156 | 160 | 43 | 39 | 0.510 | 0.30-0.50 |
| Amount of growth | 162 | 160 | 37 | 39 | 0.128 | 0.50-0.70 |
| **Cross II — Dobaku X C.I. 5087 (3:1)** | | | | | | |
| Accumulated rating | 146 | 150 | 54 | 50 | 0.427 | 0.50-0.70 |
| Amount of growth | 145 | 150 | 55 | 50 | 0.667 | 0.30-0.50 |
| **Cross III — Omugi X Tenkow (9:7)** | | | | | | |
| Accumulated rating | 136 | 128 | 91 | 99 | 1.146 | 0.20-0.30 |
| Amount of growth | 122 | 128 | 105 | 99 | 0.645 | 0.30-0.50 |
| **Cross IV — Omugi X Ward (3:1)** | | | | | | |
| Accumulated rating | 181 | 175 | 52 | 58 | 0.827 | 0.30-0.50 |
| Amount of growth | 173 | 175 | 60 | 58 | 0.092 | 0.70-0.80 |

Table 13.—Reaction of some of the more resistant varieties and hybrids of wheat and rye in order of tolerance to greenbugs in greenhouse tests at Stillwater, Okla., 1947-53.

| Variety, hybrid, or species[1] | C.I., P.I., or selection number | Source | Preference | | Tolerance Tests | | | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | One[2] | | Two[3] | | | | |
| | | | Greenbugs per plant (No.) | Comparison with Pawnee (%) | Plant life (Days) | Comparison with Pawnee (%) | Plant life (Days) | Comparison with Pawnee (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Pawnee (%) |
| *Triticum vulgare:* | | | | | | | | | | | |
| National No. 62 | 149107 | China | 7 | 55 | -- | -- | 18 | 130 | -- | 15 | 94 |
| Saline | 12674 | Illinois | 7 | 19 | -- | -- | 20 | 130 | 66 | 14 | 118 |
| Martin | 4636 | Washington | 7 | 81 | -- | -- | 13 | 129 | -- | 15 | 76 |
| Purple Straw | 1915 | Russia | 8 | 18 | -- | -- | 19 | 125 | 44 | 10 | 82 |
| Anderson | 12536 | U. S. D. A. | 9 | 52 | -- | -- | 17 | 124 | 82 | 17 | 100 |
| Tsing-Yong 302 | 149112 | China | 9 | 86 | -- | -- | 19 | 122 | -- | 16 | 100 |
| Blue Jacket | 12502 | Kansas | 8 | 66 | -- | -- | 11 | 121 | -- | 22 | 100 |
| Nanking | 124364 | China | 7 | 98 | -- | -- | 12 | 121 | -- | 15 | 75 |
| Chey.-Tq. x Mqo.-Oro | Ks. Sel. 45618 | Kansas | 9 | 89 | -- | -- | 11 | 121 | -- | 21 | 99 |
| Chancellor | 12333 | Georgia | 19 | 49 | -- | -- | 19 | 120 | 69 | 14 | 114 |
| Chey. x Turkey | 12142 | Nebraska | 9 | 88 | -- | -- | 10 | 119 | -- | 14 | 72 |
| Fulcaster | 6471 | Kansas | 8 | 66 | -- | -- | 12 | 119 | -- | 21 | 97 |
| Mqo. x Oro | 37RN1433-6 | " | 9 | 69 | -- | -- | 18 | 118 | -- | 17 | 107 |
| Hope | 8178 | S. Dakota | 25 | 63 | -- | -- | 13 | 118 | -- | 24 | 109 |
| Chey. x Tq. | 11972 | Kansas | 7 | 69 | -- | -- | 12 | 118 | -- | 19 | 87 |
| National No. 483 | 149109 | China | 7 | 62 | -- | -- | 19 | 118 | -- | 15 | 97 |
| Nanking No. 360 | 124332 | China | 10 | 90 | -- | -- | 11 | 117 | -- | 17 | 78 |
| Minhardi | 5149 | Minnesota | 8 | 100 | -- | -- | 11 | 117 | -- | 16 | 80 |
| Paw. x Oro | Wd. 44h1-34 | Oklahoma | 9 | 80 | -- | -- | 12 | 116 | -- | 19 | 88 |
| Kaw.-Mqo. x Kaw.-Tq. | 12331 | Kansas | 9 | 67 | -- | -- | 16 | 116 | -- | 15 | 99 |
| Nanking No. 22-14 | 124363 | China | 7 | 81 | -- | -- | 11 | 115 | -- | 16 | 80 |
| Nanking No. 68 | 124279 | " | 7 | 66 | -- | -- | 11 | 115 | -- | 15 | 73 |
| Med.-Hope x Paw. | 12141 | Kansas | 8 | 67 | -- | -- | 11 | 115 | -- | 18 | 82 |

**Table 13.—Continued.**

| Variety, hybrid, or species[1] | C.I., P.I., or selection number | Source | Preference | | Tolerance Tests | | | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | One[2] | | Two[3] | | | | |
| | | | Green-bugs per plant (No.) | Com-parison with Pawnee (%) | Plant life (Days) | Com-parison with Pawnee (%) | Plant life (Days) | Com-parison with Pawnee (%) | | Nymphs produced per female in 7 days (No.) | Com-parison with Pawnee (%) |
| *Triticum vulgare*—continued | | | | | | | | | | | |
| Comanche | 11673 | Kansas | 7 | 89 | -- | -- | 16 | 113 | -- | 16 | 81 |
| Seu-seun No. 3 | 157590 | Korea | 17 | 106 | 22 | 122 | 16 | 112 | 34 | 18 | 66 |
| Norin No. 10 | 156641 | Japan | 25 | 70 | 23 | 100 | 16 | 111 | 97 | -- | -- |
| Triumph | 12132 | Okla. | 8 | 105 | -- | -- | 14 | 110 | -- | 14 | 72 |
| Seu-seun No. 4 | 157591 | Korea | 24 | 65 | 22 | 121 | 19 | 109 | 35 | 14 | 52 |
| Clarkan | 8858 | Kansas | 8 | 83 | -- | -- | 13 | 108 | 41 | 14 | 70 |
| Norin No. 50 | 155271 | Japan | 18 | 97 | 23 | 137 | 17 | 107 | 42 | 14 | 105 |
| Seu-seun No. 1 | 157588 | Korea | 19 | 105 | 19 | 104 | 18 | 107 | 94 | 19 | 77 |
| Seu-seun No. 8 | 157595 | " | 17 | 66 | 21 | 119 | 17 | 106 | 30 | 18 | 68 |
| Norin No. 27 | 182581 | Japan | 31 | 122 | 29 | 100 | 18 | 105 | 95 | 12 | 100 |
| Kang-To-Shin-Ryac | 157568 | Korea | 27 | 143 | 21 | 90 | 17 | 104 | 86 | 20 | 136 |
| Norin No. 24 | 182585 | Japan | 22 | 118 | 27 | 95 | 19 | 103 | 80 | 9 | 70 |
| Norin No. 17 | 182587 | " | 17 | 76 | 27 | 91 | 19 | 103 | 85 | 14 | 119 |
| Westar | 12110 | Texas | 7 | 88 | -- | -- | 14 | 103 | -- | 11 | 57 |
| Nang-Rim No. 17 | 157578 | Korea | 32 | 73 | 20 | 86 | 16 | 103 | 83 | 16 | 121 |
| Saitama | 155279 | Japan | 16 | 95 | 26 | 132 | 16 | 103 | 93 | 12 | 81 |
| Seu-seun No. 10 | 157597 | Korea | 21 | 92 | 22 | 121 | 16 | 102 | 25 | 18 | 68 |
| Seu-seun No. 2 | 157589 | " | 18 | 89 | 23 | 126 | 18 | 102 | 55 | 19 | 72 |
| Wichita | 11952 | Kansas | 6 | 80 | -- | -- | 14 | 101 | -- | 13 | 67 |
| Norin No. 61 | 182591 | Japan | 17 | 69 | 27 | 95 | 19 | 101 | 83 | 9 | 80 |
| Pawnee | 11669 | Neb. | 18 | 100 | 27 | 100 | 17 | 100 | 50 | 20 | 100 |
| Norin No. 25 | 182582 | " | 23 | 103 | 27 | 92 | 19 | 99 | 86 | 13 | 115 |
| Norin No. 67 | 155277 | " | 25 | 114 | 25 | 126 | 17 | 99 | 55 | 9 | 55 |
| Suwon No. 95 | 157690 | Korea | 22 | 100 | 21 | 121 | 20 | 97 | 42 | 18 | 60 |
| Norin No. 26 | 155266 | Japan | 17 | 143 | 23 | 120 | 18 | 96 | 36 | 10 | 61 |
| Norin No. 36 | 182571 | " | 33 | 153 | 20 | 93 | 18 | 96 | 94 | 12 | 104 |

