INHERITANCE IN ALBIT WHEAT OF RESISTANCE TO BUNT, TILLETIA TRITICI[1]

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INTRODUCTION

Albit wheat (Washington No. 2517, C. I. No. 8275, and registration No. 258) is the result of a cross between Hybrid 128 (female) and White Odessa (male), made in 1920 by E. F. Gaines. It is a club wheat with awnless spikes, glabrous white glumes, and soft white kernels.[2] In morphological characters it is like Hybrid 128[3] (fig. 1), but in its resistance to bunt (*Tilletia tritici* (*Bjerk.*) Wint. and *T. levis* Kühn) it resembles White Odessa.

In 1931 the senior author[4] reported that Albit showed the same reaction to bunt as White Odessa, its bunt-resistant parent. "It appears," he stated, "that Gaines has completely transferred the resistance of White Odessa to a segregate having morphological characteristics similar to those of the susceptible parent, Hybrid 128."

Martin, White Odessa, Banner Berkeley, Albit, and Regal wheats have been found by the senior author[5] to be similar in their resistance to *Tilletia tritici* and *T. levis*. Briggs[6] has shown that Martin, White Odessa, and Banner Berkeley have one main dominant factor for resistance to *T. tritici*.

EXPERIMENTAL DATA

Data previously reported by the senior author[7] showing the reaction of White Odessa and Albit wheats to 43 different collections of bunt are presented graphically in Figure 2. This figure shows that the two varieties are similar in their reaction to all 10 of the forms of bunt (included in collections) used in earlier tests. Both were resistant to 29 collections and susceptible to 14. The one discrepancy, apparent susceptibility of White Odessa to collection 7c and resistance of Albit, was cleared up in 1929 when it was found that both varieties are resistant to this collection. Other trials in 1930 and 1931 also indicate that these two varieties are identical in their ability to resist bunt.

In 1928 several crosses were made between Hybrid 128 and Albit. The F_1 plants were grown in the greenhouse in 1928–29. The F_2 plants were grown in 1929–30 from copper-carbonate treated seed so that the F_3 generation should contain both susceptible and resistant

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[1] Received for publication Apr. 13, 1932; issued March, 1933. Contribution from the Department of Farm Crops, Oregon Agricultural Experiment Station. Paper No. 183 of the Journal Series.

[2] CLARK, J. A., PARKER, J. H., and WALDRON, L. R. REGISTRATION OF IMPROVED VARIETIES OF WHEAT. II. Jour. Amer. Soc. Agron. 19: 1037–1041. 1927.

[3] SCHAFER, E. G., GAINES, E. F., and BARBEE, O. E. WHEAT VARIETIES IN WASHINGTON. Wash. Agr. Expt. Sta. Bul. 207, 31 p., illus. 1926.

[4, 5] BRESSMAN, E. N. VARIETAL RESISTANCE, PHYSIOLOGIC SPECIALIZATION, AND INHERITANCE STUDIES IN BUNT OF WHEAT. Oreg. Agr. Expt. Sta. Bul. 281, 44 p., illus. 1931.

[6] BRIGGS, F. N. INHERITANCE OF RESISTANCE TO BUNT, TILLETIA TRITICI, IN WHITE ODESSA WHEAT. Jour. Agr. Research 40: 353–359, illus. 1930.

——— INHERITANCE OF RESISTANCE TO BUNT, TILLETIA TRITICI, IN HYBRIDS OF WHITE FEDERATION AND BANNER BERKELEY WHEATS. Jour. Agr. Research 42: 307–313, illus. 1931.

[7] BRESSMAN, E. N. Op. cit.

