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A SURVEY OF FUNGAL DISEASES ASSOCIATED WITH *VITIS VINIFERA* L. IN THE MALTESE ISLANDS

Matthew Tabone[1]

ABSTRACT

A survey was carried out between July and September 2000 in 10 vineyards, (8 in Malta and 2 in Gozo) to investigate which fungal diseases were present. Samples, which included leaves, berries and stems infected by the fungi, came from both traditional and modern vineyard cultivation. Pathogenic fungi identified included 26 different fungi belonging to 21 genera; 21 taxa were reported on *Vitis vinifera* L. for the first time in the Maltese Islands. It was observed that the intensity of diseases was much more pronounced in the traditional rather than in the modern method of vine-training.

INTRODUCTION

A survey was carried out between July and September 2000 in 10 vineyards, 8 in Malta and 2 in Gozo to investigate fungal diseases of vines. Table 1 shows the location of the fields sampled.

METHODS

Samples (i.e. leaves, berries or stems) were taken from vineyards where traditional practices were followed as well as vineyards using modern practices. Field samples infected by fungi were quickly transferred to the Plant Health Laboratory at Marsa and stored in a cooler so as to preserve them.

In the laboratory, the samples, together with instruments and working bench, were first sterilised with appropriate disinfecting solutions (Brookes, 2001). Infected plant organs were carefully examined under a stereomicroscope for the presence of any fruiting bodies and fungal hyphae and then sectioned and cultured in agar to allow the fungus to develop. Culture media such as water agar, potato dextrose agar and Czapek dox were used according to whether the need was for a general or specialised medium. The prepared media were sterilised in an autoclave. They were then left to cool to a temperature of 45 °C. The prepared agar suspension was cautiously poured in petri

Table 1. Sampling data

Sample Number	Sampling Locality	Sampling Date	Type of Cultivation
1	Marsaxlokk, Malta	17.07.2000	Modern
2	Wardija, Malta	20.07.2000	Modern
3	Bingemma, Malta	24.07.2000	Traditional
4	Buskett, Malta	25.07.2000	Traditional
5	Fomm ir-Rih, Malta	30.07.2000	Traditional
6	Ta` Qali, Malta	01.08.2000	Modern
7	Tas-Silg, Delimara, Malta	20.08.2000	Traditional
8	Tas-Salib, Rabat, Malta	20.08.2000	Traditional
9	San Lawrenz, Gozo	01.09.2000	Traditional
10	Xaghra, Gozo	01.09.2000	Traditional

[1] Department of Plant Health, Plant Quarantine Section, Ta` Qali, Malta.

dishes in equal proportions to a thickness of 5 mm. They were left to solidify in a laminar flow cupboard and annotated appropriately. Infected plant tissues were then placed on the agar and after some days the fungi were examined under both a stereomicroscope and a high power compound microscope. Fungal characteristics were noted and appropriate keys used for identification (see fungal key references).

RESULTS

The study produced 26 different taxa in 21 genera. The 21 fungi marked with an asterisk were recorded on *Vitis vinifera* L. for the first time in the Maltese Islands. The percentage composition of genera found was as follows: Obligate parasites: 10% (2); Facultative parasites: 29% (6) and Saprophytes: 61% (13) (Tabone, 2001). The following is a list of the fungi recorded:

FUNGI IMPERFECTI

FORM ORDER: MELANCONIALES

Gloeosporium sp. [Two species of *Gloeosporium* were recorded from vine by Borg (Borg, 1922)]

FORM ORDER: MONILIALES

Family: Dematiaceae

Acremonium sp. *
Alternaria alternata (Fr.) Keissler, *
Alternaria tenuissima (Kunze ex Pers.) Wiltshire, *
Aspergillus candidus Link.*
Aspergillus flavipes (Bainier & Sartory)*
Aspergillus nidulans (Reinhard Fischer)*
Aspergillus niger van Tiegh., *
Aspergillus versicolor (Vuillemin) Tiraboschi*
Cladosporium sp. [Two species of *Cladosporium* were recorded from vine by Borg (Borg, 1922)]
Helminthosporium sp. . *
Memnoniella sp. *
Pseudobotrytis sp. *
Stachobotrytis sp. *
Stemphylium sp. *
Ulocladium sp. *