**Table 13.—Continued.**

| Variety, hybrid, or species[1] | C.I., P.I., or selection number | Source | Preference | | Tolerance Tests | | | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | One[2] | | Two[3] | | | | |
| | | | Greenbugs per plant (No.) | Comparison with Pawnee (%) | Plant life (Days) | Comparison with Pawnee (%) | Plant life (Days) | Comparison with Pawnee (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Pawnee (%) |
| *Triticum vulgare*—continued | | | | | | | | | | | |
| Nang-Rim No. 38 | 157581 | Korea | 22 | 113 | 23 | 99 | 17 | 95 | 83 | 16 | 112 |
| Lochiga Sakitori I | 182578 | Japan | 29 | 174 | 20 | 94 | 182 | 94 | 88 | 13 | 114 |
| Tenmarq | 6936 | Kansas | 11 | 143 | -- | -- | 12 | 94 | -- | 12 | 61 |
| Ponca | 12128 | Kan.-Okla. | 9 | 95 | -- | -- | 11 | 93 | -- | 20 | 96 |
| Cheyenne | 8885 | Neb. | 15 | 114 | -- | -- | 13 | 93 | -- | 13 | 68 |
| Haya Komugi | 182565 | Japan | 35 | 106 | 20 | 94 | 17 | 93 | 95 | 13 | 102 |
| Norin No. 43 | 182586 | " | 21 | 140 | 29 | 100 | 18 | 92 | 80 | 11 | 90 |
| *Triticum macha* | P-49-79.2-2 | | 7 | 26 | -- | -- | 24 | 111 | 75 | 10 | 111 |
| *Triticum spelta* | P-50-70.1-1 | | 15 | 84 | -- | -- | 23 | 98 | 87 | 10 | 111 |
| *Triticum vavilovi* | P-49-79.2-2 | | 21 | 73 | -- | -- | 24 | 112 | 86 | -- | --- |
| Belagatch | 3643 | Russia | 11 | 36 | 24 | 88 | 23 | 136 | 46 | 8 | 85 |
| Golden Ball | 5059 | Africa | 9 | 32 | -- | -- | 18 | 135 | -- | -- | --- |
| Kubanka | 2094 | Russia | 11 | 67 | 31 | 78 | 20 | 135 | 38 | 10 | 121 |
| Kahla | 2088 | Algeria | 16 | 39 | 31 | 80 | 22 | 133 | 35 | 14 | 117 |
| Dur-Oran | 3986 | " | 17 | 51 | -- | -- | 21 | 132 | -- | -- | --- |
| Mahmoudi | 3816 | Tunis | 11 | 33 | 28 | 112 | 22 | 131 | 16 | 4 | 50 |
| Minieh | 1751 | Egypt | 18 | 80 | 42 | 105 | 22 | 131 | 50 | 15 | 125 |
| Unnamed | 3649 | Turkestan | 16 | 38 | 23 | 84 | 21 | 126 | 59 | 12 | 118 |
| " | 3766 | Russia | 12 | 32 | 25 | 91 | 19 | 125 | 53 | 10 | 109 |
| Durum No. 4 | 3321 | N. Dak. | 8 | 18 | -- | -- | 21 | 125 | 69 | 7 | 73 |
| Mahmoudi | 3809 | Tunis | 16 | 60 | 21 | 82 | 20 | 124 | -- | 12 | 174 |
| Unnamed | 3856 | Algeria | 15 | 55 | -- | -- | 20 | 123 | 53 | -- | --- |
| Pentad | 3322 | N. Dak. | 11 | 28 | 29 | 112 | 20 | 123 | 51 | 5 | 60 |

**Table 13.—Continued.**

| Variety, hybrid, or species[1] | C.I., P.I., or selection number | Source | Preference | | Tolerance Tests | | | | | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | One[2] | | Two[3] | | | | |
| | | | Green-bugs per plant (No.) | Com-parison with Pawnee (%) | Plant life (Days) | Com-parison with Pawnee (%) | Plant life (Days) | Com-parison with Pawnee (%) | Growth factor | Nymphs produced per female in 7 days (No.) | Com-parison with Pawnee (%) |
| *Triticum durum*-continued | | | | | | | | | | | |
| Unnamed | 4526 | India | 9 | 23 | -- | -- | 18 | 122 | -- | -- | --- |
| Kubanka | 2234 | Russia | 16 | 96 | 31 | 78 | 19 | 122 | 47 | 9 | 100 |
| Jalalia | 4563 | India | 20 | 86 | -- | -- | 23 | 122 | -- | -- | --- |
| Howrah | 4562 | " | 23 | 65 | -- | -- | 18 | 121 | 57 | -- | --- |
| Unnamed | 2431 | Egypt | 15 | 41 | 32 | 79 | 17 | 120 | 52 | 5 | 50 |
| Agini | 3845 | Algeria | 9 | 42 | -- | -- | 23 | 120 | -- | -- | --- |
| " | 3844 | " | 6 | 18 | -- | -- | 19 | 119 | -- | -- | --- |
| " | 4587 | Africa | 13 | 69 | -- | -- | 22 | 119 | -- | -- | --- |
| Unnamed | 3984 | Tunis | 9 | 32 | -- | -- | 20 | 118 | -- | -- | --- |
| " | 3656 | Japan | 10 | 24 | 23 | 79 | 22 | 118 | 49 | 17 | 150 |
| " | 3160 | Tunis | 13 | 66 | 32 | 103 | 25 | 118 | 90 | 7 | 81 |
| Missogen | 2468 | Germany | 18 | 78 | 36 | 111 | 19 | 118 | 25 | 10 | 59 |
| Tigharia | 4564 | India | 21 | 90 | -- | -- | 23 | 118 | 45 | -- | --- |
| Unnamed | 3647 | Turkestan | 13 | 25 | 25 | 91 | 17 | 117 | -- | 14 | 149 |
| Beliouni | 3848 | Algeria | 12 | 42 | -- | -- | 22 | 117 | -- | -- | --- |
| Realforte | 3813 | Tunis | 15 | 51 | 27 | 102 | 19 | 116 | 65 | 9 | 88 |
| Unnamed | 3158 | " | 15 | 95 | 26 | 81 | 24 | 116 | 31 | 9 | 88 |
| Candeal | 4524 | Philippines | 13 | 87 | -- | -- | 20 | 116 | -- | -- | --- |
| Unnamed | 3162 | Tunis | 17 | 111 | 27 | 90 | 23 | 116 | 22 | 10 | 131 |
| Velvet Don | 2122 | Russia | 9 | 54 | 27 | 66 | 19 | 115 | 42 | 12 | 100 |
| Unnamed | 4525 | India | 12 | 34 | -- | -- | 18 | 115 | -- | -- | --- |
| " | 3117 | Tunis | 5 | 50 | 28 | 109 | 20 | 113 | 30 | 9 | 46 |
| Saragolla | 2228 | Italy | 12 | 57 | 38 | 95 | 20 | 112 | 92 | 9 | 111 |
| Mahmoudi | 3824 | Tunis | 6 | 28 | -- | -- | 21 | 109 | -- | -- | --- |