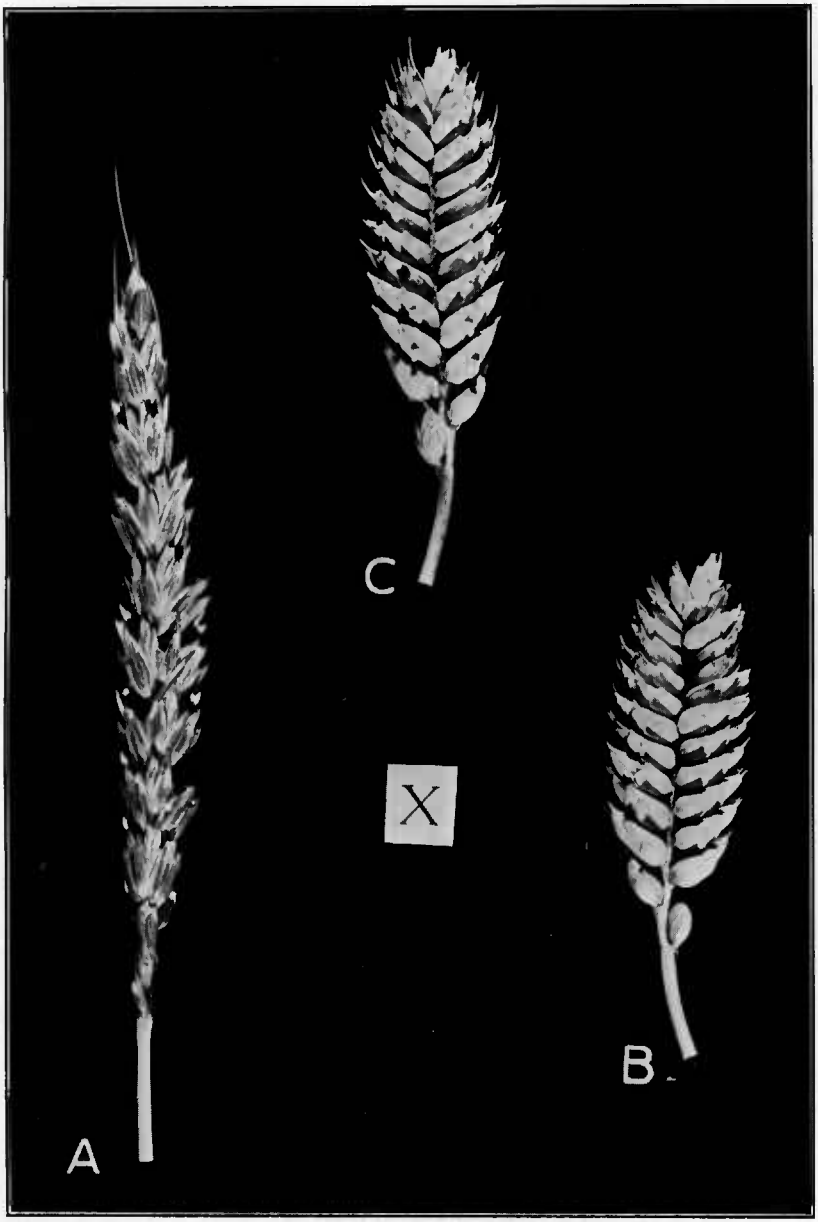

FIGURE 1.—Typical heads of White Odessa (A) and Hybrid 128 B). A cross between these two, made by E. F. Gaines in 1920, yielded a segregate, Albit (C), which carries the morphological characters of the female parent (Hybrid 128) and the bunt resistance of the male parent (White Odessa)

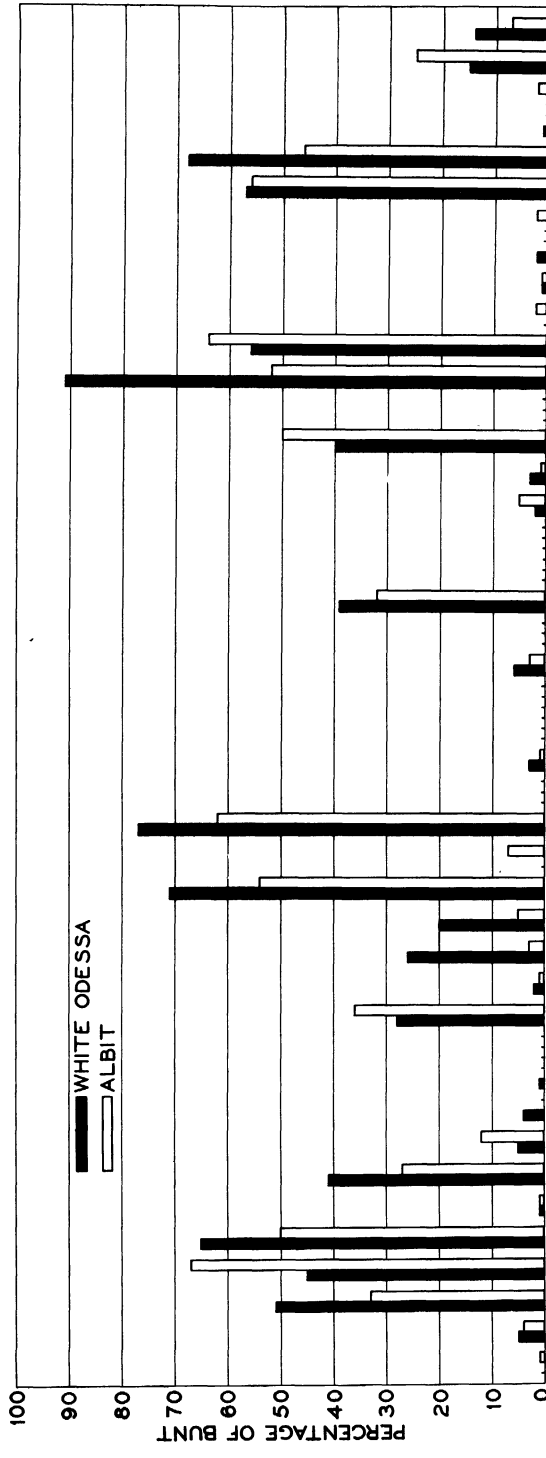

FIG. 2.—Reaction of White Odessa and Albit wheats to various collections of bunt. The percentages of bunt are the averages of two trials conducted in 1928 at Corvallis and Moro, Oreg. Note the similarity of reaction of these two varieties, parent and segregate

segregates. In the fall of 1930 the seed for the F_3 generation was heavily coated with inoculum from bunt collection No. 12a. This collection was originally obtained from Tucson, Ariz. It is a form of *Tilletia tritici*, classified as physiologic form VIII. This collection was used as inoculum because the Hybrid 128 parent is susceptible and the Albit parent is resistant.

