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Differences in reaction to Puccinia striiformis between first and second leaves in wheat crosses

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In work with wheat rusts the analysis of the inheritance of resistance is generally made on the basis of the reaction of the first leaf of seedlings. Macer (1966) reported that in his reciprocal crosses the rust reaction was not affected by the direction in which the cross was made. He also reported that on the other hand Dekaprelevich and Naskidashvilli (1960) suggested that there was a higher transmission of resistance if this was introduced from the maternal parent. Macer (1966) observed that when a highly resistant variety (infection type 00) was crossed with a highly susceptible variety (infection type IV) the first leaves of the F2 population showed gradual differences in infection type. The same phenomenon was noticed in my tests with the F2 population of some wheat crosses. In order to find confirmation of these gradual differences in infection type exhibited by the first leaves of these F2 populations, the second leaves were also inoculated. The inoculation of the first and second leaves was done separately, the latter at a time when the second leaf had sufficiently expanded. Some of the F2 seedlings showed an infection type on the second leaf which was entirely different from that on the first leaf. In the cross 'Cappelle Desprez' × 'Michigan Amber' some F2 seedlings inoculated with race 8 exhibited a susceptible infection type (type IV) on the first leaf, while on the second leaf they showed a resistant infection type (type ON). The reverse was observed on all the F1 seedlings and some of the F2 seedlings of the cross 'Heines VII' × 'Michigan Amber', inoculated with race 20 A. In these tests it often happened that the first leaf was inoculated when the second leaf was just emerging from the sheath of the first. The infection type on the tip of the second leaf was then similar to that on the first leaf. However, during the growth of the rust towards the middle of the leaf this reaction would change into a type which was quite similar to that when the second leaf was inoculated at a later stage.

The phenomenon, as it is decribed above, may point to an influence of the endosperm. As the endosperm is formed by fusion of one haploid male nucleus with two haploid embryo-sac nuclei, the endosperm is more strongly influenced by the maternal parent than by the paternal parent. For its first growth the seedling is partly dependent on the reserves in the endosperm. According to Friend (1966) the seedling reaches its independence at a definite morphological stage, viz. when the first and second leaves are fully expanded but while the lamina of the latter is still partly folded and the tip of the third leaf is just emerging from the sheath of the second. Relating these facts to the phenomenon of the differences in infection type between the first and second leaf,

one may presume that the reaction of the first leaf is influenced by the endosperm and the reaction of the second leaf is determined by the genotype of the embryo. As for the gradual differences in infection type on the first leaf of an F2 population, these may be interpreted as due to a gene dosage effect in the endosperm.

Samenvatting

Verschillen in reactie op Puccinia striiformis tussen het eerste en tweede blad bij tarwekruisingen

In toetsingen van F1- en F2-kiemplanten van enige tarwekruisingen is gebleken dat het infectietype op het tweede blad tegenovergesteld kan zijn aan dat van het eerste. Dit verschijnsel zou verband kunnen houden met de invloed van het endosperm op de fysiologie van het eerste blad, terwijl de reactie van het tweede blad bepaald wordt door het genotype van het embryo. De graduele verschillen in infectietypen op het eerste blad van F2-kiemplanten, een verschijnsel dat ook door Macer (1966) is gevonden, zouden het gevolg kunnen zijn van een gen-dosis effect in het endosperm.

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