**Table 13.—Continued.**

| Variety, hybrid, or species[1] | C.I., P.I., or selection number | Source | Preference | | Tolerance Tests | | | | | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Greenbugs per plant (No.) | Comparison with Pawnee (%) | Plant life (Days) | Comparison with Pawnee (%) | Plant life (Days) | Comparison with Pawnee (%) | Growth factor | Nymphs produced per female in 7 days (No.) | Comparison with Pawnee (%) |
| *Triticum durum - continued* | | | | | | | | | | | |
| Dickinson No. 485 | 3707 | N. Dak. | 6 | 37 | 29 | 118 | 21 | 108 | 88 | 9 | 88 |
| Kubanka | 3303 | Russia | 7 | 57 | 29 | 100 | 24 | 107 | 36 | 6 | 47 |
| Unnamed | 5143 | Spain | 9 | 29 | -- | -- | 16 | 105 | -- | -- | --- |
| " | 3146 | Tunis | 21 | 105 | 32 | 103 | 19 | 104 | -- | 6 | 44 |
| " | 3141 | Tunis | 16 | 75 | 27 | 109 | 22 | 102 | 42 | 8 | 45 |
| Penquite | 3068 | Abyssinia | 11 | 41 | 30 | 115 | 22 | 102 | 68 | 8 | 48 |
| Unnamed | 3136 | Spain | 15 | 88 | 29 | 113 | 21 | 101 | 56 | 8 | 48 |
| " | 3069 | Abyssinia | 12 | 70 | 32 | 121 | 21 | 90 | 70 | 7 | 41 |
| Number 7 | 3323 | N. Dak. | 8 | 21 | 28 | 102 | 20 | 88 | 68 | 9 | 103 |
| Adjini | 1594 | Algeria | 16 | 125 | 39 | 121 | 17 | 87 | 32 | 13 | 96 |
| Kubanka | 1354 | Russia | 9 | 51 | 40 | 123 | 16 | 85 | 31 | 9 | 56 |
| *Triticum persicum* | P-50-53-2 | -?- | 12 | 56 | -- | -- | 23 | 107 | 92 | -- | --- |
| Triticum polonicum | 70738 | -?- | 4 | 13 | -- | -- | 20 | 117 | 76 | 9 | 77 |
| *Triticum pyramidale* | | | | | | | | | | | |
| Beladi | 7265-5 | Egypt | 14 | 45 | -- | -- | 21 | 119 | 90 | 9 | 78 |
| *Triticum turgidum* | | | | | | | | | | | |
| Gaza 277 | 12616 | Egypt | 13 | 62 | -- | -- | 22 | 121 | 81 | 12 | 96 |
| Barrigon yaqui 52 | ----- | Mexico | 14 | 86 | -- | -- | 21 | 102 | 90 | 10 | 86 |
| *Triticum monococcum* | 119422 | Turkey | 13 | 58 | -- | -- | 22 | 123 | 55 | 10 | 83 |
| *Triticum monococcum* | 94743 | Russia | 16 | 73 | -- | -- | 19 | 101 | 95 | 14 | 118 |
| *Intergeneric hybrids* | | | | | | | | | | | |
| Rye x Wheat | Wd. 44h4-3 | Okla. | 8 | 61 | -- | -- | 13 | 122 | -- | 5 | 21 |
| Chinese Rye x *A. elong.* x Fwd. | Ks. 46-411 | Kansas | 18 | 93 | -- | -- | 15 | 119 | -- | -- | --- |
| Rye x Wheat | Wd. 44h4-14 | Okla. | 11 | 67 | 28 | 112 | 14 | 115 | -- | 9 | 53 |

**Table 13.—Concluded.**

| Variety, hybrid, or species[1] | C.I., P.I., or selection number | Source | Preference | | Tolerance Tests | | | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | One[2] | | Two[3] | | | | |
| | | | Green-bugs per plant (No.) | Com-pari-son with Pawnee (%) | Plant life (Days) | Com-pari-son with Pawnee (%) | Plant life (Days) | Com-pari-son with Pawnee (%) | | Nymphs produced per female in 7 days (No.) | Com-pari-son with Pawnee (%) |
| *Triticum-A. elong.* x Paw. $F_5$ | 515921 | Okla. | 18 | 38 | 22 | 89 | 16 | 115 | 32 | 17 | 138 |
| Rye x Wheat | Wd. 44h4-19 | " | 13 | 70 | -- | -- | 14 | 114 | 18 | 6 | 33 |
| *Triticum-A. elong.* x Paw. $F_5$ | 516218 | " | 26 | 135 | 28 | 105 | 22 | 106 | 90 | 10 | 100 |
| *Triticum-A. elong.* x Paw. $F_5$ | 516241 | " | 41 | 145 | 28 | 108 | 19 | 106 | 95 | 12 | 118 |
| *Triticum-A. elong.* x Paw. $F_5$ | 516224 | " | 14 | 185 | 28 | 105 | 23 | 104 | 95 | 12 | 118 |
| *Secale cereale* | | | | | | | | | | | |
| Balbo rye | ------ | Italy | 7 | 74 | -- | -- | 14 | 124 | -- | 22 | 100 |
| Abruzzi rye | ------ | " | 8 | 66 | -- | -- | 12 | 115 | -- | 22 | 96 |

[1] Abbreviations used in this table: *A. elong.* = *Agropyron elongatum*, Chey. = Cheyenne, Fwd. = Forward, Med. = Mediterranean, Mqo. = Marquillo, Paw. = Pawnee, and Tq. = Tenmarq.
[2] Original infestation one winged adult per plant.
[3] Original infestation five nymphs per plant.

**Table 14.—Tolerance of some of the more resistant varieties and hybrids of wheat and rye to greenbugs in the insectary at Stillwater, Okla., 1952-53.**

| Variety or hybrid* | C.I. or selection number | Source | Tolerance | |
|---|---|---|---|---|
| | | | Plant life (Days) | Comparison with Pawnee (%) |
| *Triticum vulgare:* | | | | |
| Chiefkan X Oro-Tenmarq | 12518 | Kansas | 20 | 139 |
| New Chief | 12714 | " | 19 | 134 |
| Red Jacket | 12713 | " | 21 | 123 |
| Double Cross | 12504 | Texas | 17 | 120 |
| Marquillo-Oro X Comanche | Stw. 484233 | Oklahoma | 22 | 118 |
| Mediterranean-Hope X Fulcaster | Tex. 114-44-75 | Texas | 21 | 116 |
| Hard Federation Hybrid | 12515 | Oklahoma | 26 | 116 |
| Double Cross | 12511 | Texas | 16 | 116 |
| *Triticum compactum:* | | | | |
| Elgin | 11755 | Wash. State | 23 | 123 |
| Hymar | 11605 | " | 22 | 120 |
| *Triticum durum:* | | | | |
| Dickinson No. 485 | 3707 | N. Dak. | 29 | 170 |
| Sbei | 4588 | Africa | 18 | 129 |
| " | 4586 | " | 17 | 128 |
| Marsters Perfection | 4726 | Australia | 28 | 127 |
| Mahmoudi | 3816 | Tunis | 15 | 126 |
| Lenah Khetifa | 4585 | Africa | 17 | 125 |
| Jalalia | 4563 | India | 16 | 122 |
| Unnamed | 3166 | Tunis | 13 | 116 |
| " | 4526 | India | 14 | 115 |
| *Intergeneric hybrids:* | | | | |
| Chinese Rye X *A. elong.* X Fwd.* | Kansas 46-411 | Kansas | 19 | 132 |
| *Secale cereale:* | | | | |
| Tetraploid Rye (Tetra Petkus) | ---- | Germany | 22 | 122 |

* Abbreviations used in this table: *A. elong.* = *Agropyron elongatum,* Fwd. =Forward.

