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A CASE OF RACE DIFFERENTIATION OF BROWN RUST ON MATURE PLANTS OF WHEAT[1]

Een geval van fysio-onderscheiding bij bruine roest op volwassen tarweplanten

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INTRODUCTION

When a wheat variety is tested using a unipustular culture of yellow rust *(Puccinia striiformis)*, there is frequently a difference between the reactions of the seedling and the mature plant (ZADOKS, 1961). This difference imposes serious limitations upon the interpretation of race identification work with seedlings. Field observations suggested that a similar difference occurs in some wheat varieties tested with brown rust *(Puccinia recondita)* and the following is a description of a pilot experiment performed in 1961.

Since the method of the race nurseries used in yellow rust work is very expensive, comparative tests have been made with detached leaves floating on an aqueous substrate. PERSON et al. (1957) grew rust on detached seedling leaves floating on 30 to 100 ppm benzimidazole or on 5 ppm kinetine. BJÖRKMAN (1960) showed race identification to be feasible with detached seedling leaves floating on 40 ppm, or partly submerged in 60 ppm, benzimidazole.

MATERIAL AND METHODS

Two unipustular isolates of brown rust were selected, one virulent on the commercial wheat variety 'Felix' in all growth stages (isolate A), the other avirulent on this variety in the mature plant stage (isolate B).

A set of varieties was sown in two race nurseries in the polder Oostelijk Flevoland (for details see ZADOKS, 1961). The spreader rows, planted with the variety 'Rubis', were inoculated on April 14th; notes were taken on June 27th at the end of flowering (growth stage ca. 10.5 on FEEKES scale).

For testing mature plant reaction with detached leaves, an identical set of varieties was grown on the trial field at Wageningen. Leaves from plants in growth stages 8 to 10.3 and apparently uninfected were detached and washed in a 1% Tween 80 solution and in tap water. Fragments 5 cm long were inserted in glass clips and floated in petri dishes on a 20 ppm kinetine solution. After uniform inoculation with a spore duster, the petri dishes were closed and stored in a conditioned greenhouse at ca. 15 °C, a minimum light intensity of ca. 40,000 ergs. cm^{-2}. sec^{-1} sphere diameter.

The seedling tests were carried out in two ways, using intact plants grown in pots and also detached leaves, kept under the greenhouse conditions mentioned.

The following observations were made. In all tests the infection type was

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noted in the traditional scale from i (no reaction) to 4 (susceptible reaction). In the race nurseries the percentage of attack of the two upper stem leaves was estimated. On the detached leaves of mature plants the number of pustules per square centimeter was counted on the 14th day after infection.

RESULTS

The two isolates could not be differentiated on intact seedlings nor on detached seedling leaves. Sixty varieties were tested, among which were the varieties showing mature plant differentiation. The standard differential set for brown rust was not tested, as no seed was available.

When tested on mature plants in the race nurseries, the two isolates behaved very differently. Most of the differences could be reproduced with the detached leaf method. Table 1 gives a typical result. In the seedling stage there is no difference between isolates, varieties or methods. In the mature plant stage there are clear differences between varieties and isolates, but no essential differences between methods. Several varieties give the same reaction pattern as 'Felix', some with smaller and others with larger differences between isolates. Few varieties present the reaction pattern of 'Hybrid 46', all with smaller differences between isolates.

TABLE 1. Observations on two wheat varieties tested with two brown rust races, in the seedling and in the mature plant stage, on intact plants and on detached leaves.

Methods *Methoden*	Mature plants *Volwassen planten*		Seedlings *Kiemplanten*		Varieties *Rassen*
Intact plants	Relative percentage of attack		Infection type		
Intacte planten	*Relatief aantastings-percentage*		*Infectie-type*		
	12	0.05	4	4	'Felix'
	1	3.2	4	4	'Hybrid 46'
Detached leaves	Number of pustules *Aantal sporenhoopjes*		Infection type *Infectie-type*		
Afgesneden bladeren	9	0	4	4	'Felix'
	1.3	8.5	4	4	'Hybrid 46'
Isolates *Herkomsten*	A	B	A	B	

A serious inconvenience is the lability of infection types. A type 0 reaction in the race nursery often corresponds with a type 4 reaction on detached leaves. Table 2 shows an extreme but not unusual example. The greatest lability is shown by varieties with a type 0 reaction in the race nurseries. Moreover, there is a general tendency towards higher infection types on the detached leaves as compared with the intact leaves. The i type in the field corresponds with an i type on detached leaves.

TABLE 2. The lability of the 0 type reaction in mature plants, demonstrated by the difference in infection type between intact and detached leaves.

Variety *Ras*	Race nurseries *Fysiovelden*				Detached leaves *Afgesneden bladeren*			
	Infection type *Infectie-type*		Percentage of attack *Aantastings-percentage*		Infection type *Infectie-type*		Number of pustules *Aantal sporen-hoopjes*	
'Opal'	0	i	3.5	0	4	i	7.2	0
Isolates *Herkomsten*	A	B	A	B	A	B	A	B

CONCLUSIONS

Experiments with two brown rust isolates, tested on sixty wheat varieties, showed that in brown rust of wheat there exist races which can be differentiated only on mature plants.

Race differentiation on mature plants can be done in a race nursery or by the detached leaf method, both methods having their specific limitations.

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SAMENVATTING

Proeven met 2 bruine-roestherkomsten, getoetst op 60 tarwerassen, toonden aan, dat er fysio's bestaan, die alleen met behulp van volwassen planten herkend kunnen worden.

Fysio-determinatie met volwassen planten kan geschieden met de fysioveldmethode of met de afgesneden-bladmethode, waarbij in aanmerking genomen moet worden, dat beide methoden hun beperkingen hebben.

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