Vitis 11, 29—33 (1972)

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Blossom-end rot of Anab-e-Shahi grape (Vitis vinifera L.)

by

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Fruchtendenfäule bei der Rebsorte Anab-e-Shahi (Vitis vinifera L.)

Zusammenfassung. — Um die Beziehung der N-, P-, K-, Ca- und Mg-Ernährung zur Fruchtendenfäule (Blossom-end rot) der Rebsorte Anab-e-Shahi zu klären, wurden Blattstiele, Blattspreiten, Beeren und Beerenhäute aus je 5 Rebanlagen ohne erkrankte und mit erkrankten Beeren untersucht. Die Ergebnisse zeigen, daß weniger die verschieden starke Aufnahme des Calciums durch die Rebe als eine unzulängliche Assimilation des Calciums durch die Früchte für das Auftreten der Krankheit verantwortlich ist.

Introduction

Blossom-end rot occurs in tomato (Chamberlain 1933, Stout 1934, Foster 1939, Young 1942, Raleigh and Chucka 1944, Ansiaux 1956, Geraldson 1957 a, b, and Spurr 1959) and pepper (Geraldson 1957 a) but its occurrence in grapes has not, so far, been reported. During 1969—70 this disorder affecting the berries of Anab-e-Shahi grape (Fig. 1) was observed in certain vineyards in Hyderabad, the foremost centre of viticulture in India.

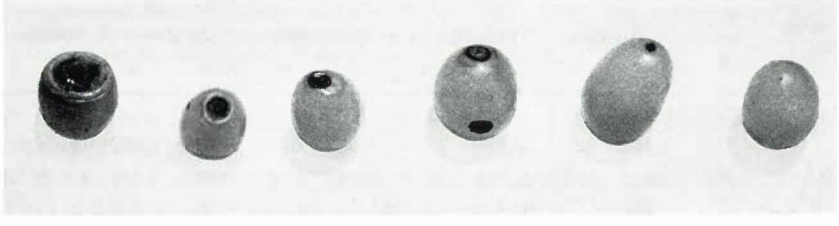

Fig. 1: Anab-e-Shahi berries with increasing severity of blossom-end rot.

Blossom-end rot is commonly attributed to various nutritional factors. In solution culture experiments on tomato, as early as 1939, Raleigh found that deficiencies of micro-elements did not induce blossom-end rot, but with solutions lacking the major elements typical blossom-end rot symptoms did develop. This disorder has been largely attributed to the factors affecting the availability of calcium to the developing fruit (Ansiaux 1956, Geraldson 1957 a, Spurr 1959). Lyon *et al.* (1942) reported that where the rot was most severe, the fruit was low in calcium content and high in potassium and magnesium. The present study was therefore made to assess the association of the major nutrient levels in the leaves and berries with the incidence of the rot in Anab-e-Shahi grape.

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Materials and Methods

For the present study, the leaf and berry samples were collected from five vineyards showing the symptoms of blossom-end rot and five healthy (normal) vineyards. The contents of nitrogen, phosphorus, potassium, calcium and magnesium were determined in petioles and leaf blades separately. The berries were cut transversely for stalk-end and blossom-end halves which were analysed for calcium and magnesium. The skins of the blossom-end and stalk-end halves were also analysed for calcium and magnesium contents.

The samples were washed, dried and powdered following the standard laboratory procedures. Nitrogen was determined by the modified micro-Kjeldahl method given by IAE agency (ANONYMOUS 1964), phosphorus was estimated by the vanado-molybdate method given by JACKSON (1958) and potassium by the flame photometer method given by PIPER (1944). Calcium and magnesium were determined by the versenate titration method given by the U.S. Salinity Laboratory Staff, after eliminating the interfering cations as suggested by JACKSON (1958).