Table 15.—Greenbug injury to spring-seeded winter wheat varieties and hybrids in natural infestations at Lawton and Stillwater, Okla., 1947, 1950-52.

| Variety or hybrid* | C.I., P.I., or selection number | Source | Percent of leaves injured | | | | | Comparison with Pawnee |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | Average | |
| | | | 1947 | 1950 | 1951 | 1952 | | |
| Nanking No. 66 | 124278 | China | 25 | -- | -- | -- | 25 | 68 |
| Hope | 8178 | N. Dak. | 27 | -- | -- | -- | 27 | 73 |
| Com. x Med.-Hope | 12513 | Texas | -- | 21 | -- | -- | 21 | 75 |
| (Sinv.-Wich. x Hope-Chey.) x Wich. | 12703 | " | -- | 21 | -- | -- | 21 | 75 |
| Timstein x (Mqo.-Oro x Kaw.-Tq.) | Stw. 516625 | Okla. | -- | -- | -- | 37 | 37 | 77 |
| Nanking No. 389 | 124339 | China | 29 | -- | -- | -- | 29 | 77 |
| Nanking No. 394 | 124341 | " | 29 | -- | -- | -- | 29 | 78 |
| Bkhl.-Oro x Paw. | Wd. 46A-174 | Okla. | 29 | -- | -- | -- | 29 | 78 |
| Mqo. x Oro | 11979 | Kansas | 29 | -- | -- | -- | 29 | 78 |
| Timstein x (Mqo.-Oro x Kaw.-Tq.) | Stw. 516645 | Okla. | -- | -- | -- | 39 | 39 | 80 |
| Med.-Hope x Paw.$_2$ | 12141 | Kansas | 30 | -- | -- | -- | 30 | 80 |
| Seabreeze | 12611 | Texas | -- | 21 | 79 | 40 | 47 | 81 |
| Martin | 4636 | Wash. | 30 | -- | -- | -- | 30 | 81 |
| Mqo.-Oro x Com. | Ks. 2796 | Kansas | 31 | -- | -- | -- | 31 | 84 |
| Reliant | 12144 | Okla. | 31 | -- | -- | -- | 31 | 84 |
| Timstein x (Mqo.-Oro x Kaw.-Tq.) | Stw. 516617 | " | -- | -- | -- | 41 | 41 | 84 |
| Quivira x Tq. | 12116 | Kansas | 32 | -- | -- | -- | 32 | 85 |
| (Kaw.-Mqo. x Tq.) x (Med.-Hope x Paw.) | Stw. 484129 | " | -- | 24 | 85 | 40 | 50 | 86 |
| Bkhl.-Oro x Paw. | Wd. 46h-114 | " | 32 | -- | -- | -- | 32 | 86 |
| Mqo. x Oro | 11980 | Kansas | 32 | -- | -- | -- | 32 | 86 |
| Denton | 8265 | Texas | 33 | 19 | 90 | 42 | 46 | 87 |
| Timstein x (Mqo.-Oro x Kaw.-Tq.) | Stw. 516628 | Okla. | -- | -- | -- | 43 | 43 | 88 |
| Chiefkan | 11754 | Kansas | 33 | -- | -- | -- | 33 | 88 |
| Clarkan | 8858 | " | 33 | -- | -- | -- | 33 | 89 |
| Nebred x Med.-Hope | Okla. 42 | Okla. | 33 | -- | -- | -- | 33 | 89 |
| Bkhl. x Chey. | 12101 | Kansas | 33 | -- | -- | -- | 33 | 89 |
| Kanred | 5146 | " | 33 | -- | -- | -- | 33 | 89 |
| Mqo.-Oro x Pawnee | Stw. 484117 | Okla. | -- | 25 | -- | -- | 25 | 89 |
| Nanking No. 345 | 124326 | China | 33 | -- | -- | -- | 33 | 89 |
| Fultz x Hungarian | 12017 | Ind. | 34 | -- | -- | -- | 34 | 90 |
| (Sinv.-Wich. x Hope-Chey.) x Wich. | 12702 | Texas | -- | 19 | 91 | 48 | 53 | 91 |

**Table 15.—Continued.**

| Variety or hybrid* | C.I., P.I., or selection number | Source | Percent of leaves injured | | | | | Comparison with Pawnee |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | | |
| | | | 1947 | 1950 | 1951 | 1952 | Average | |
| Com. x Bkhl.-Hd. Fed. | Wd. 43h2-329 | Okla. | 34 | -- | -- | -- | 34 | 91 |
| Fulcaster | 6471 | Kansas | 34 | -- | -- | -- | 34 | 91 |
| Bkhl.-Oro x Paw. | Wd. 43h1-61 | Okla. | 34 | -- | -- | -- | 34 | 92 |
| Chey. x Tq. | 11972 | Kansas | 34 | -- | -- | -- | 34 | 92 |
| Kan. x Hope-Hd. Fed. | 12135 | Colo. | 34 | -- | -- | -- | 34 | 92 |
| Minhardi | 5149 | Minn. | 34 | -- | -- | -- | 34 | 92 |
| Nanking No. 124 | 124364 | China | 34 | -- | -- | -- | 34 | 92 |
| (Kan. x Hd. Fed. x Tq.) x (Com. x Ks. Hope-Hussar) $F_6$ | 1825-2 | Kansas | -- | -- | 91 | -- | 91 | 93 |
| Blue Jacket | 12502 | " | 36 | 22 | 94 | -- | 51 | 93 |
| Tenmarq | 6936 | " | 35 | -- | -- | -- | 35 | 93 |
| (Kan.-Hd. Fed. x Tq.) x (Com. x Hope-Hussar) | Stw. 516797 | Okla. | -- | -- | -- | 45 | 45 | 93 |
| Mqo.-Oro x Com. | Stw. 484243 | " | -- | 20 | 97 | -- | 59 | 93 |
| Wich. x Mqo.-Oro | Wd. 487025 | " | -- | 22 | 95 | -- | 59 | 93 |
| Med.-Hope x Med. | Tex. 97-38-7-2 | Texas | -- | 24 | 94 | -- | 59 | 94 |
| (Med. 5993-23 x Hd. Fed.) x Hope-Med. 41-8-3) | Stw. 484254 | Okla. | -- | 22 | 96 | -- | 59 | 94 |
| Quivira x (Kan.-Hd. Fed. x Prelude-Kan.) | 12525 | Kansas | -- | -- | 92 | -- | 92 | 94 |
| Hard Federation Hybrid | 12515 | Okla. | -- | -- | 92 | -- | 92 | 94 |
| Double Cross | 12504 | Texas | -- | -- | 92 | -- | 92 | 94 |
| Quanah | 12145 | " | -- | 28 | 91 | -- | 59 | 94 |
| Sinv.-Wich. x Hope-Chey. | 12701 | " | -- | 25 | 93 | 47 | 55 | 94 |
| Early Blackhull | 8856 | Kansas | 32 | -- | 95 | -- | 64 | 94 |
| Kaw.-Mqo. x Kaw.-Tq. | Ks. 2793 | " | 35 | -- | -- | -- | 35 | 95 |
| Mqo.-Oro x Paw. | Ks. 462676 | " | -- | 22 | 97 | -- | 60 | 95 |
| Nanking No. 248 | 124316 | China | 35 | -- | -- | -- | 35 | 95 |
| Timstein x (Mqo.-Oro x Kan.-Tq.) | Stw. 516644 | Okla. | -- | -- | -- | 46 | 46 | 95 |
| Com. x Bkhl.-Hd. Fed. | 12710 | " | -- | -- | 93 | -- | 93 | 95 |
| (Hope-Turkey x Turkey) x Com. | Wd. 487074 | " | -- | 27 | -- | -- | 27 | 95 |
| Ponca | 12128 | Ks. & Okla. | 33 | -- | 96 | -- | 64 | 95 |
| Mqo. x Oro x Eureka | Stw. 484282 | Okla. | -- | 27 | -- | -- | 27 | 95 |
| Med. Sel. x Hope-Med. | Tex. 98-40-118-5 | Texas | -- | 27 | -- | -- | 27 | 95 |

