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Some Vine Clones Resistant to Plasmopora*)

by

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The problem of resistant clones in general is one of the most important in plant breeding (Stakman, 1963). In vine-breeding, the resistance to *Plasmopora viticola* is specially interesting (Husfeld, 1944). Branas (1953) on this subject wrote: "Ce problème est un des plus importants, sinon le plus important de tous ceux qui se trouvent posés devant la viticulture européenne". In the case of the subject of the present paper it is obvious for us since in the majority of Portuguese vineyards mildew is still the most important cryptogamic disease both from the point of view of losses and of treatment (to 20% of the total expenses).

The present note concernes work carried out since 1945 and which has been described in detail elsewhere (Coutinho, 1950). A collection was made covering the main varieties cultivated in Portugal and data where obtained on their behaviour relative to *Plasmopora* attack. None were resistant but differences in susceptibility were observed denoting the existence of factors which in convenient combination may originate a type of resistance (Husfeld, 1938).

Material and Methods

Methods used were: mass sowing, intraspecific crossing *(Vitis vinifera)* and selection. Mass sowing was indicated since *V. vinifera* is considered heterozygous (Husfeld, 1943; Dalmasso, 1939). This was confirmed both in the F_1 of intraspecific crosses and in the population obtained through self pollination in single varieties (Coutinho, 1953): The F_1 of these two groups were not uniform, the plants showing four and three classes of resistance, respectively (Fig. 1).

Over 200 crosses were made using the varieties less susceptible toward *Plasmopora,* and selection was made of F_1 and F_2 plants. Recently the following backcrosses have been made and are still being studied:

C. 6 (Jaen × Azal branco) × Jaen
C. 19 (Jaen × Azal branco) × Jaen
C. 27 (Jaen × Azal branco) × Jaen

The sowing usually were made in Dutch frames in the soil or in the pots. Seedlings surviving natural infection were subject to two inoculations, and in the following years their behaviour toward natural infection was followed.

Results

Knowledge of the types of leaf tissue reaction to the fungus is necessary in order to define selection criteria. In some plants the cells delimiting, or near, the stomata react to initial mycelium penetration by forming stomatic or peristomatic necroses which appear one or two days after infection, as small, disperse, dark brown to

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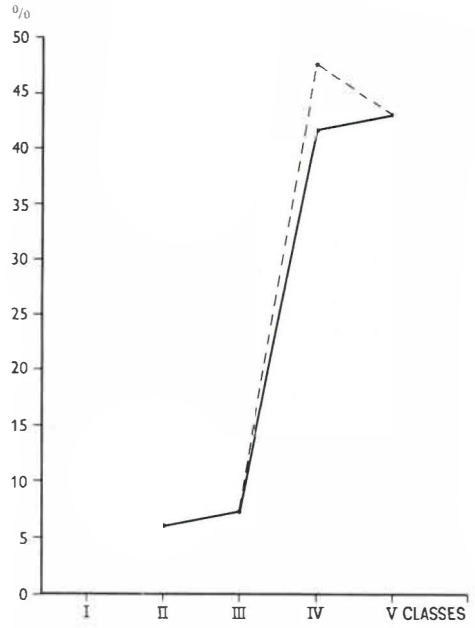

Fig. 1: The heterozygous F_1 of V. vinifera. - - - - selfpollination, and —— crossing.

blackish patches (BOUBALS, 1959). Normally they do not spread simply because the rapid death of the cells affected by the haustoria, blocks their development: a case of hypersensivity. In other less common cases, however, the mycelium may spread beyond the zone of necrosis, and sporulate. Similar necrotic symptoms may result from dessication of infected tissue in restricted zones due to a limited mycelium development; these necroses normally manifest before the 5th or 6th day after infection, may or may not show sporulation according to environmental conditions (e. g. when atmosferic humidity is very high, exterior fungal formation may be found before tissue necrosis takes place.

In contrast to susceptible clones when mycelium spread is normally great, in resistant clones penetration of tissues is limited and shows different aspects. In the former case (susceptible clones), a particular aspect representing only a phasic resistance related to leaf age and climatic conditions, is that of the limitation due to the stereoma of veins. This aspect is also found under conditions favourable to *Plasmopora* development and is a case of intrinsic resistance: it corresponds to a limited mycelial development which, even before tissue necrosis, is confined to the most reduced areas, hyphae showing less branching and fewer haustoria (HUSFELD, 1933). This type is considered associated with a deficiency of growth factors for hyphae development, and/or for fungus' enzyme synthesis.

