

DIFFERENCES IN AGGRESSIVENESS BETWEEN
TMV-ISOLATES FROM TOMATO ON CLONES OF
*LYCOPERSICUM PERUVIANUM*¹

*Verschillen in agressiviteit tussen TMV-isolaties van tomaat op klonen van
Lycopersicum peruvianum*

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The reactions of 64 TMV-isolates from tomato were compared on 30 clones of *Lycopersicum peruvianum*. Differences in aggressiveness, as appearing from the number of clones infected, were established between isolates belonging to one strain as well as between isolates belonging to symptomatologically different strains.

INTRODUCTION

MCRITCHIE & ALEXANDER (1963) proved the existence of four host specific *Lycopersicum*-strains of tobacco mosaic virus (TMV) in Ohio, U.S.A. The differentiation of these Ohio-strains is based upon the reactions on the *L. esculentum*-variety 'Bonny Best', WALTER's *L. esculentum*-selection CStMW-18 and a number of *L. peruvianum*-selections. An investigation made by ALEXANDER (1962) in the Netherlands revealed a close relationship of Dutch TMV-isolates to the Ohio-strains I, II and IV. However, from the limited number of isolates studied no evidence was found for the presence of the Ohio-strain III. On the basis of symptoms on susceptible tobacco and tomato varieties the Ohio-strains represent isolates of common green strains. According to their reaction on the 'White Burley'-line of *Nicotiana tabacum*, selected by TERMOHLEN & VAN DORST (1959), the Ohio-strains I and II belong to the tobacco strain of TMV, the Ohio-strains III and IV to the tomato strain of TMV. The tobacco strain which is the TMV proper and is alternatively referred to as the tobacco form or tobacco type, causes a systemic infection of 'White Burley'. On the other hand the tomato strain, which more or less corresponds with the tomato streak virus (SMITH, 1957: 522-524) and is alternatively called tomato form or tomato type, causes only local necrotic lesions.

Classification of TMV-strains in the Netherlands so far has been based mainly on the differentiating quality of the 'White Burley'-line mentioned next to the symptoms on susceptible tobacco and tomato varieties, notably *N. tabacum* 'Samsun nn.' and *L. esculentum* 'Moneymaker'. On this basis at least five strains could be distinguished, a brief description of which is given below. For a resistance-breeding program in tomato it is important to know whether or not differences in aggressiveness exist between isolates of any one strain and between isolates of strains which differ symptomatologically.

¹ Accepted for publication 3 May, 1967.

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MATERIALS AND METHODS

Apart from the tobacco and the tomato strains of TMV, which both cause a green mosaic on the susceptible hosts mentioned and hence are called green strains, other symptomatologically different strains have been isolated from tomato in the Netherlands. These strains, which all show the same reaction on 'White Burley' as does the tomato strain, are the following:

- the distorting strain, which on tomato is characterized by leaf-narrowing and enations arising from the lower sides of leaves throughout the year being similar in this respect to the tobacco distorting virus (SMITH, 1957: 518-519),
- the yellow strain, which causes a yellow mosaic both on tobacco and tomato and which is probably identical to the tomato aucuba virus (SMITH, 1957: 520) and
- the yellow ringspot strain, which is characterized by the formation of yellow ringspots on susceptible hosts, particularly on 'Samsun nn.' (RAST, 1965).

The abbreviations used to indicate these five strains in the present paper refer to symptom characteristics on susceptible hosts and a systemic or localized reaction on 'White Burley'. So GS and GL stand for the green tobacco and tomato strains respectively, DL, YL and YRL for the distorting, yellow and yellow ringspot strains respectively.

Ever since ALEXANDER's investigation (1962) attempts have been made to correlate Dutch isolates reacting like the tomato strain with the Ohio-strains III and IV. For this purpose the *L. peruvianum*-selection P.I. 128655-2Y-1-1-1-M was used as differential host, since it is known to be resistant to the Ohio-strains I, II and III, but susceptible to the Ohio-strain IV. However, contradictory results were obtained when successive groups of seedling plants were inoculated with any one isolate. It was thought that by using clones instead of seedlings more uniform results could be expected. So, 30 plants grown from seeds of the *L. peruvianum*-selection mentioned were propagated vegetatively by means of cuttings so as to compose genetically identical populations for each isolate to be tested.

During a period of 18 months a total of 64 isolates, representing five symptomatologically different strains, were tested each on 30 clones; 15 of these isolates were tested at least twice.

The great majority of the isolates infected less than 10 clones visibly, which necessitated a search for virus-carriers among those which had remained symptomless. This was accomplished by taking a random sample of about 10 symptomless clones per isolate and assaying these separately on *N. tabacum* 'Xanthi nc.'. The assays, however, did not substantially alter the results as obtained by the readings of visual symptoms alone. Following inoculation the plants were kept in observation for at least five weeks after which the assays were made.

