

The Volcani Center, Agricultural Research Organization, Bet Dagan, Israel

Virus diseases of grapevine in Israel¹⁾

by

EDNA TANNE and F. E. NITZANY

Viruskrankheiten der Rebe in Israel

Zusammenfassung. — Folgende Viruskrankheiten wurden in Israel nachgewiesen: Fan leaf, Gelbmosaik, Blattrollkrankheit sowie die durch ein Mycoplasma hervorgerufene Flavescence dorée. Von ihnen sind Fan leaf und Rollkrankheit weit verbreitet, während Flavescence dorée in den heißen Tälern von Nordost-Israel sehr häufig ist. Eine neue Nematodenart, *Xiphinema italiae*, wurde als Vektor des Fan-leaf-Virus ermittelt. Mechanische Übertragung auf krautige Pflanzen löst das Problem eines schnellen Nachweises nicht.

Introduction

Although many of the grapevine varieties grown in Israel are indigenous, a great deal of introduction has gone on since 1890, the year of Phylloxera outbreak in some regions of the country. During the years 1940—1950, many new root stocks were introduced from several sources.

At the beginning of 1960 signs of decline were observed in several vineyards, accompanied by symptoms of different leaf and bud abnormalities and by a decrease in grape yields.

As a first step, a general survey was undertaken of vineyards throughout the country in order to identify and classify the diseases. This paper presents the results of tests carried out on plant material collected from all over the country and describes the phenomena pertaining to the cause of the diseases and the physiological aspects of the diseased plants.

All the diseases described were found to be graft-transmissible, and since they could not be attributed to any fungal or bacterial agent, they were considered to be virus diseases.

Materials and Methods

Indicator root stocks were grown for one year at least, in nematode-free sterilized soil in a greenhouse. Budwood from the tested grapevine was grafted onto the respective indicator. In the summer, the chip-grafting method was employed, whilst in winter, a modification of this method was adopted, whereby one eye is left on the rootstock near the grafting point, to ensure vegetative growth of the grafted indicator. The following rootstocks were employed as indicators: Rupestris St. George, Mission, Baco 22/A, LN 33 (a cross between 1613 C × Thompson Seedless) and Kober 5 BB.

Mechanical inoculation tests were also done on herbaceous plants, usually on *Chenopodium amaranticolor* COSTE and REYN, and *Ch. quinoa* WILLD. Test plants were kept in the dark for 48 hours prior to inoculation. Inoculum was prepared by macerating suspected grapevine leaves and root tips, with the addition of 0.1 M phosphate buffer (pH 7.6) or of 2.5% nicotine. Inoculated plants were dusted with carborundum (1, 13).

¹⁾ Contributions from The Agr. Res. Organization, The Volcani Center, Bet-Dagan, Israel. 1972 Series, No. 2246-E.

Table 1

Virus and mycoplasma diseases identified on different grapevine varieties and rootstocks in Israel

Virus- und Mycoplasma-Krankheiten, die an Ertrags- und Unterlagssorten in Israel nachgewiesen wurden

Varieties and Rootstocks	Fanleaf virus	Yellow mosaic virus	Leaf-roll virus	Flavescence dorée	Local variety
Aledo			×		
Alfonse	×				
Almeria negra	×				
Cabernet-Sauvignon			×		
Carignan		×			
Chalili			×		
Colorado de-Ragol			×		
Danoug	×		×		×
Harsh Levely	×				
Malca			×	×	×
Mouscat	×		×		
Mouscat Français	×				
Pnina	×		×		
Santa Caterina	×				
Semillon			×		
Sousau	×				
Tamar	×		×	×	
41 B	×		×		
N 19-62			×		
N 15-3			×		
333 EM			×		
Paulsen			×		

Nematodes of the genera *Xiphinema* and *Longidorus* were tested as possible vectors, following the procedure described elsewhere (3). These nematodes were generally kept on the infected plants for an acquisition period of 3—6 months, and then removed (4), selected for vitality and finally transferred to healthy Rupestris St. George or Mission vines growing in sterilized soil. Within 4 months from the transfer, apical leaves and root tips of the inoculated plants were macerated, and mechanical inoculations were carried out on *Ch. amaranticolor* and *C. quinoa*, as described above.