**Table 15.—Continued.**

| Variety or hybrid* | C.I., P.I., or selection number | Source | Percent of leaves injured | | | | | Comparison with Pawnee |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | | |
| | | | 1947 | 1950 | 1951 | 1952 | Average | |
| Bkhl.-Oro x Paw. | Wd. 43h1-86 | Okla. | 36 | -- | -- | -- | 36 | 96 |
| " | Wd. 43h1-94 | " | 36 | -- | -- | -- | 36 | 96 |
| Hope x Chey. | 11969 | Neb. | 36 | -- | -- | -- | 36 | 96 |
| Kan. x Hope-Hd. Fed. | 12136 | Colo. | 36 | -- | -- | -- | 36 | 96 |
| Kawvale | 8180 | Kansas | 36 | -- | -- | -- | 36 | 96 |
| Kaw.-Mqo. x Kaw.-Tq. | 12331 | " | 36 | -- | -- | -- | 36 | 96 |
| Red Chief | 12109 | " | 36 | -- | 95 | -- | 65 | 96 |
| Wich. x Mqo.-Oro | Wd. 487067 | Okla. | -- | 25 | 96 | -- | 60 | 96 |
| Com. x Med.-Hope | 12514 | Texas | -- | 27 | -- | -- | 27 | 96 |
| Blackhull | 6251 | Kansas | 36 | -- | -- | -- | 36 | 97 |
| Chey. x Tq. | 12104 | " | 36 | -- | -- | -- | 36 | 97 |
| Super Red | ----- | " | 36 | -- | -- | -- | 36 | 97 |
| Marquillo | 6887 | Minn. | 36 | -- | -- | -- | 36 | 97 |
| Com. x Bkhl.-Hd. Fed. | Wd. 43h2-187 | Okla. | -- | -- | 95 | -- | 95 | 98 |
| Comanche | 11673 | Kansas | 36 | -- | 96 | -- | 66 | 98 |
| Wichita | 11952 | " | 34 | -- | 98 | -- | 66 | 98 |
| Mqo.-Oro x Pawnee | Ks. 462664 | " | -- | 24 | 99 | -- | 62 | 98 |
| Concho | 12517 | Okla. | 36 | -- | 96 | -- | 67 | 98 |
| (Kan.-Hd. Fed. x Tq.) x (Com. x Hope-Hussar) | Ks. 1825-5 | Kansas | -- | -- | 96 | -- | 96 | 98 |
| Double Cross | 12512 | Texas | -- | -- | 96 | -- | 96 | 98 |
| Nanking No. 158 | 124294 | China | 37 | -- | -- | -- | 37 | 98 |
| Nanking No. 221 | 124307 | " | 37 | -- | -- | -- | 37 | 98 |
| Triumph | 12132 | Okla. | 38 | -- | 95 | -- | 67 | 99 |
| Kaw.-Mqo. x Kaw.-Tq. | Stw. 484336 | " | -- | 28 | -- | -- | 28 | 99 |
| Mqo.-Oro x Pawnee | Ks. 462681 | Kansas | -- | 28 | -- | -- | 28 | 99 |
| Neb. 60 x Med.-Hope | 12500 | Neb. | -- | 28 | -- | -- | 28 | 99 |
| Kiowa | 12133 | Kansas | 37 | -- | -- | -- | 37 | 99 |
| Nanking No. 360 | 124332 | China | 37 | -- | -- | -- | 37 | 99 |
| Timstein x (Mqo.-Oro x Kaw.-Tq.) | Stw. 516604 | Okla. | -- | -- | -- | 48 | 48 | 99 |
| Westar | 12110 | Texas | 39 | -- | 96 | -- | 67 | 100 |
| Bkhl.-Oro x Paw. | Wd. 43h1-236 | Okla. | 37 | -- | -- | -- | 37 | 100 |
| Chey. x Bkhl. | 12112 | Neb. | 37 | -- | -- | -- | 37 | 100 |

**Table 15.—Continued.**

| Variety or hybrid* | C.I., P.I., or selection number | Source | Percent of leaves injured | | | | | Comparison with Pawnee |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | | |
| | | | 1947 | 1950 | 1951 | 1952 | Average | |
| Pawnee | 11669 | Neb. | 37 | 28 | 98 | 49 | 53 | 100 |
| Timstein x (Mqo.-Oro x Kaw.-Tq.) | Stw. 516640 | Okla. | -- | -- | -- | 49 | 49 | 100 |
| Bkhl.-Oro x Paw. | 12516 | " | -- | -- | 98 | -- | 98 | 100 |
| (Kan.-Hd. Fed. x Tq.) x (Com. x Hope-Hussar) | Stw. 516800 | " | -- | -- | -- | 49 | 49 | 101 |
| Chiefkan x Oro-Tq. | 12134 | Kansas | 38 | -- | -- | -- | 38 | 101 |
| Mqo.-Oro x Paw. | 12505 | " | -- | 28 | -- | -- | 28 | 101 |
| Bobin-Gaza-Bobin x Paw. | Stw. 516870 | Okla. | -- | -- | -- | 49 | 49 | 101 |
| Oro x Med.-Hope | 12140 | " | 38 | -- | -- | -- | 38 | 102 |
| Apache | 12122 | Kansas | 35 | 32 | -- | -- | 33 | 102 |
| Mqo.-Oro x Paw. | 12505 | " | -- | 29 | -- | -- | 29 | 103 |
| " | Ks. 484115 | " | -- | 29 | -- | -- | 29 | 103 |
| Kharkof | 1442 | Russia | 38 | -- | -- | -- | 38 | 103 |
| Martin-Tq. x Chiefkan | 12146 | Texas | -- | -- | 91 | 60 | 76 | 103 |
| Cheyenne | 8885 | Neb. | 39 | -- | -- | -- | 39 | 105 |
| Kan.-Hd. Fed. 254887 x Tq. | | | 39 | -- | -- | -- | 39 | 105 |
| Nanking No. 22-14 | 124363 | China | 39 | -- | -- | -- | 39 | 105 |
| Rescue | 12435 | Canada | 39 | -- | -- | -- | 39 | 105 |
| Med.-Hope x Fulcaster | Tex. 114-44-75 | Texas | -- | 30 | -- | -- | 30 | 106 |
| Bobin-Gaza-Bobin x Pawnee | Stw. 516847 | Okla. | -- | -- | -- | 52 | 52 | 106 |
| Bkhl.-Oro x Paw. | Wd. 43h1-297 | " | 40 | -- | -- | -- | 40 | 106 |
| Com. x Chey.-Bkhl. | 12708 | " | -- | -- | 94 | 62 | 78 | 106 |
| Minturki | 6155 | Minn. | 40 | -- | -- | -- | 40 | 107 |
| Mqo.-Oro x Com. | Stw. 484233 | Okla. | -- | 30 | -- | -- | 30 | 108 |
| Moking | 12556 | Kansas | 41 | -- | -- | -- | 41 | 109 |
| Martin-Tq. x Kharkof | 12147 | Texas | -- | 31 | -- | -- | 31 | 110 |
| Med.-Hope x Fulcaster | Tex. 114-40-166-2 | " | -- | 31 | -- | -- | 31 | 110 |
| Chey. x Turkey | 12142 | Neb. | 41 | -- | -- | -- | 41 | 110 |
| Tq. x Bkhl. | 12126 | Minn. | 41 | -- | -- | -- | 41 | 110 |
| Chey. x Chiefkan | 12129 | Texas | 41 | -- | -- | -- | 41 | 111 |
| Kaw.-Mqo. x Kaw.-Tq. | Stw. 484387 | Okla. | -- | 31 | -- | -- | 31 | 111 |
| Cimarron | 12120 | " | 42 | -- | -- | -- | 42 | 112 |
| Bkhl.-Oro x Paw. | Wd. 43h1-98 | " | 42 | -- | -- | -- | 42 | 112 |

