

CSIRO Division of Horticultural Research, Merbein, Victoria, Australia

A comparison of grapevine summer mottle and vein mosaic diseases

by

R. C. WOODHAM and L. R. KRAKE

Ein Vergleich von Grapevine summer mottle und Vein mosaic disease

Zusammenfassung. — Das in Australien vorkommende Grapevine summer mottle und das in Frankreich (Elsaß) verbreitete Vein mosaic sind keine identischen Krankheiten. Daß die auslösenden Agenzien der beiden Krankheiten sich unterscheiden, zeigten Gewächshausbeobachtungen an erkrankten Reben australischer und französischer Herkunft und Versuche zur Pfropfübertragung auf Indikatorreben. Zwei mit Vein mosaic infizierte Rebsorten lösten bei Indikatorreben (*Vitis vinifera*) keinerlei Symptome von Summer mottle aus. Diese beiden Sorten und die mit Summer mottle infizierte Sorte induzierten jedoch identische Krankheitssymptome bei *V. riparia* Gloire, einem Indikator für Vein mosaic.

Im Freiland wurde nur einmal die natürliche Ausbreitung von Summer mottle auf eine benachbarte Rebe festgestellt.

Introduction

A comparison of photographs made at the Centre de Recherches — INRA, Colmar, France, in 1978 indicated that leaf symptoms associated with grapevine summer mottle disease in Australia appeared similar to those of vein mosaic disease in France. Summer mottle symptoms described by KRAKE and WOODHAM (1978) were first found in a single provenance of *Vitis vinifera* L. cv. Sideritis at Merbein, Australia, while symptoms associated with vein mosaic in Europe have been reported by LEGIN and VUITTENEZ (1973), POP (1973). Vein mosaic is common in the Alsace region and occurs in several cultivars (VUITTENEZ, personal communication), but summer mottle is rare in Australia. Both are graft-transmissible diseases of unknown etiology.

To determine the relationship of the diseases, two *V. vinifera* cultivars infected with vein mosaic were imported from France in 1979. This paper reports the foliar symptoms of the two diseases in the respective source vines and in other experimentally infected vines grown in a glasshouse, and demonstrates that the two diseases are not the same.

Materials and methods

For the comparative studies, a virus-tested clone of each of three cultivars was grown at Merbein in a glasshouse under quarantine regulations. The cultivars grown were Sideritis, from Merbein, infected with summer mottle disease (KRAKE and WOODHAM 1978), and the two French clones of Viognier and Ehrenfelser infected with vein mosaic (VUITTENEZ, personal communication). Cuttings from each cultivar were propagated in winter 1979, and three plants of each were grown in containers and used as sources of disease for two graft-transmission tests to known vine indicators of the respective diseases:

- (1) For summer mottle, newly established plants of Cabernet Franc and Mission or Mission Seedling 1 (a selected seedling of Mission) were inoculated in spring 1980 with semi-mature chip-buds from each source.
- (2) For vein mosaic, young vines of a healthy clone of *V. riparia* cv. Gloire (B 570), imported from France, were green-grafted in February 1981 with scions from each source. This cultivar is a good indicator for vein mosaic (LEGIN and VUITTENEZ 1973).

Three successfully grafted plants of each indicator were grown in containers, and corresponding uninoculated plants of each indicator were used as controls. For both tests, the growth of each inoculum scion was kept restricted to promote growth of the indicator stocks. Each winter the vines were pruned to 6–8 basal buds. At each pruning and at subsequent handlings, care was taken to avoid contamination and thus the possible spread of disease between sources.

Regular inspections for foliar symptoms on source vines were made during 4 growing seasons, and on the indicators for 3 and 2 years, respectively. Temperatures within the glasshouse, which was shaded during the summer-autumn periods, ranged between a maximum of 30 °C and a night minimum of 16 °C and, when shaded, the light intensity was 250–300 $\mu\text{E m}^{-2} \text{s}^{-1}$.

Results

The presence or absence of symptoms associated with summer mottle and vein mosaic diseases in source vines and in inoculated indicator cultivars are given in the Table. Typical severe symptoms of summer mottle, namely yellowish feathering from

Observations of summer mottle and vein mosaic diseases in source vines and grafted indicator vines in a glasshouse over 4 years

Summer mottle und Vein mosaic bei den als Infektionsquellen benutzten Reben und bei gepfropften Indikatorreben · Ergebnisse 4jähriger Beobachtungen im Gewächshaus

Cultivar	Inoculum source	Disease symptoms noted in growing season ¹⁾			
		1979/80	1980/81	1981/82	1982/83
Sideritis		SM	SM	SM	SM
Viognier		0	0	0	0
Ehrenfelser		0	0	0	0
Cabernet Franc	Sideritis	—	SM, LR	SM, LR	SM, LR
Cabernet Franc	Viognier	—	0	LR	LR
Cabernet Franc	Ehrenfelser	—	0	0	0
Mission	Sideritis	—	0	SM	SM
Mission Seedling 1	Viognier	—	0	0	0
Mission Seedling 1	Ehrenfelser	—	0	0	0
<i>V. riparia</i> cv. Gloire	Sideritis	—	0	VM	} ²⁾
<i>V. riparia</i> cv. Gloire	Viognier	—	0	VM	
<i>V. riparia</i> cv. Gloire	Ehrenfelser	—	0	VM	

¹⁾ The growing season in Australia occurs over parts of 2 calendar years.