RESULTS AND DISCUSSION

The results of the tests on *L. peruvianum* have been compiled in Table 1. Since the five clones referred to in the 3rd column are ever the same and appeared to be generally susceptible to all isolates tested, these clones are unavoidably included in the 4th and 5th columns indicating a greater total number of clones infected. It should be born in mind, however, that in these cases the same total number of clones does not necessarily mean the same clone numbers.

TABLE 1. Differences in aggressiveness among TMV-isolates appearing from the number of clones infected out of 30 clones of *Lycopersicum peruvianum*.
Verschillen in agressiviteit tussen TMV-isolaties zoals op 30 klonen van Lycopersicum peruvianum tot uiting komend in de aantallen aangetaste klonen.

Strain (for explanation see text)	Total number of isolates	Number of isolates infecting:		
		5 clones only (nrs. 6,20, 23, 25, 28)	up to 10 clones (including nrs. 6,20, 23, 25, 28)	more than 10 clones (with actual total numbers)
GS	7	7	0	0
GL	32	20	9	3 (12, 16, 20)
DL	5	3	2	0
YL	7	5	1	1 (23)
YRL	13	7	3	3 (17, 18, 26)

TABLE 2. Differentiation of TMV-isolates on 30 clones of *Lycopersicum peruvianum*.
 + = susceptible; arrows indicate supplementary reactions.
Differentiatie van TMV-isolaties op 30 klonen van Lycopersicum peruvianum.
 + = vatbaar; pijlen geven aanvullende reacties aan.

Strain (for explanation see text)	GS	GL	DL	GL	GL	GL	YL	YRL	YRL	YRL	YRL	YL
Isolate nr	1	2	3	4	5	6	7	8	9	10	11	12
Clone nr												
6	+	+	+	+	+	+	+	+	+	+	+	+
20	+	+	+	+	+	+	+	+	+	+	+	+
23	+	+	+	+	+	+	+	+	+	+	+	+
25	+	+	+	+	+	+	+	+	+	+	+	+
28	+	+	+	+	+	+	+	+	+	+	+	+
17		+	+	+	+	+	+	+	+			
18				+	+	+	+	+	+	+		
2		+		+	+		←+	+	+			
16			+	+	+	+	+	←+	+			
14					+	+	+	+	+	+		
19			+			+	+	+	+	+		
24				+	+	+	+	+	+			
7			+	+	+	+	→		←+			
11				+		+	+	+	+			
22						+	+	+	+		+	
29					+	+	+	+		+		
12					+	+	+	+				
13					+	+	+	+				
15					+	+	+	+		+		
30					+	+	→		←+			
3							←+	+				
4							←+	+				
8						+	→	+				
9							+	+				
10							+	+				
21							+	+				
1								+				
5								+				
26								+				
27									←+			
Total number of clones infected	5	7	9	12	16	20	23	26	17	10	6	5

Table 2 presents the results with 12 isolates for which the above mentioned assays included all clones that remained symptomless up to six weeks after inoculation.

It should be pointed out that the symptomatologically different isolates numbers 6 and 7 originated from one TMV-leaf sample and then it is interesting to note that these isolates fill up each other's gaps nicely. The same is true for the isolates numbers 8 and 9 which, however, came from two different sources though representing one strain symptomatologically. The results indicate that yellow strains should not be ignored when searching for differences in aggressiveness in an attempt to provide plant breeders with the most suitable inocula. On the other hand isolate number 12, which represents the most virulent yellow strain, is not more aggressive than isolate number 1, which represents the moderately virulent tobacco strain of TMV.

Except for the tobacco strain-isolates the results in general confirm the existence of differences in aggressiveness between and within strains of TMV. The Dutch isolates, however, as already suggested by ALEXANDER (1962), are apparently not identical to the Ohio-strains. Considering only the reactions on this particular *L. peruvianum*-host differential, most of the tomato strain-isolates and those reacting similarly on 'White Burley' seem to be related to the Ohio-strain III rather than to the Ohio-strain IV. In this connection, however, reference should be made to ALEXANDER *et al.* (1963) whose results with Dutch isolates indicated a close serological relationship to Ohio-strain IV, but a very distant relationship to the Ohio-strain III. This remarkably also applied to what appeared to be tobacco strain-isolates.

Obviously serological tests, next to the testing of more differential hosts, are necessary in future work to settle the issue of the relationships between the Ohio-strains and some of the TMV-isolates presented above.

SAMENVATTING

De reacties van 64 TMV-isolates van tomaat werden vergeleken op 30 klonen van *Lycopersicum peruvianum*. Verschillen in agressiviteit, zoals tot uiting komend in de aantallen aangetaste klonen, werden vastgesteld zowel voor isolaties behorend tot één stam als voor isolaties behorend tot symptomologisch verschillende stammen.

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