**Table 15.—Continued.**

| Variety or hybrid* | C.I., P.I., or selection number | Source | Percent of leaves injured | | | | | Comparison with Pawnee |
|---|---|---|---|---|---|---|---|---|
| | | | Lawton | Stillwater | | | | |
| | | | 1947 | 1950 | 1951 | 1952 | Average | |
| Hard Federation | 4733 | Australia | 42 | -- | -- | -- | 42 | 112 |
| Mqo. x Oro | 11978 | Kansas | 42 | -- | -- | -- | 42 | 112 |
| Martin x Tq. | 50-37-92 | Texas | 42 | -- | -- | -- | 42 | 112 |
| Turkey | 1558 | Turkey | 42 | -- | -- | -- | 42 | 112 |
| (Kan.-Hd. Fed. x Tq.) x (Com. x Hope-Hussar) | Stw. 516774 | Okla. | -- | -- | -- | 56 | 56 | 114 |
| Bobin-Gaza-Bobin x Paw. | Stw. 516858 | " | -- | -- | -- | 56 | 56 | 115 |
| Chey. x Early Bkhl. | 12000 | " | 44 | -- | -- | -- | 44 | 119 |
| Nanking No. 68 | 124279 | China | 44 | -- | -- | -- | 44 | 119 |
| Timstein x (Mqo.-Oro x Kaw.-Tq.) | Stw. 516674 | Okla. | -- | -- | -- | 58 | 58 | 119 |
| Com. x Chey.-Bkhl. | Wd. 43h3-85 | " | -- | 34 | -- | -- | 34 | 120 |
| Mqo.-Oro x Pawnee | 12851 | Kansas | -- | 35 | -- | -- | 35 | 125 |
| " | Ks. 45R2024 | " | -- | 36 | -- | -- | 36 | 129 |
| Med.-Hope x Fulcaster | Tex. 114-43-38 | Texas | -- | 36 | -- | -- | 36 | 129 |
| Mqo.-Oro x Paw. | Ks. 45R2027 | Kansas | -- | 37 | -- | -- | 37 | 133 |
| | | *Intergeneric Hybrids* | | | | | | |
| Rye wheat | Wd. 44h4-14 | Okla. | -- | 20 | 82 | -- | 51 | 81 |
| " | Wd. 44h4-9 | " | -- | 23 | -- | -- | 23 | 83 |
| " | Wd. 44h4-3 | " | -- | 24 | -- | -- | 24 | 86 |
| " | Wd. 44h4-19 | " | -- | 20 | 95 | -- | 57 | 91 |
| " | Wd. 44h4-18 | " | -- | 26 | -- | -- | 26 | 93 |
| " | Wd. 44h4-20 | " | -- | 27 | -- | -- | 27 | 95 |
| Triticum x *A. elong.* | Ks. 46-4683 | Kansas | -- | 27 | -- | -- | 27 | 96 |
| " | Ks. 46-4708 | " | -- | 27 | -- | -- | 27 | 96 |
| Chinese rye x *A. elong.* x Fwd. | Ks. 46-411 | " | -- | 29 | -- | -- | 29 | 103 |
| Triticum-*A. elong.* x Pawnee $F_5$ | Stw. 515972 | Okla. | -- | -- | -- | 59 | 59 | 121 |

* Abbreviations used in this table:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *A. elong.* | = *Agropyron elongatum* | Fwd. | = Forward | Mqo. | = Marquillo |
| Bkhl. | = Blackhull | Hd. Fed. | = Hard Federation | Neb. | = Nebraska |
| Chey. | = Cheyenne | Kan. | = Kanred | Sinv. | = Sinvalocho |
| Com. | = Comanche | Kaw. | = Kawvale | Tq. | = Tenmarq |
| | | Med. | = Mediterranean | Wich. | = Wichita |

**Table 16.—Greenbug injury to spring-seeded wheat varieties grown in unreplicated plots at Lawton, Okla., 1947.**

| Variety | C.I., P.I., or selection number | Source | Percent of leaves injured | Comparison with Pawnee (%) |
|---|---|---|---|---|
| Marquillo X Oro | 42'RN2501 | Kansas | 26 | 70 |
| Kawvale-Tenmarq X Comanche | 12149 | " | 30 | 80 |
| Turkey | 12150 | Colo. | 30 | 80 |
| Marquillo-Oro X Oro-Tenmarq | 12406 | Kansas | 32 | 86 |
| Marquillo X Oro | 11851 | " | 35 | 94 |
| Pawnee X Durum | 94587 | -- | 35 | 94 |
| Chiefkan X Oro-Tenmarq | 12148 | Kansas | 37 | 99 |
| Marquillo X Oro | 37FN634B | " | 38 | 102 |
| Red Chief X Marquillo-Oro $F_4$ | 45FN1410 | " | 40 | 107 |
| Composite Hybrid | 12501 | Neb. | 45 | 121 |

**Table 17.—Reaction of some of the more resistant varieties and hybrids of oats in order of tolerance to greenbugs in greenhouse tests at Stillwater, Okla., 1947-53.**

| Variety or hybrid* | C.I. or selection no. | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|
| | | Greenbugs per plant (No.) | Comparison with Wintok (%) | Plant life (Days) | Comparison with Wintok (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Wintok (%) |
| Cherokee | 3846 | 11 | 112 | 12 | 160 | -- | 10 | 65 |
| Camellia | 4079 | 7 | 62 | 10 | 159 | 19 | 16 | 77 |
| A-B x R-F | 4673 | 10 | 107 | 11 | 151 | -- | 12 | 76 |
| Ukraine | 3259 | 6 | 68 | 10 | 151 | 22 | 20 | 100 |
| Abegweit | 4970 | 7 | 73 | 9 | 149 | 23 | 20 | 100 |
| Bannock | 2592 | 6 | 74 | 9 | 147 | 8 | 19 | 96 |
| Red Algerian | 840 | 5 | 61 | 16 | 146 | 57 | 3 | 28 |
| Calcutta | 994 | 6 | 68 | 15 | 145 | 30 | 3 | 36 |
| Nelson | 4845 | 6 | 76 | 13 | 144 | 32 | 17 | 103 |
| Uton | 3141 | 7 | 90 | 10 | 144 | 33 | 20 | 99 |
| Andrew | 4170 | 8 | 86 | 10 | 141 | -- | 14 | 90 |
| Landhafer | 3522 | 6 | 71 | 9 | 139 | 26 | 19 | 94 |
| Hancock | 3346 | 5 | 68 | 9 | 138 | 18 | 19 | 97 |
| A-B x R-F | 4674 | 8 | 88 | 10 | 138 | -- | 14 | 86 |
| Keystone | 2146 | 6 | 70 | 9 | 137 | 30 | 20 | 100 |
| Fleischman | 5077 | 5 | 53 | 12 | 134 | 59 | 11 | 51 |
| Black Algerian | 3215 | 8 | 92 | 15 | 133 | 24 | 9 | 102 |
| Bond x Rainbow | 4253 | 8 | 85 | 10 | 132 | -- | 13 | 82 |
| Marion | 3247 | 7 | 67 | 9 | 132 | 32 | 18 | 91 |
| Green Mountain | 1892 | 7 | 64 | 10 | 131 | 24 | 17 | 85 |
| Taggart | 4652 | 8 | 86 | 10 | 131 | 24 | 16 | 82 |
| Westdale | 3101 | 7 | 67 | 9 | 131 | 37 | 20 | 100 |
| Fulgrain (Original) | 3253 | 7 | 73 | 15 | 130 | 23 | 7 | 80 |
| Richland | 787 | 7 | 63 | 14 | 129 | 19 | 11 | 88 |
| (Appler) Red Rustproof | 1815 | 9 | 88 | 13 | 128 | 27 | 13 | 71 |
| Storm King | 1602 | 8 | 94 | 10 | 128 | 23 | 18 | 91 |
| Ballidu | 4497 | 10 | 101 | 9 | 127 | -- | 15 | 93 |
| Black Rival | 807 | 7 | 82 | 12 | 126 | 6 | 12 | 81 |
| Iogold | 2329 | 7 | 59 | 12 | 126 | 33 | 12 | 93 |
| Burt | 2886 | 6 | 68 | 15 | 126 | 31 | 7 | 84 |