Results and Discussion

In general, the leaves of blossom-end rot affected vineyards tended to contain more nitrogen, phosphorus and potassium but less calcium and magnesium than

Table 1

Nutrient content of the leaves of blossom-end rot affected and healthy vineyards of Anab-e-Shahi

Sample No.	P or B	Content in mg/100 mg on dry weight basis									
		Nitrogen		Phosphorus		Potassium		Calcium		Magnesium	
		A	H	A	H	A	H	A	H	A	H
1	P	0.924	0.812	0.645	0.370	2.42	2.23	0.481	0.541	0.164	0.328
	B	3.164	2.632	0.510	0.240	1.08	0.92	0.247	0.691	0.164	0.109
2	P	0.980	1.512	0.550	0.370	2.33	3.50	0.571	0.301	0.584	0.292
	B	3.360	2.604	0.400	0.370	1.42	1.50	0.601	0.661	0.146	0.146
3	P	0.896	1.092	0.590	0.970	3.08	2.82	0.451	0.481	0.347	0.438
	B	3.164	2.828	0.440	0.520	2.17	1.59	0.992	0.541	0.164	0.219
4	P	0.924	0.924	0.830	0.755	2.57	2.90	0.421	0.511	0.219	0.383
	B	2.352	3.052	0.480	0.265	1.08	1.33	0.842	1.232	0.164	0.219
5	P	1.036	0.924	1.050	0.660	3.32	3.06	0.361	0.752	0.164	0.565
	B	2.856	2.296	0.280	0.100	1.75	1.59	0.752	0.391	0.592	0.182
Mean	P	0.952	1.053	0.733	0.625	2.744	2.902	0.457	0.517	0.296	0.401
	B	2.979	2.682	0.422	0.299	1.500	1.383	0.685	0.703	0.164	0.175
% deviation from healthy leaves	P	— 9.6		+17.2		—5.4		—11.6		—26.2	
	B	+11.1		+41.1		+8.3		— 2.6		— 6.3	

P = Petiole; B = Leaf blade.
A = Affected samples; H = Healthy samples.

Table 2

Calcium and magnesium contents of the blossom-end rot affected and healthy berries of Anab-e-Shahi

Sample No.	B or S	Content in mg/100 mg on dry weight basis							
		Calcium				Magnesium			
		Berries		Peels		Berries		Peels	
		A	H	A	H	A	H	A	H
1	B	0.09	0.09	0.15	0.15	0.055	0.037	0.055	0.018
	S	0.12	0.09	0.15	0.15	0.018	0.018	0.018	0.037
2	B	0.09	0.09	0.15	0.21	0.037	0.018	0.055	0.018
	S	0.12	0.12	0.15	0.27	0.037	0.037	0.018	0.037
3	B	0.09	0.12	0.15	0.18	0.055	0.055	0.055	0.018
	S	0.12	0.12	0.15	0.21	0.018	0.037	0.018	0.018
4	B	0.09	0.12	*	0.18	0.055	0.037	*	0.037
	S	0.09	0.12	*	0.18	0.018	0.018	*	0.037
5	B	0.12	0.12	0.15	0.15	0.037	0.018	0.055	0.037
	S	0.12	0.09	0.21	0.15	0.018	0.018	0.018	0.037
Mean	B	0.096	0.108	0.150	0.174	0.048	0.033	0.055	0.026
	S	0.114	0.108	0.165	0.192	0.022	0.026	0.018	0.033
% deviation from healthy berries	B	—11.1		—13.8		45.4		111.5	
	S	5.6		—14.1		—15.4		—45.4	

B = Blossom-end half; S = Stalk-end half.
A = Affected samples; H = Healthy samples.
* Peels could not be analysed as sample size was very small.

those of normal vineyards. These differences, however, were statistically not significant (Table 1).

The data on berry analysis, given in Table 2, indicate that in blossom-end rot affected berries the calcium content of blossom-end halves was less than that of stalk-end halves. It is also seen that the blossom-ends of the affected berries had less calcium than those of the healthy ones, while the position was reversed in respect of stalk-ends. However, the differences between the calcium content of the skins of stalk-end halves and blossom-end halves, both in healthy and rot affected berries, were not appreciable. The magnesium content on the other hand was higher in the blossom-ends than in the stalk-ends. But the differences were significant only in rot affected berries (Table 3). The magnesium content in the skins of the two halves of the fruit reflected the same trend. The skins of the blossom-end halves had a significantly higher magnesium content than those of the stalk-end ones in affected berries but not in healthy ones. Compared with healthy berries, the blossom-end skins of the affected berries had 111.5% more magnesium (highly significant) while the stalk-end skins had 45.4% less magnesium.