No bunt appeared at Corvallis on Albit when it was inoculated with collection 12a (Table 1); but in 1929 at Moro 2 bunted heads out of a total of 505 were found in this variety. No significance is attached to this fact, however, for a few bunted heads are commonly found in a resistant variety. Hybrid 128 in all tests was susceptible to collection 12a. At Moro in 1929 this collection produced 63 per cent infected heads in Hybrid 128.

White Odessa was inoculated with collection 12a in 1929 only. In these trials 200 heads of White Odessa were counted at Corvallis and 300 at Moro, but no bunt was found.

TABLE 1.—*Percentage of bunt in the parent varieties when inoculated with bunt collection 12a, Corvallis, Oreg.*

Variety	Percentage of bunt in—				
	1928	1929	1930	1931	Average
Albit	0	0	0	0	0
Hybrid 128	43	40	91	82	64

In the Hybrid 128 × Albit crosses, the F_1, F_2, and F_3 progenies were all identical in morphological characters with the parent varieties. In other words, there was no segregation for these characters. In fact, the only method of determining that hybridization had been effected was through the segregation for bunt resistance. This segregation is shown in Table 2. Each row, fall sown in the field at Corvallis, was 16 feet long and contained about 60 plants. The F_3 generation was represented by four families and a total of nearly 5,000 plants. One family did not segregate for bunt resistance, indicating that it was not a hybrid. The results of its smutting, therefore, are not included.

TABLE 2.—*Distribution of the F_3 rows of the cross, Hybrid 128 × Albit, into 10 per cent classes for bunt infection, Tritici species, collection 12a, physiologic form VIII, Corvallis, Oreg., 1931*

Hybrid family No.	Number of rows having indicated percentage of plants infected										Total rows
	0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100	
1	5	2	5	1	2		1	4	4		24
2	3		1			1	2	1			8
3	4	3	1	4					2	2	16
4	4	4	7	5	1			2	3	2	28
Total	16	9	14	10	3	1	3	7	9	4	76

P=0.72.

In the crosses between Hybrid 128 and Albit the distribution of F_3 rows into 10 per cent classes for bunt infection agrees closely with a 1:2:1 ratio when the 0–10 class is considered as resistant and the classes above 70 as susceptible. In the resistant class there are 16 rows, in the susceptible class 20, and in the segregating class 40. On the basis of a 1-factor difference, there should have been 19, 38, and 19 rows, respectively, in the three classes. Since $P = 0.72$, a very satisfactory agreement with the 1:2:1 ratio is indicated. The value of P was obtained from Fisher.[8]

One family, No. 3, shows a perfect segregation of 1:2:1 with 4 resistant rows, 8 segregating, and 4 susceptible in a total of 16 rows. In fact, all four families show a satisfactory agreement with a 1:2:1 ratio. The F_3 rows are plant rows.

Briggs [9] states that there may be more than one factor for resistance in White Odessa wheat. The results herein reported indicate that White Odessa has only one factor for resistance and that it applies only to certain physiologic forms of bunt, namely, Nos. II, III, V, VI, and VIII of the senior writer's classification.[10] This factor (*MM*) has been transferred from White Odessa to Albit, so that both varieties contain the identical factor. These varieties, however, contain no factor for resistance to forms I, IV, VII, IX, and X. Hybrid 128 is entirely susceptible and carries no factor for resistance to any of the physiologic forms.

SUMMARY AND CONCLUSIONS

Albit wheat contains one main dominant factor for resistance to certain physiologic forms of bunt. This factor, *MM*, is the same as that carried by its male parent, White Odessa.

Apparently the factor *MM* is fairly well distributed, for it has been found by Briggs (who designated it) or by the writers in Martin, White Odessa, Hussar, Banner Berkeley, Albit, and possibly Regal wheats. These wheats differ in species, size and shape of head, color of kernel, color of chaff, bearded condition, color of straw, and other characters.

Albit wheat contains morphological characters similar to its female parent, Hybrid 128. Crosses between Albit and Hybrid 128 do not segregate for morphological characters, but they do segregate for bunt resistance and possibly for other factors such as yielding ability. Apparently Hybrid 128 carries no factor for bunt resistance.

[8] FISHER, R. A. STATISTICAL METHODS FOR RESEARCH WORKERS. Ed. 2, rev. and enl., 269 p., illus. Edinburgh and London. 1925.
[9] BRIGGS, F. N. Op. cit. (Footnote 6, first reference.)
[10] BRESSMAN, E. N. Op. cit.