**Table 17.—Continued.**

| Variety or hybrid* | C.I. or selection no. | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|
| | | Greenbugs per plant (No.) | Comparison with Wintok (%) | Plant life (Days) | Comparison with Wintok (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Wintok (%) |
| Clinton | 3971 | 7 | 79 | 9 | 126 | -- | 14 | 87 |
| Enbaku | 2854 | 5 | 48 | 10 | 126 | 33 | 14 | 67 |
| Russian No. 77 | 2508 | 8 | 72 | 10 | 126 | 25 | 19 | 89 |
| Bond | 2733 | 5 | 59 | 15 | 125 | 38 | 5 | 53 |
| Enbaku | 2855 | 5 | 43 | 10 | 125 | 35 | 20 | 94 |
| Belar | 2760 | 8 | 93 | 15 | 123 | 42 | 5 | 61 |
| Tartar King | 1599 | 8 | 75 | 10 | 123 | 22 | 18 | 88 |
| Coker No. 3 | ---- | -- | -- | 20 | 123 | -- | 12 | 104 |
| Aida | 4884 | 6 | 78 | 13 | 122 | 36 | 8 | 49 |
| Frazier | 2381 | 16 | 140 | 19 | 121 | -- | -- | --- |
| Cassel | 2911 | 6 | 64 | 14 | 121 | 37 | 8 | 93 |
| Kherson | 459 | 7 | 65 | 11 | 121 | 16 | 15 | 114 |
| Enbaku | 2852 | 6 | 59 | 10 | 120 | 31 | 16 | 76 |
| Marvelous | 1999 | 8 | 85 | 9 | 119 | 21 | 20 | 98 |
| Hobson | 4842 | 8 | 75 | 11 | 119 | 17 | 10 | 63 |
| Yakutsk | 498 | 8 | 76 | 13 | 119 | 18 | 13 | 86 |
| Santa Fe (Sept. 2) | 4519 | 7 | 76 | 9 | 118 | 17 | 19 | 96 |
| Fulmer | 2912 | 6 | 63 | 13 | 118 | 19 | 10 | 111 |
| Hozan Zairai | 2858 | 5 | 48 | 9 | 118 | 35 | 18 | 84 |
| White Oats | 3463 | 7 | 93 | 9 | 118 | 23 | 19 | 93 |
| Coast Black | 1025 | 5 | 60 | 14 | 118 | 28 | 8 | 93 |
| Black Tartar | 3468 | 7 | 62 | 10 | 117 | 14 | 12 | 57 |
| Hudson | 1906 | 7 | 74 | 12 | 117 | 15 | 13 | 87 |
| Oriental | 1598 | 5 | 48 | 11 | 117 | 7 | 24 | 154 |
| Early Red Rustproof | 2823 | 8 | 89 | 14 | 117 | 17 | 9 | 97 |
| Mexico 41-12 | 4908 | 6 | 71 | 12 | 117 | 25 | 16 | 97 |
| Tobolsk | 1709 | 6 | 64 | 13 | 117 | 11 | 13 | 85 |
| Carton No. 5 | 1884 | 7 | 80 | 12 | 116 | 12 | 14 | 92 |
| State Pride | 1154 | 6 | 61 | 10 | 116 | 16 | 11 | 84 |
| Tennessee 1922 x Bond-Iogold | 4873 | 8 | 123 | 13 | 115 | 33 | 11 | 66 |
| Black Mesdag | 1877 | 7 | 90 | 13 | 114 | 42 | 9 | 85 |

**Table 17.—Concluded.**

| Variety or hybrid* | C.I. or selection no. | Preference | | Tolerance | | Growth factor | Fecundity | |
|---|---|---|---|---|---|---|---|---|
| | | Greenbugs per plant (No.) | Comparison with Wintok (%) | Plant life (Days) | Comparison with Wintok (%) | | Nymphs produced per female in 7 days (No.) | Comparison with Wintok (%) |
| Black Mogul | 1074 | 7 | 88 | 13 | 114 | 44 | 11 | 102 |
| Olney | 4846 | 6 | 81 | 13 | 114 | 32 | 10 | 58 |
| Navarro | 966 | 8 | 88 | 13 | 112 | 15 | 5 | 57 |
| Palestine | 3600 | 9 | 123 | 12 | 112 | 26 | 8 | 48 |
| Nakota | 2883 | 5 | 48 | 13 | 111 | 18 | 8 | 86 |
| Kanota | 839 | 11 | 108 | 12 | 111 | 25 | 13 | 68 |
| Neosho | 4141 | 11 | 110 | 12 | 111 | 16 | 15 | 81 |
| Klein 69-B | 4118 | 8 | 72 | 11 | 110 | 42 | 11 | 68 |
| Stanton Strain No. 1 | 3855 | 9 | 90 | 11 | 110 | 26 | 16 | 88 |
| Kozan | 3467 | 6 | 64 | 9 | 109 | 17 | 7 | 34 |
| Tulun | 4882 | 8 | 103 | 12 | 109 | 38 | 5 | 29 |
| Astra | 4887 | 6 | 87 | 12 | 109 | 44 | 8 | 46 |
| Forkedeer | 3170 | 14 | 132 | 12 | 106 | -- | 13 | 81 |
| Tennex | 3169 | 13 | 121 | 12 | 106 | -- | 15 | 97 |
| Franklin | 2892 | 8 | 91 | 12 | 105 | 25 | 5 | 44 |
| New Nortex | 3422 | 13 | 117 | 13 | 105 | -- | 15 | 92 |
| Nemaha | 4301 | 10 | 105 | 7 | 100 | -- | 13 | 81 |
| Wintok (ck.) | 3424 | 10 | 100 | 11 | 100 | 14 | 18 | 100 |
| Traveler | 4206 | 10 | 93 | 11 | 98 | -- | 18 | 104 |
| Vavilov | 2465 | 5 | 48 | 11 | 98 | 7 | 10 | 116 |
| DeSoto | 3923 | 16 | 150 | 10 | 97 | -- | 18 | 111 |
| Fultex | 3531 | 11 | 105 | 9 | 96 | -- | 16 | 100 |

* Abbreviations used in this table: A-B = Anthony x Bond, R-F = Richland x Fulghum, and Tenn. = Tennessee.