When the ratio of calcium to magnesium was worked out (Fig. 2), it was significantly higher in the stalk-end halves than in the blossom-end halves of the affected berries (Table 3). In the healthy berries the ratio between the two halves was not significantly different. The position was similar in the skins. Compared

Table 3

Differences in the means of the nutrient contents and their ratios in the blossom-end rot affected and healthy berries of Anab-e-Shahi grape

Mean tested	't' values			
	B — S		A — H	
	Berries	Peels	Berries	Peels
1. Ca in the healthy samples	0.00	—1.5	—	—
2. Ca in the affected samples	—2.34	—1.0	—	—
3. Ca in the stalk-ends	—	—	0.63	—0.94
4. Ca in the blossom-ends	—	—	—1.26	—1.905
5. Mg in the healthy samples	0.95	—1.65	—	—
6. Mg in the affected samples	3.51*	infinity**	—	—
7. Mg in the stalk-ends	—	—	—0.633	—3.45*
8. Mg in the blossom-ends	—	—	1.805	5.65**
9. Blossom-end Ca/stalk-end Ca	—	—	—1.90	0.024
10. Blossom-end Mg/stalk-end Mg	—	—	2.02	15.83**
11. Ca/Mg in the affected berries	—4.58*	—7.68**	—	—
12. Ca/Mg in the healthy berries	—0.70	1.1	—	—
13. Ca/Mg in the stalk-ends	—	—	1.09	1.5
14. Ca/Mg in the blossom-ends	—	—	—1.97	—3.12*

S = Stalk-end contents; B = Blossom-end contents.
A = Affected samples; H = Healthy samples.
* Significant at 5% P level; ** Significant at 1% P level.

to healthy berries the Ca/Mg ratio was significantly lower in the blossom-end skins of the affected berries (Fig. 2).

As shown above, there were no significant differences in the calcium and magnesium contents of petioles and leaf blades of the affected and healthy vineyards. But differences in magnesium contents and in the ratios of calcium to magnesium in berries and skins were significant. This status revealed that there was no difference in the absorption of nutrients but only in their assimilation. Low

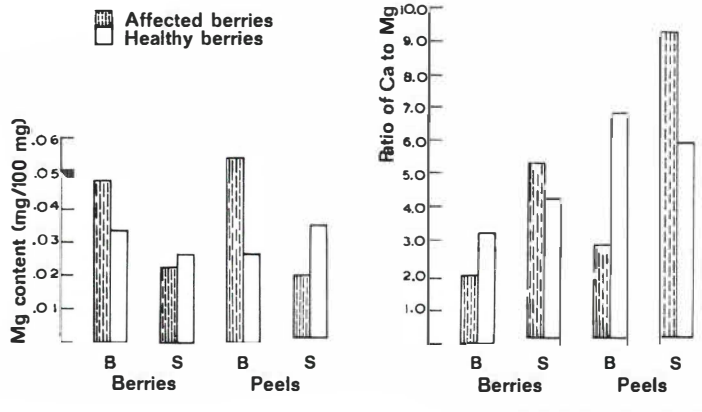

Fig. 2: Mg contents and the ratio of Ca to Mg in blossom-end rot affected and healthy berries.
B: Blossom-end; S: Stalk-end.

level of calcium in the blossom-end associated with high magnesium level is presumably due to a compensating uptake of magnesium. The Ca/Mg ratio of the blossom-ends of berries appears to be closely associated with this disorder. As calcium could not be absorbed by the skins of the blossom-ends in rotten berries, more magnesium might have been translocated as a substitute of calcium to maintain ionic equilibrium. Thus, the higher magnesium content in the blossom-ends of the affected berries may not be the cause for this disorder, but the result of low calcium absorption by the rotten berries.

Further work will be needed to elucidate the causes for the low Ca/Mg ratio in the affected berries.

Summary

To assess the association of N, P, K, Ca and Mg nutrition with "Blossom-end rot" of Anab-e-Shahi grape, petioles, leaf blades, berries and peels from five normal and five rot-affected vineyards were analysed. Results of the analysis indicated that the defective calcium assimilation by fruits is responsible for this disorder, rather than the differential uptake of calcium by vines.

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Eingegangen am 16. 8. 1971

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