

## NOTE ON IMMUNE WHEATS.

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WHILE reading the two interesting papers<sup>1</sup> on immune wheats in the last number of this *Journal* it occurred to us that our observations on rust resistant wheats in India might be of some interest. During the past two years a large number of varieties of Indian and European wheats have been grown by us at Pusa in Behar and at Lyallpur in the Punjab, one of the objects being to obtain wheats immune or at least resistant to rusts which would serve as parents in raising rust resistant hybrids. Biffen last year suggested that a trial should be made with Einkorn (*Triticum monococcum vulgare*, Kcke.), and kindly supplied us with a sample of the seed. Another sample was obtained from Messrs Vilmorin, and the sowings were made at the ordinary time, in October 1906 at Pusa and in November of the same year at Lyallpur. In all cases the grains germinated and produced the characteristic thick grass-like tufts of foliage but in no instance were ears formed, the plants remaining in the vegetative condition up to harvest time (March 1907 at Pusa and May 1907 at Lyallpur). Consequently no use could be made of Einkorn as a parent.

The behaviour of this variety towards rust proved however to be of interest. At Lyallpur, the leaves remained uniformly green till the hot weather set in towards the end of April, when it was found that numerous light-green translucent spots were being formed in the leaves. These were no doubt produced by the entry of infecting tubes of rust spores through the stomata into the intercellular spaces of the leaves resulting in the breaking down of the host cells in the manner described by Miss Marryat in the paper referred to above. Only in one case was a pustule observed and the development of this was extremely feeble.

<sup>1</sup> Biffen, *Journal of Agricultural Science*, Vol. II. p. 109; Marryat, *ibid.* Vol. II. p. 129.

Nothing further was noted up to the first week in May when the hot winds began to wither up the plants. As regards immunity to rust the behaviour of Einkorn in the Punjab closely corresponds with that observed at Cambridge and elsewhere. There was no lack of infecting material as the wheats in the surrounding plots and also in the vast stretches of country for miles round in the Chenab Colony were affected by both *Puccinia glumarum*, Eriks. and Henn., and to a less extent by *Puccinia graminis*, Pers. The weather towards the end of the wheat-growing season was very wet and cloudy and distinctly favourable to rust attack.

At Pusa the results were quite different. Up to the harvest time no pustules were formed on the leaves and the plot was immune to all three rusts *Puccinia triticina*, *P. glumarum*, and *P. graminis*, which were abundant on some or other of the numerous varieties grown close by. The light-green translucent spots on the leaves mentioned above were however produced, and it was decided to allow the plot to remain after harvest time to see if any ears would be formed. Early in May it was found that vigorous uredospore pustules were produced in large numbers on the leaves and this continued through the month and into June, when the pustules began to darken through the copious formation of teleutospores. Examination of the pustules and spores showed that they belonged to the black rust of wheat (*Puccinia graminis*). Uredospores were noticed up to June 15th when the plot had to be transplanted. April and May are the hottest months of the year in the Indo-Gangetic plain, and at Pusa this year the maximum shade temperature in these months varied from 84.2° F. to 105° F. We have here an interesting result of the struggle between the host and the parasite in the case of a plant ordinarily immune to a fungus. Perfect immunity was enjoyed by the host till the hot weather of April and May lowered its vitality to such an extent that pustules were formed in large numbers just as in the case of a wheat susceptible to rust attack. The formation of uredospores during the hot season is also of interest in connexion with the way in which wheat rusts pass over from one wheat crop to another in India. At present we are quite in the dark as to the way in which the wheat rusts survive the hot weather and monsoon in India and infect the crop in the following cold season. The behaviour of Einkorn towards *Puccinia graminis* at Pusa during the present hot weather indicates the possibility that if a suitable host plant were available this fungus might pass from one wheat crop to another in the uredo stage.

Although Einkorn did not prove of service as a rust resistant parent we were more fortunate with several varieties of Emmer<sup>1</sup> (*Triticum dicoccum*, Schrk.) which proved to be immune to the rusts met with at Lyallpur. These varieties flowered at the same time as the majority of the Indian wheats and reciprocal crosses were successfully made with several local wheats valuable in most respects but susceptible to rust attacks. The behaviour of Emmer towards rusts at Lyallpur closely followed that described by Miss Marryat in the case of Einkorn at Cambridge. Small circular sharply defined translucent spots and brownish-red dead areas surrounded by healthy green tissue were abundant on the leaves, but pustules were only very rarely produced and when found were very feebly developed. Side by side the wheats of the country were suffering from an epidemic of yellow rust (*Puccinia glumarum*). We hope that Emmer may be almost as useful in wheat breeding in certain parts of India as Einkorn has proved itself to be in Biffen's hands at Cambridge.

<sup>1</sup> The Indian varieties of Emmer are often referred to as Spelt wheats. We have however not yet discovered any Spelt wheats in India. As Spelts are mostly winter wheats it is hardly likely that they occur in India where the growing period of the crop is so short.