**Table 18.—Greenbug injury to spring-seeded oat varieties and hybrids in a natural infestation at Lawton and Stillwater, Okla., 1947 and 1950-52.**

| Variety or hybrid* | C.I. or selection number | Percent of leaves injured | | | | | Comparison with Wintok (percent) |
|---|---|---|---|---|---|---|---|
| | | Lawton | Stillwater | | | Avg. | |
| | | 1947 | 1950 | 1951 | 1952 | | |
| Coastblack | 1025 | -- | -- | -- | 22 | 22 | 75 |
| Winter Fulghum Selection | Stw. 462522 | -- | -- | 28 | -- | 28 | 85 |
| Andrew | 4170 | -- | 23 | 37 | 19 | 26 | 87 |
| A-B X R-F | 4673 | -- | 24 | -- | -- | 24 | 88 |
| Wintok Selection | Stw. 483143 | -- | -- | 30 | 26 | 28 | 89 |
| Winter Fulghum Selection | Stw. 462546 | -- | -- | 30 | -- | 30 | 90 |
| " | Stw. 462567 | -- | -- | 30 | -- | 30 | 90 |
| Woodward Composite Selection | 4829 | -- | -- | 28 | 30 | 29 | 94 |
| Kanota | 839 | 35 | 29 | 25 | -- | 30 | 97 |
| Forkedeer | 3170 | 31 | 27 | 32 | -- | 30 | 97 |
| Frazier | 2381 | 32 | -- | -- | -- | 32 | 100 |
| Wintok (check) | 3424 | 32 | 27 | 33 | 29 | 30 | 100 |
| Cherokee | 3846 | -- | 26 | 35 | -- | 31 | 101 |
| Tennex | 3169 | 29 | 36 | 25 | 32 | 31 | 101 |
| Arkansas 160 | 2502 | 32 | -- | -- | -- | 32 | 101 |
| Columbia | 2820 | 32 | -- | -- | -- | 32 | 101 |
| Fulwin | 3168 | 32 | -- | -- | -- | 32 | 101 |
| Woodward Composite Selection | 4828 | -- | -- | 28 | 35 | 32 | 101 |
| Letoria | 3392 | 31 | 29 | -- | -- | 30 | 102 |
| A-B X R-F | 4674 | -- | 24 | 33 | 35 | 31 | 102 |
| Black Algerian | 3215 | -- | 28 | -- | -- | 28 | 103 |
| Victorgrain | 3692 | 33 | -- | -- | -- | 33 | 103 |
| Fulgrain Original | 3253 | -- | 23 | 38 | 33 | 31 | 105 |
| Wintok Selection | Stw. 483136 | -- | -- | 35 | -- | 35 | 105 |
| Woodward Composite Selection | Wd. 3527-43-P8 | -- | -- | 35 | -- | 35 | 105 |
| " | Wd. 3527-43-P6 | -- | -- | 35 | -- | 35 | 105 |
| Fleischman | 5077 | -- | -- | -- | 31 | 31 | 106 |
| Fulton | 3327 | 32 | 31 | -- | -- | 31 | 106 |
| Nemaha | 4301 | -- | 29 | 38 | 28 | 32 | 106 |
| Traveler | 4206 | 29 | 30 | 40 | -- | 33 | 107 |
| (Victoria X Hajira-Banner) X Fulghum-Victoria | Texas 73-44-46 | -- | -- | -- | 32 | 32 | 109 |

**Table 18.—Concluded.**

| Variety or hybrid* | C.I. or selection number | Percent of leaves injured | | | | Avg. | Comparison with Wintok (percent) |
|---|---|---|---|---|---|---|---|
| | | Lawton | Stillwater | | | | |
| | | 1947 | 1950 | 1951 | 1952 | | |
| Osage | 3991 | 32 | 34 | -- | -- | 33 | 110 |
| Columbia X D69-Bond | 4628 | -- | 30 | -- | -- | 30 | 111 |
| Lega | 3379 | 36 | 31 | -- | -- | 33 | 113 |
| Camellia | 4079 | -- | 25 | 43 | -- | 34 | 113 |
| Neosho | 4141 | 30 | 33 | 42 | -- | 35 | 113 |
| Wintok (early selection) | 5849 | -- | -- | -- | 33 | 33 | 114 |
| Fultex | 3531 | 36 | 32 | -- | -- | 34 | 114 |
| Wintok Selection | Stw. 483149 | -- | -- | 38 | -- | 38 | 115 |
| Bond | 2733 | -- | 30 | 40 | -- | 35 | 115 |
| Ventura | 3989 | 36 | 32 | -- | -- | 34 | 115 |
| Lelina | 3404 | 32 | 37 | -- | -- | 35 | 117 |
| Winter Fulghum | 2500 | 38 | -- | -- | -- | 38 | 118 |
| Fulghum Coker No. 3 | 3666 | 38 | -- | -- | -- | 38 | 119 |
| De Soto | 3923 | 33 | 27 | 50 | -- | 37 | 119 |
| Tama | 3502 | 39 | -- | -- | -- | 39 | 121 |
| New Nortex | 3422 | 36 | 36 | -- | -- | 36 | 121 |
| Tennex X (Victoria X Hajira-Banner) | 5113 | -- | -- | 41 | -- | 41 | 123 |
| Missouri 0-200 | 4626 | -- | 34 | -- | -- | 34 | 123 |
| Stanton Strain No. 1 | 3855 | 26 | 37 | 55 | -- | 39 | 127 |
| Winter Fulghum Selection | 6570 | -- | -- | -- | 37 | 37 | 129 |
| Appler Red Rustproof | 1815 | 32 | 30 | 60 | -- | 41 | 132 |
| Bond X Rainbow | 4186 | -- | 36 | -- | -- | 36 | 132 |
| Belar | 2760 | -- | 25 | 60 | 36 | 40 | 134 |
| Calcutta | 994 | -- | -- | 45 | -- | 45 | 135 |
| Cimarron | 5106 | -- | 31 | 43 | 49 | 41 | 138 |
| Le Conte | 5107 | -- | -- | 47 | -- | 47 | 140 |
| Stanton Strain No. 2 | 4390 | -- | -- | 47 | -- | 47 | 140 |
| Stanton Strain No. 3 | 4543 | -- | -- | 47 | -- | 47 | 140 |
| Clinton | 3971 | -- | 25 | 60 | -- | 43 | 141 |
| Red Algerian | 840 | -- | 27 | 63 | -- | 45 | 149 |
| Andrew X Landhafer | 5697 | -- | -- | -- | 53 | 53 | 183 |

* Abbreviations used in this table: A-B = Anthony X Bond, and R-F = Rchland X Fulghum.

**Table 19.—Greenbug injury to and yield of spring-seeded oat varieties grown under moderate infestation at Stillwater, Okla., 1952.**

| Variety | C.I. or selection number | Percent of leaves injured | Yield | | Test weight | |
|---|---|---|---|---|---|---|
| | | | Bushels per acre | Rank | Pounds per bushel | Rank |
| Bond X Rainbow Selection | Stw. 477004 | 21 | 44 | 2 | 33 | 1 |
| Clinton X Ventura | Stw. 476774 | 24 | 36 | 5 | 31 | 11 |
| Clarion | 5647 | 27 | 46 | 1 | 33 | 5 |
| Sac X Hajira-Joanette | 5927 | 30 | 36 | 6 | 33 | 3 |
| Cherokee (check) | 3846 | 32 | 27 | 13 | 31 | 12 |
| Andrew (check) | 4170 | 35 | 42 | 3 | 32 | 7 |
| Kanota (check) | 839 | 37 | 27 | 14 | 31 | 9 |
| Andrew X Landhafer | 5696 | 38 | 13 | 17 | 22 | 18 |
| Neosho (check) | 4141 | 38 | 24 | 15 | 30 | 15 |
| ($F_1$ Ventura X Camellia) X Clinton | 5027 | 39 | 13 | 17 | 24 | 17 |
| (Victoria-Hajira-Banner) X Fultex | Stw. 10509 | 39 | 21 | 16 | 31 | 9 |
| Santa Fe X Clinton | 5869 | 40 | 31 | 9 | 28 | 16 |
| Nehaha (check) | 4301 | 41 | 28 | 11 | 33 | 3 |
| (Victoria-Hajira-Banner) X Fulghum-Victoria | Stw. 10506 | 43 | 34 | 7 | 31 | 8 |
| (Victoria X Hajira-Banner) 5371 X Fulghum-Victoria | ---- | 45 | 28 | 12 | 32 | 6 |
| (Victoria-Hajira-Banner) X Fulghum-Victoria | Stw. 10503 | 45 | 36 | 4 | 33 | 1 |
| (Victoria-Hajira-Banner) X Fulghum-Victoria | Stw. 10501 | 49 | 29 | 10 | 30 | 13 |
| Cimarron (check) | 5106 | 50 | 32 | 8 | 30 | 14 |