SM = summer mottle, LR = leafroll, VM = vein mosaic, — = not applicable.

²⁾ Vines discarded in winter 1982.

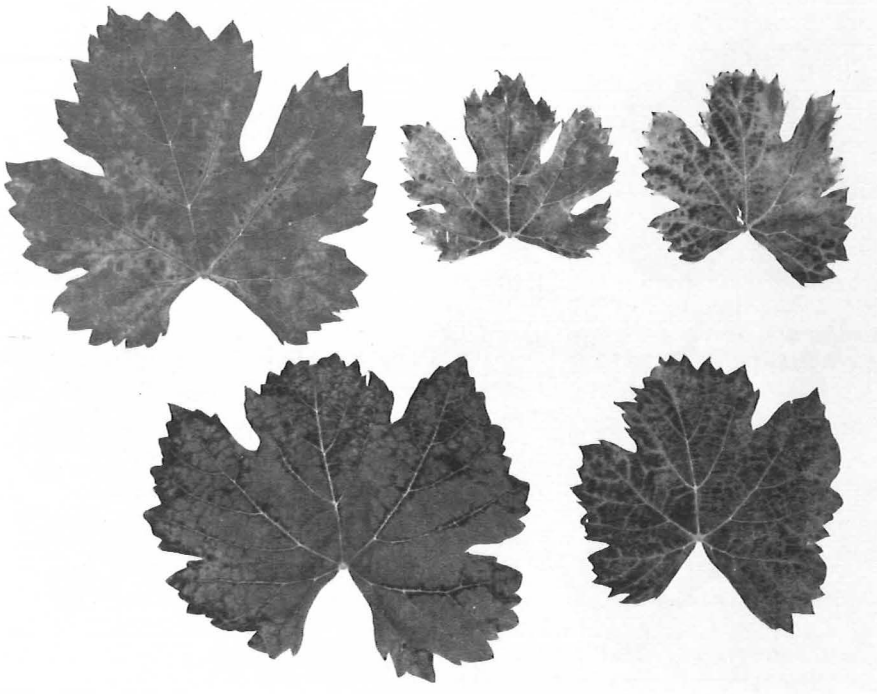


Fig. 1: Symptoms of summer mottle disease in Cabernet Franc induced by *Sideritis* but not by the two French sources.

Durch die Rebsorte *Sideritis* ausgelöste Symptome von Summer mottle bei Carbernet Franc; die beiden erkrankten Sorten französischer Herkunft sind dazu nicht in der Lage.

veins and yellowish mottling of recently matured and expanding laminae (KRAKE and WOODHAM 1978), occurred on all *Sideritis* source vines in each of the 4 years; the symptoms remained systemic on actively growing shoots through to autumn. However, no symptoms appeared on either Ehrenfelser or Viognier source vines which do express vein mosaic symptoms in the greenhouse in France (VUITTENEZ, personal communication).

Typical summer mottle symptoms were induced in the summer mottle indicators by *Sideritis* (Fig. 1), but not by Viognier or Ehrenfelser. On the other hand, all three inoculum sources induced an identical symptom in *V. riparia* cv. Gloire. The symptom of yellowish feathering from veins, pseudo-ringspot and line pattern-like discolourations on recently matured and older laminae (Fig. 2) was systemic on new active growth, and was similar to that of vein mosaic in cv. Gloire illustrated by UYEMOTO et al. (1978). When used as inoculum in February 1981, *Sideritis* vines showed summer mottle symptoms but the two French sources were symptomless. The transmission of leafroll disease to Cabernet Franc from *Sideritis* and Viognier confirmed the knowledge that these two source vines were also infected with leafroll (WOODHAM and KRAKE 1978; VUITTENEZ, personal communication).