Family: Moniliaceae

Botrytis cineria Micheli ex Pers. (1794)
Geotrichum sp. *
Monilia sp. *

FUNGI PERFECTI

ORDER: DOTHIDEALES

Family: Didymosphaeriaceae

Didymosphaeria igniaria Booth, *

ORDER: Erysiphales

Family: Erysiphaceae

Uncinula necator (Schwein.) Burrill 1851

ORDER: Microascales

Family: Microascaceae

Petriella sp. *

ORDER: Sordariales

Family: Chaetomiaceae

Chaetomium sp. *

Family: Ceratostomaceae

Persiciospora sp. *

Order: Peronosporales

Family: Peronosporaceae

Plasmopara viticola J. Schrot. (1886)

Order: Mucorales

Family: Mucoraceae

Mucor sp. *

Plasmopara viticola and *Oidium* spp. [oidial state of *Uncinula necator* (Schwein.) Burrill] were previously recorded on *Vitis vinifera* L. by Wheeler, B.E.J., (1957). The genus *Botrytis* was previously recorded by Borg (1922), Sommier & Caruana Gatto (1915) and Brooks, F. E. (2001). The two genera *Cladosporium* and *Gloeosporium* are mentioned by Borg (Borg, 1922) and are also mentioned in the fungal section of the Red Data Book (Lanfranco, 1989), which was based on Sommier & Caruana Gatto (1915).

Note: The Saccardo System was chosen for the classification of Imperfect Fungi. The primary basis of this system is the morphology of the sporulating structures as well as the morphology and pigmentation of conidia and conidiophores. However for the two largest families i.e. Moniliaceae and Dematiaceae, the Hughes-Tubaki-Barron System of classification was used. As for Ascomycetes and Oomycetes, the nomenclature follows Hawksworth, D.L. *et al*, 1995.

DISCUSSION

The most common obligate fungi were Powdery mildew, *Uncinula necator* (Schwein.) Burrill (1851), (6.5%), Downy mildew, *Plasmopara viticola* J. Schrot. (1886),

(12%) and grey mould, *Botrytis cineria* Micheli ex Pers. (1794) (23%) (Tabone, 2001). An explanation for the high occurrence of the latter could be due to the ability of this fungus to live as both parasite and saprophyte according to prevalent environmental conditions (Vella, 1991). It was sampled mainly from the berries, although leaves and stems were also affected. In the berries various saprophytic fungi were present together with *B. cinerea,* including several facultatively parasitic fungi.

Some of the more important facultatively parasitic fungi that were found in this study included *Alternaria, Cladosporium*, and *Stemphylium*. *Alternaria* was very common in many of the samples. and this could be due to its dual feeding behaviour i.e. as a primary and secondary invader (Goheen, & Person, 1994). *Cladosporium,* like *Alternaria,* is also a parasite but can also be a saprophyte. Only a few specimens of *Cladosporium* were present in the samples, possibly meaning that either the optimum conditions for this fungus were absent or that it had severe competition from other fungi such as *Alternaria* (Tabone, 2001). An important facultative parasitic fungus was *Stemphylium* which was found in 47% of all samples. It was noticed in the petri dish cultures that the populations of *Alternaria* and *Stemphylium* were inversely proportional possibly due to competition between the two fungi (Tabone, 2001). There seems to be an association between *Alternaria* and other species and *Stemphylium*, according also to Smith *et al* (1988).

Saprophytes included *Aspergillus*, *Acremonium* and *Stachobotrytis* amongst others. A relatively common disease was Grey Rot caused by the parasitic fungus *Botrytis cinerea.* Rot caused by *Helminthosporium* spp. alone is very similar to that caused by *Cladosporium herbarum.* These fungi, *Botrytis* and *Helminthosporium*, grow under humid conditions and sporulate on cast-off flower parts that remain in the cluster (Flaherty, 1992).

The traditional local grapevine varieties like *Girghentina* and *Gellewza* were found in the fields of small-scale or part-time growers whereas foreign varieties were found in the vineyards of commercial growers. It has been observed that the intensity of diseases was much more pronounced in the traditional rather than in the modern way of training the vines. The reason is probably that in the traditional bush form wind currents are much reduced and the penetration of solar radiation to the inner leaves and berries is also reduced, thus increasing humidity which promotes the growth of fungi. Conversely in the modern, more open system, the vines have good air circulation which reduces the relative humidity in the vines. Another reason could be that when using the traditional method, weed removal is difficult with the result that any diseased weeds present could infect the vines. Moreover an open canopy not only maintains a microclimate less favourable for disease development but also allows for better penetration of fungicides used to prevent or control the diseases (Tabone, 2001).

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