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SEARCH FOR USEFUL GENETIC CHARACTERS IN DIPLOID *TRITICUM SPP.*

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ABSTRACT

A collection consisting of 102 strains of *T. monococcum* was screened for % protein and basic aminoacid content, as well as for resistance towards *Puccinia graminis*, *P. recondita*, *P. striiformis*, *Frysiphe graminis*, and *Septoria nodorum*. A relatively high degree of variation amongst forms was observed in relation to most of the characters taken into consideration, Moreover, none of the strains proved to be susceptible to *P. recondita*. The possibilities of transfering useful traits from diploid *Triticum* to the cultivated wheats are discussed.

Introgression *via* triploid bridges (Vardi and Zohary, 1967) has proved to be a successful tool for the transfer of simply inherited characters (Kerber and Dyck, 1973; Gerechter-Amitai *et al.*, 1971) from *T. monococcum* to the cultivated wheats. Screening of the former has hence acquired renewed importance, and should prove particularly useful in the identification of rare (recessive) mutants difficult to detect in the polyploids (for instance high lysine types).

Previous reports, both on collections and single strains of *T. monococcum*, have recorded mainly their behaviour in relation to diseases such as *Puccinia graminis f. sp. tritici* (Hiratsuka, 1955; Kerber, 1966; Gerechter-Amitai *et al.*, 1971; Vallega, 1977), *Puccinia recondita* Rob. ex Desm. *f. sp. tritici* (Johnston, 1940; Rao, 1963; The, 1976), *Puccinia striiformis* Westend (Bell and Lupton, 1955; The, 1976), *Septoria spp.* (Weber, 1922; Arsenijevic, 1965; Zitelli and Vallega, 1977), *Cercosporella herpetrichoides* Fron (Macer, 1966), and *Oulema Melanopa* L (Jankovic, 1975). Observations on protein and lysine content (Villegas *et al.*, 1968; Johnson *et al.*, 1975) as well as on baking quality (Mettin, 1964) and on cytoplasms (Hori and Tsunewaki, 1967; Maan and Lucken, 1968) have also been published.

This note deals with the results obtained during the analysis of our collection of this species which, so far, has been screened for resistance to *P. graminis, P. recondita, P. striiformis, Erysiphe graminis,* and *Septoria nodorum* Berk., as well as for protein and basic aminoacid content.

MATERIALS AND METHODS

A total of 152 forms of *T. monococcum*[1] (both wild and cultivated) and an arti-

[1]Accessions were kindly provided by : the N. I. Vavilov All-Union Institute of Plant Industry, USSR; the Plant Breeding Institute, England (which provided also the autotetraploid); and the F.A.O. (Seeds Laboratory). The amount of duplication is unknown.

can thus be excluded as a source of resistance to *P. recondita.* However, since minor heritable differences in resistance appear between strains, work has ben undertaken to establish the nature and stability of this variation with regard to the parasitic population.

A high number (87) of accessions proved to be resistant to *Erysiphe graminis* (Table 1). Unfortunately, transference of resistance to this pathogen to levels of higher ploidy seems difficult (The, 1976).

Results regarding resistance towards *Septoria nodorum* Berk. (Fig. 1) appear to indicate a lesser degree of susceptibility on the part of *T. monococcum* as compared with the cultivated wheats. A further experiment evidenced an even more pronounced

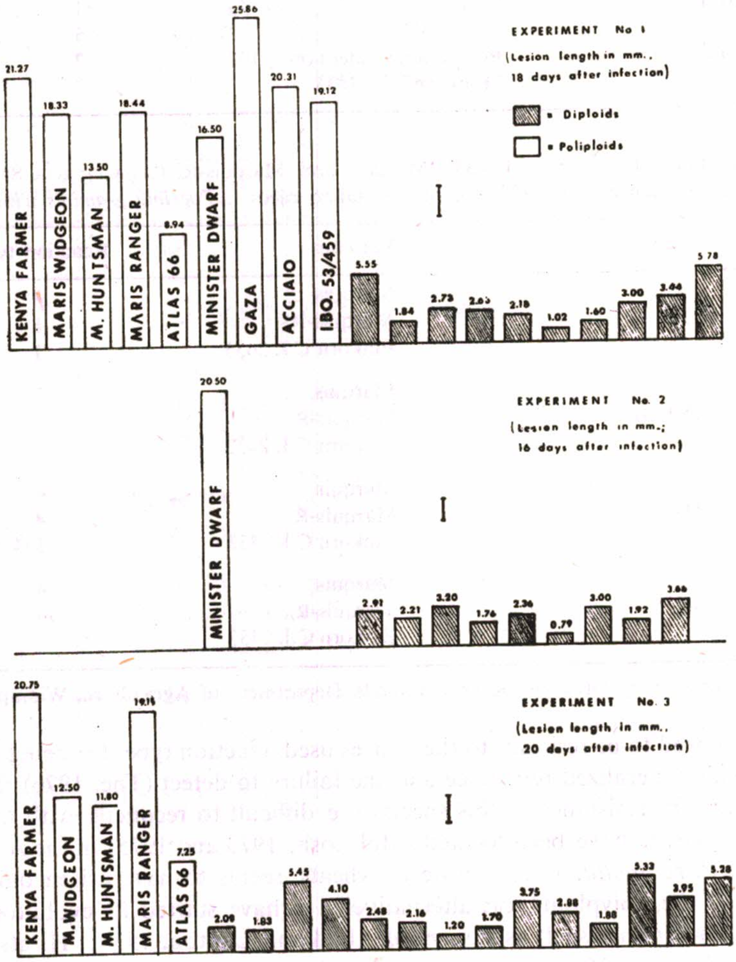

Fig. 1 Behaviour of 34 diploid and selected tetra- and hexaploids with regards to *Septoria nodorum* Berk. lesion in mm. ; 18, 16 and 20 days after infection, respectively.