PIOTH (1957) demonstrated in the cell sap the presence of indolic auxins, greater concentrations being found in susceptible plants whereas resistant clones only showed traces. Applications of β-IAA lowered resistance.

Conidiophores were present under favourable environmental conditions but were sparce and with few spores. When atmospheric humidity decreases, the tissues of the invaded zone dry up giving rise to relatively small patches, polygonal in shape and following the vein net-work; in general there is a covering of spores of low density which may be absent when tissue dessication precedes conidiophora formation. This aspect is the most common in the varieties we are studying (Fig. 2).

In some clones under observation we have noted a curious aspect of resistance: a sort of "ringspot". It may be considered a case of "limited patch", but is unusual in that necrotic tissues are not central but marginal (Fig. 3).

As complete immun it is unnecessary, our aim being the so-called economic resistance (which dispenses with treatment), selection included also those clones showing limited mycelial development besides those of the necrotic type. In the maintenance of these types of resistance we whish to remark on just two aspects:

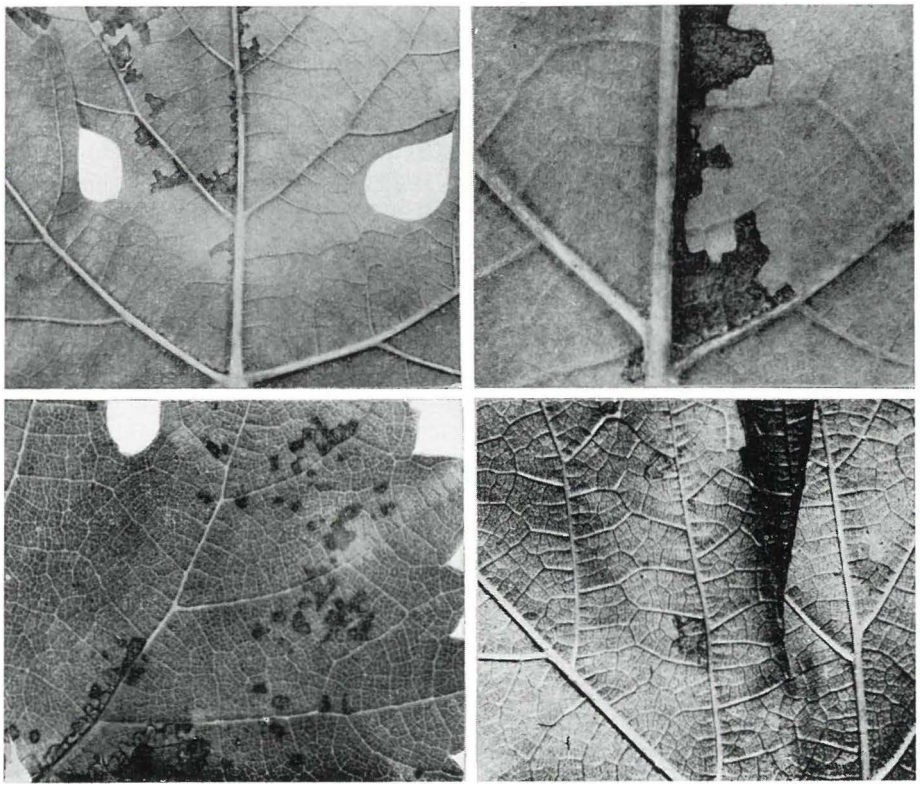

Fig. 2: Limited patches in leaf tissues.

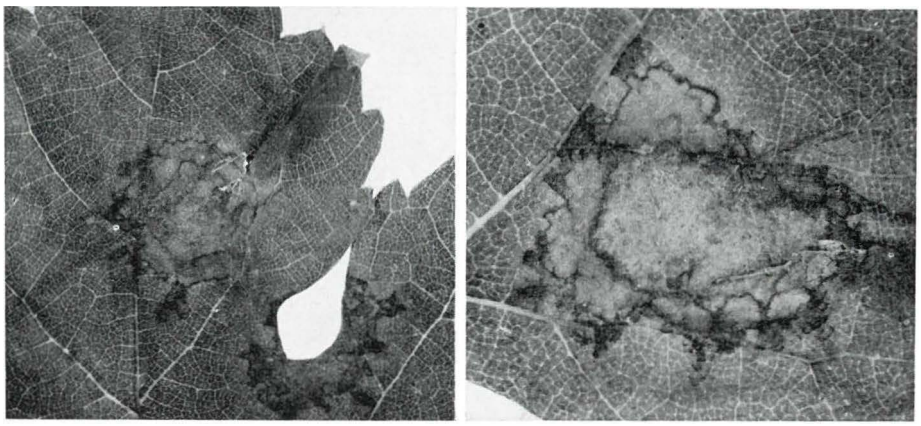

Fig. 3: Limited patches with marginal dessication.