Serological tests following the agar gel diffusion method were carried out to identify the fanleaf virus (14).

Results

Graft-transmissible diseases could be grouped into the following three categories: a) The fanleaf group showing leaf deformations, mosaics, and mottles of different kinds, whose viral origin could be confirmed through mechanical inoculation, vector transmission, partial purification of the virus, and serological tests (9, 10, 12). b) The leaf-roll group, distinguished by the downward rolling of the leaves, premature red colouring in dark varieties, and early drying of the leaves (6, 7, 9).

c) Flavescence dorée, showing a combination of branch and leaf abnormalities — yellowing of the leaves, elastic branches due to improper xylem formation — and general deterioration of the plants (2).

The virus diseases identified in vineyards in Israel are described in the following.

Grape fanleaf virus: The disease, observed all over the country, causes rapid degeneration of the affected grapevines and drastic reduction of their yielding capacity. In some areas, a general decline of the plants is observed after 8—10 years, accompanied by diminishing yields, which makes grape growing uneconomical.

The disease has been identified by graft transmission to healthy Rupestris St. George and Mission indicator stocks, which manifested severe leaf deformation and vein clearing 6 to 24 months after budding. Mechanical inoculation to *Ch. amaranticolor* and to *Ch. quinoa* also gave positive results, but frequently, no symptoms were evident in the inoculated *Chenopodia*.

Transmission was also secured by the nematodes *X. index* and *X. italiae* (3) following the technique described previously.

Grape yellow mosaic virus: This disease appears to be caused by a strain of the grapevine fanleaf virus. It has been observed sporadically in Israel since 1969.

The disease was identified by positive response to grafting on Rupestris St. George, Mission, Baco and Kober 5 BB. Symptoms are quite specific and appear rapidly; when grafting was done in late autumn, distinct symptoms appeared already in the early spring. Mechanical transmission tests on *Ch. amaranticolor* and on *Ch. quinoa* gave positive results. Nematode transmission tests were not performed.

Grape leaf-roll virus: This disease has been commonly observed in different varieties in all regions of Israel. It is so widespread in some varieties that disease symptoms were taken for normal characteristics of the variety and were included in its description.

Grafting on Mission and on LN 33 transmitted the disease but often the symptoms appeared only 1½—2 years after grafting. The disease could not be transmitted by mechanical inoculations, and it has no known vector. — Frequently, the same plant was found to be infected by Grape leaf-roll and Grape fanleaf viruses.

Flavescence dorée: Till 1969 the disease had been known as a virus disease; however, in that year a mycoplasma-like agent (5) was identified as the causal organism. The disease has been observed in many regions in Israel but it is particularly severe in the Jordan and Bet Shean valleys. It is not yet known whether its prevalence in that area is due to the warm climate or to the early-maturing varieties grown there.

Flavescence dorée was difficult to identify at first, and it took a few years till positive results were obtained. Transmission was achieved by grafting on Baco 22 A. The vector, *Scaphoideus littoralis* BALL. (12), has not been found in Israel.

Conclusions

Three virus diseases and one caused by mycoplasma have been identified and described.

In addition to the nematode *X. index*, reported by HEWITT (8, 11) and by VUITTEZ (15) as the vector of Grape fanleaf virus, another species, *X. italiae*, has been described by COHN *et al.* (3) as vector of this virus in Israel.

Local grapevine varieties were found to be far less affected than imported ones, (Table 1) either because of innate resistance or because of more favourable geographical distribution.

More rapid means of identification are desirable, especially in the case of leaf-roll virus, where mechanical methods do not give positive results.