difference between diploid (0.07 — 0.91 mm) and polyploid (5.60 — 15.45 mm) varieties, as that shown in the figure. Differences between diploids were slight, but nevertheless significant. The greater resistance of 'Atlas 66' (Frecha, 1973; Kleijer *et al.,* 1977) is indirectly confirmed.

As shown in Fig. 2, variability in protein (9.5 — 25%) and basic amino acid content (DBC) amongst the 64 strains analysed in 1976, was substantial. The correlation between these characters (r = 0.857), and between % protein and thousand kernel weight (—0.5004) was highly significant and similar to that observed by Johnson *et al.* (1975). Analogous results were obtained following the analysis of the accessions grown

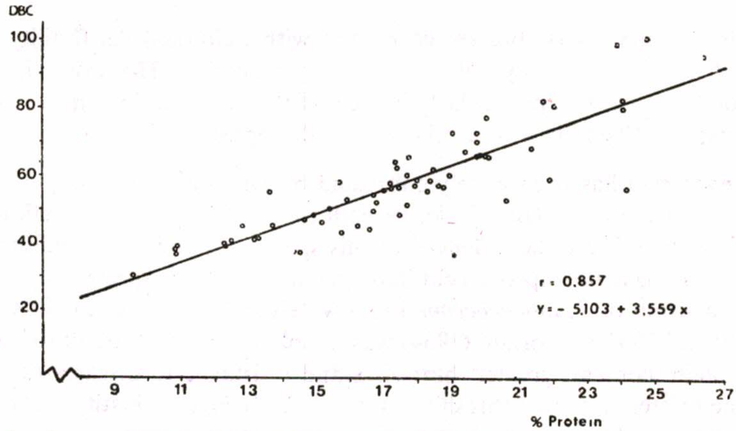

Fig. 2-Regression betwen protein content (%) and DBC in 64 forms of *T. monococcum* grown in 1976 (from Vallega 1977).

in 1977, which presented a range of 11.2 — 18.3 in % protein content, and correlations of 0.960 (between % protein and DBC) and —0.465 (between % protein and thousand kernel weight). Deviations from the regression between % protein content and DBC, evidentiate the presence of strains with higher than expected basic aminoacid content: none of these, however, resemble, in potency, the high lysine mutants found in maize (*opaque*-2 and *floury*-2) and barley (*hily*). Search of genes of this nature is thus being continued, both through the analysis of a greater number of diploid accessions, as well as through mutagenic treatment.

Although grains appeared to be, in all cases, well developed, quite a large amount of variation was observed in relation to the weight of thousand (threshed) kernels (mean = 26.9 g) which ranged from 17 to 34 g between accessions.

Final Considerations

The polyploid nature of cultivated wheat has been decisive for the success of this crop throughout the world, providing us, at the same time, with a virtually unequalled variability on which to base its further improvement. If this potential is to be fully exploited, however, greater effort should be devoted in breaking up the complexity of this species into its single components : *T. monococcum, Ae. speltoides* (?) and *Ae. squarrosa*. A detailed screening of the latter will no doubt facilitate the finding of genes already known to exist in other (diploid) Gramineae but as yet undetected in wheat (high lysine, uniculms, etc.), and increase the variability available for other important characters (height, giberellic acid insensitivity, branched spikes, resistance genes, genetic markers, etc.). Moreover, comparative studies on the behaviour of the different diploid progenitors of cultivated wheat with regard to pests and diseases, as well as on the origin and genetics underlying these relationships, may give us important clues, both on possible differential affinities within the genome of hexaploid wheat, and ways to enhance these to our advantage.

Transfer of characters directly correlated with yield (spikelet fertility, thousand kernel weight, etc.) is obviously difficult, and as yet untried. However, this possibility cannot be totally discarded, particularly in view of the fact that, in some diploid strains, these traits express themselves in a relatively high degree.

T. monococcum has been widely cultivated by our ancestors and is still grown in restricted areas of the world (Borojevic, 1956; Rao, 1963). Little, if any effort, however has been made to evaluate the potential of this species in modern agriculture. In spite of the fact that no genetic improvement had been made on this species, a yield comparison between a strain of *T. monococcum* and a widely cultivated hexaploid variety made in 1936, 1940 and 1941 by Forlani (1954) was unable to demonstrate drastic differences. The high protein content, greater hardiness and resistance to diseases of this species, as well as the existence of free-threshing strains (*T. sinskajae*) justify, in our view, the need for a closer look at this ancient, but still interesting, wheat.

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