modification of ecological characteristics and physiological races. Since the host-parasite interaction is influenced by such known factors as age, season and micro-climate, diversity of environmental conditions, indicates that work should be carried out under the least favourable conditions possible. However, in the types of intrinsic resistance, this character is not destroyed by changes either in temperature or in host nutrition although these factors affect considerably the extent of development of the disease in susceptible or fairly resistant plants. An example is found in some of our clones selected as resistant in Sacavém (near Lisbon), which have maintained the character in the Madeira Island during the 9 years they have been grown there.

As to the aspect physiological races of the fungus, although we accepted their existance as logical (COUTINHO, 1956), from the practical point of view we did not find any variation in resistance induced by different behaviour of the fungus and up to the present none of the selected vines have shown significant lowering of resistance by any physiological race.

At present 110 F_2 clones resistant to mildew are being tested for production and quality. One of them (C. I.—76), with golden yellow and very sweet grapes, seems promising as a "table variety" (Fig. 4, 1). Eighteen clones are already under field trial, and some of them seem to be of interest, namely: C. I. — C. 67, a product of the cross: "Souzao × Azal de correr" and C. I. — C. 6; C. 19 and C. 27 the products of the cross "Jaen × Azal branco".

The clone C. 19 has black grapes. The enological characteristics are listed in table 1. The clone showing, up to the present, the best sum of qualities is C. 27, named by us "Sacavém" (Fig. 5). The bunch is fairly compact with little branching, an average length between 16—18 cm., with round, firm, very sweet grapes of a beautiful golden yellow at maturity and a slight covering of pruine. It may be considered quite

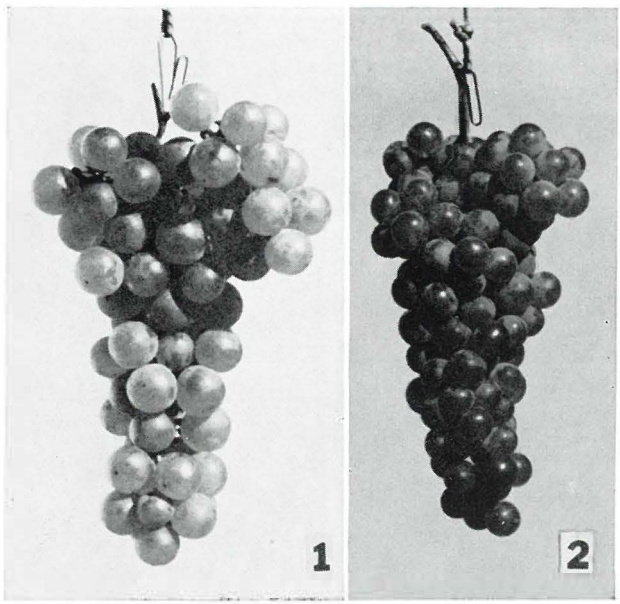

Fig. 4: Clusters of clones C.I-76(1) and C.27(2).

productive since 4—5 year old vines have shown productions of 7—8 kg (Fig. 4, 2). The data of must and vine are summarized in table 1. The berries have a clear pleasant tasting, a sui-generis arome, and a good quality.

Fig. 5: The "Sacavém" (C.27) in Ribeira Brava, Madeira Island.

The clone C. 27 is being studied with great interest in the Madeira Island by the Agricultural Station of Funchal (VIEIRA, 1960). The opinion of the Viticulture Department (VIEIRA, 1962) is the following: "C. 27, besides its high productivity may be considered a noble european variety showing affinity towards various root stocks. It is high in sugar and resistant to mildew; any point of fungal attack on a leaf does not spread, indicating that mycelial development is arrested".

From the above it may be concluded that, although still in the experimental stage, the results obtained are of interest in relation to the problem of vine resistance toward mildew.

Table 1

The enological characteristics of two *Plasmopara* resistant grape varieties

	Resistant strain	C. 19	C. 27
Must:	Density	1,0979	1,1025
	Sugar	231	229,5
	Probable alcohol (vol. %)	13,6	13,5
	Total acidity (‰)	7,5	9,2
	pH	3,42	3,62
Wine:	Alcohol (%)	13,9	13,7
	Fixed acidity (‰)	6,7	7,4
	Volatile acidity (‰)	0,5	0,8
	Total acidity (‰)	7,3	8,4
	Density	0,9953	0,9920

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