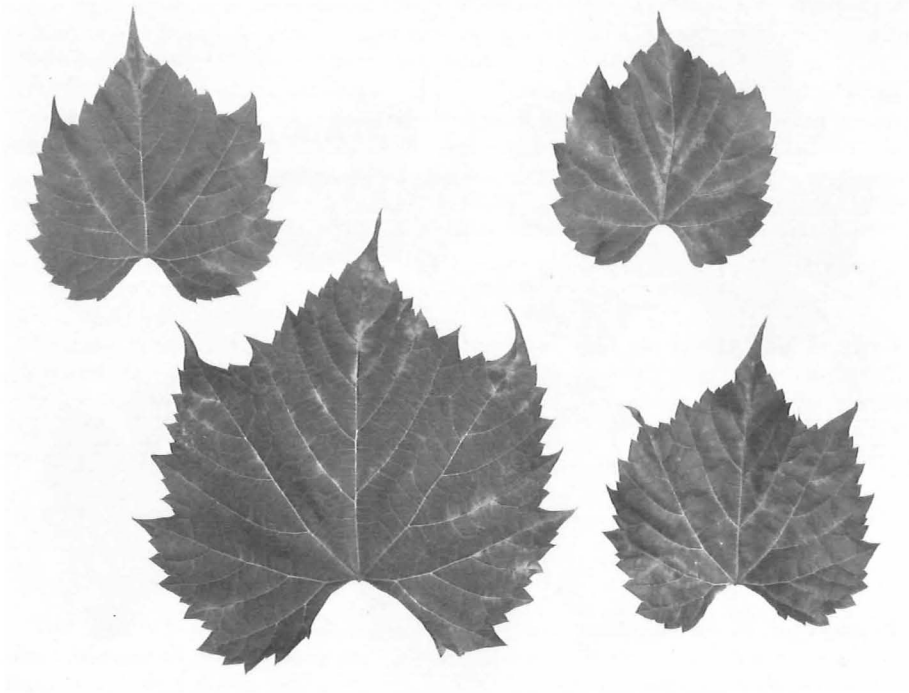


Fig. 2: Symptoms in *V. riparia* cv. Gloire induced by all three sources of disease. Top: Recently matured leaves. Bottom: Mature leaves.

Symptome bei *V. riparia* Gloire, die durch alle drei erkrankten Sorten ausgelöst wurden. Oben jüngere, unten ältere Blätter.

Discussion

The data presented indicate that summer mottle disease in Sideritis is caused by a component different to that of vein mosaic in Viognier and Ehrenfelser as both clones from France failed to induce summer mottle symptoms in Cabernet Franc and Mission Seedling 1, and suggest that Sideritis also contains vein mosaic. The transmission of leafroll from Viognier to Cabernet Franc proved a successful graft inoculation technique. It is noteworthy that the necrotic spot syndrome expressed by vein mosaic (LEGIN and VUITTENEZ 1973) was not observed in our glasshouse, and also does not occur with summer mottle in Australia — in field, glasshouse or shadehouse environments.

POP (1973) reported that symptoms were induced in *V. rupestris* cv. St. George and in hybrid LN 33 by a vein mosaic disease that caused symptoms variable in appearance and intensity between cultivars and between years, and which depressed shoot growth and root development. Conversely, summer mottle in Australia does not induce symptoms in St. George or LN 33, produces identical and consistent symptoms in both the glasshouse and field from year to year, and does not obviously reduce shoot growth. The differences in host range and symptom expression distinguish summer mottle in Australia from the reported vein mosaic diseases in Europe, and we suggest that the agent of each disease differs.

We presently consider that summer mottle may have a viroid etiology because the disease appears to be temperature-dependent (1) the symptoms are expressed in early summer and remain as a systemic mottling syndrome on active growth through to autumn, and (2) BARLASS *et al.* (1982) found that 60 % of the plants derived from the culture of fragmented shoot-apices from summer mottle-infected plants grown at 32/28 °C (in a growth cabinet) were still infected with the disease, whereas all plants similarly regenerated from infected field-grown vines were free from summer mottle.

A recent inspection of a variety collection at Rutherglen, Victoria, revealed that only the source vines of our Sideritis clone used herein expressed summer mottle symptoms. This is further evidence that summer mottle was probably introduced into Australia with this provenance of Sideritis (KRAKE and WOODHAM 1978); however, the previous overseas source is unknown. Regular inspections of a variety collection at CSIRO, Merbein, since 1978 have shown that summer mottle has spread naturally in the field to an adjacent vine of Flame Tokay. Such spread was noted in only one instance, and occurred recently in the 20-year-old vines.

Summary

Comparisons of grapevine summer mottle disease in Australia and of vein mosaic disease in France using source vines and graft-inoculated indicator vines in a glass-house have demonstrated that the two diseases are not the same. Summer mottle contains a component different to that in vein mosaic. Two sources infected with vein mosaic did not induce any symptoms in *V. vinifera* indicators for summer mottle. However, the two sources and the summer mottle source induced identical symptoms in *V. riparia* cv. Gloire, an indicator for vein mosaic.

Natural spread of summer mottle in the field to an adjacent vine was recorded in only one instance.

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R. C. WOODHAM

L. R. KRAKE

CSIRO Division of Horticultural Research

Merbein, Victoria, 3505

Australia