Summary

The following virus diseases have been identified in Israel: Grape fanleaf, Grape yellow mosaic, Grape leaf-roll virus, as well as the mycoplasma disease Flavescence dorée. Among them grape fanleaf and leaf-roll viruses are widespread, while Flavescence dorée is most common in the hot valleys of north-east Israel. A new species of nematode, *Xiphinema italiae*, has been identified as vector of grape fanleaf virus. Mechanical inoculation of herbaceous plants, while helpful, does not solve the problem of a rapid indexing.

Literature Cited

1. CADMAN, C. H., DIAS, H. F. and HARRISON, B. D., 1960: Sap transmissible viruses associated with diseases of grape vines in Europe and North America. *Nature* **187**, 577.
2. CAUDWELL, A., 1964: Identification d'une nouvelle maladie à virus de la vigne, la Flavescence dorée. Etude des phénomènes de localisation des symptômes et de rétablissement. *Ann. Epiphyties* **15**, N° hors-série, 1935.
3. COHN, E., TANNE, EDNA and NITZANY, F. E., 1970: *Xiphinema italiae*: a new vector of grapevine fanleaf virus. *Phytopathology* **60**, 181—182.
4. D'HERDE, J. and VAN DER BRANDE, J., 1964: Distribution of *Xiphinema* and *Longidorus* spp. in strawberry fields in Belgium and methods for their quantitative extraction. *Nematologica* **10**, 454—458.
5. GIANNOTTI, J., CAUDWELL, A., VAGO, C. et DUTHOIT, L.-L., 1969: Isolement et purification de micro-organismes de type mycoplasme à partir de vignes atteintes de Flavescence dorée. *C. R. Séances Acad. Sci. (Paris)* **268**, 845—847.
6. GOHEEN, A. C. and COOK, J. A., 1959: Leaf roll (red leaf or rougeau) and its effects on vine growth, fruit quality and yields. *Amer. J. Enol. Viticult.* **10**, 173—181.
7. —, HARMON, F. N., and WEINBERGER, J. H., 1958: Leafroll (White Emperor disease) of grapevines in California. *Phytopathology* **48**, 51—54.
8. HEWITT, W. B., 1956: Fanleaf virus of grapevines is soil-borne. *Phytopathology* **46**, 15.
9. —, 1970: Les maladies à virus de la vigne. *Bull. O.I.V.* **469**, 97—125.
10. —, GOHEEN, A. C., RASKI, D. J. and GOODING, C. V. JR., 1962: Studies on virus diseases of grapevines in California. *Vitis* **3**, 57—83.
11. —, RASKI, D. J. and GOHEEN, A. C., 1958: Nematode vector of soil-borne fanleaf virus of grapevines. *Phytopathology* **48**, 586—595.
12. SCHVESTER, D., CARLE, P. et MOUTOUS, G., 1961: Sur la transmission de la flavescence dorée des vignes par une cicadelle. *C. R. Séances Acad., Agricult. France* **47**, 1021—1024.
13. VUITTENEZ, A., 1960: Mise en évidence chez les vignes atteintes de dégénérescence infectieuse d'un virus transmissible mécaniquement aux Chénopodes (*Chenopodium amaranticolor* et *C. quinoa*). *C. R. Hebd. Séances Acad. Sci. (Paris)* **251**, 783—785.
14. —, 1963: Isolement, propriétés physiques et sérologiques du virus de la dégénérescence infectieuse chez les chénopodes et la vigne. *Virologie Appliquée INRA Versailles* **4**, 133—142.
15. — et LEGIN, R., 1964: Recherches sur les vecteurs naturels de la dégénérescence infectieuse. Confirmation de la transmission du virus par *Xiphinema index* (THORNE et ALLEN) et de l'activité parasitaire de ce nématode. *C. R. Séances Acad. Agricult. France* **50**, 286—306.

Eingegangen am 29. 11. 1972

EDNA TANNE
Dr. F. E. NITZANY
Agricult. Res. Organization
The Volcani Center
P.O.B. 6, Bet Dagan
Israel