

THE PHYTOSANITARY SITUATION OF CYPRESS IN SPAIN AND THE NEW PROSPECT

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The cypress (*Cupressus* spp.) and its most important species (*C. sempervirens* L.) is of rather recent introduction in Spain. The oldest trees are not more than 160-180 years of age and the early (and widest) dispersion was almost exclusively confined to the religious grounds (monasteries, hermitage roads, graveyards, etc.), and, also, in private and public gardens. It is a normal seeing to meet throughout the Spanish geography cypress rows growing alongside of the narrow and zigzag roads leading to a white hermitage, monastery, convent or calvary and also, the dark green colour of these trees with a cone type crown (it is majority the fastigiata from), exceeding above the graveyards walls. This landscape is, in most cases, a typical Spanish identity symbol for foreign visitors (TUSET, 1990).

Later, at the end of the XIX century, the common or Italian cypress (*C. sempervirens*) came into usage as windbreaks ornamental hedges, and country house boundaries. It is only 40 years ago since this species has been incorporated as auxiliary plant in new reforestation of pine trees. For these reasons, it is not possible to find large (or small) areas populated by this interesting species in Spain. Its usage is increasing at present, specially in ornamental horticulture (TUSET, 1990).

The most important cypress species present in Spain are: *C. sempervirens* under both *fastigiata* (the more abundant) and *horizontalis* forms, and *C. arizonica* Greene, *C. macrocarpa* Hartw., *C. glabra* Sudw, and *C. lusitanica* Mill. (some trees of the latter one growing in the Atlantic coast) are also present, generally in gardens as ornamental trees.

The small areas of expansion of the cypress together with the common low environmental moisture clearly condition the pathological problems, generally limiting their importance (TUSET, 1979). Anyway, we have emphasized during the last decade the study of the cypress diseases occurring in Spain, starting a research program at the Mycology Department of the I.V.I.A.

CYPRESS PATHOLOGICAL DISORDERS

Based on the analysis of cypress samples coming from reforestation areas, diseased trees growing in public and private gardens, as well as from frequent visits to cypress nurseries or to areas where the specimens grow under stress, we are currently confirming that the pathological disorders of cypress have -under the Spanish conditions- a clear physiological component. The non parasitic diseases are, without any doubt, the most extended group of disorders that affect the cypress, particularly the *C. arizonica* species.

In the etiology of these diseases, certain complexities can be detected but most of them are generally included in the texts already published by us in 1979, which are:

1. - *Excess of moisture in the soil, particularly around the stem base or collar root.* This is a serious problem in nurseries and gardens. Frequent irrigation accumulating water around the stem base or collar root of the trees produce, in a sort time, the rot of epidermic tissues in that area and in the roots, causing wilt and death of the same.

An interesting case that we are treating since 1985 is worthy to be commented here. The centenary Silos cypress, growing in the garden of the marvellous romanico cloister of the Santo

Domingo de Silos monastery (province of Burgos) is, for its placement and sharp shape, admired by thousands of visitors, being without any doubt the most important specimen in our country. As it is the tree exalted by most of the famous Spanish poets, any little trouble that it may suffer causes a great people interest which reaches the institutions. When I observed the first time this cypress (year 1985), the remarkable presence of yellowish twigs, important defoliations, abundant and visible bald foliage spots and the overspread greyish colour shown by this tree, clearly proved a typical symptomatology determined by a physiological disorder. This disorder broke out as a consequence of the frequent irrigations with low volumes of water required to maintain in good conditions the lawn that covered the soil of the cloister garden, as well as, the high moisture of this soil (quite alkaline otherwise) during prolonged periods.

The restitution of those edaphic-environmental conditions enjoyed by the cypress before the sowing of the lawn, based on the almost total irrigation withdrawal and non soil cultivation during the last five years, have clearly led to a very important reduction of the disease; thus the Silos cypress is showing at present new buds, a good fructification and the deep green colour has returned to its leaves. We may say that the life has returned to this very important tree.

2. - *Highly alkaline soil concentration*. It is our most widespread problem in ornamental horticulture. Soils with calcium carbonate levels over 40% are very common and usually determine small growing cypress plants with poor foliage and a lot of dry twigs, specially in low laying foliage and close to the stem. This problem is more severe if cypress plants are irrigated with small volumes of water.

3. - *Inadequate soil texture and structure*. Insufficient soil depth, excessive compactation, poor permeability, low level of organic matter, etc., are conditions widely extended in our country which determine stunted cypress plants, with poorly growing patterns and remarkable root and twig shortage. Many of the cypress plants used in reafforestations and those in gardens, windbreaks or hedges grow under these limiting conditions.

These edaphic conditions determine as a whole or separately that many of the Spanish cypress trees (specially those located in the Mediterranean coast), show visible dried out symptoms in branchlets and leaves, poor development and, in some cases entire plants completely dried out. In these plants it is easy to detect, both in the bark and leaves, a number of fungi, all them with a saprophytic behaviour, as: *Alternaria alternata* (Fr.) Keissler, *Cladosporium herbarum* (Pers.) Lk., *Pleospora herbarum* (Pers. ex Fr.) Rabh and, generally, *Pestalotiopsis funerea* (Desm.) Stey. The latter one is a typical non obligate parasite belonging to the group of non aggressive.

PARASITIC DISEASES

Although the cypress is considered as a very resistant tree to all its potential parasites and, for this reason, of great longevity, it is being observed little by little in our country that many specimens of *C. sempervirens* and other species are affected by insects and fungi producing them serious damage.

Among the arthropods, aphids (specially the *Cinara cupressi* Buck species) are the most injurious. This aphid produces the damage during the spring and early summer in nurseries, gardens, windbreaks and hedges. This damage may be so important that requires specific aphicide usage. *C. cupressi* is widely spread all over the country.

During the last three years, various *C. sempervirens* and *C. arizonica* specimens have been sent to our laboratory, all them affected by *Armillaria mellea* (Vahl. and Fr.) Kummer. All these samples came from areas reafforested with pines and from country house gardens where pines coexist or have formerly grown. *A. mellea* is a soil born fungus, a common invader, very active as pathogen of wood plants. Its detection in the cypress in Spain confers

to this pathogen an special importance, opening new expectatives to the pathology of this plant. The possibility of saprophitic life of this fungus in the soil for a long time (decades of years), as well as its remarked attractiveness for the pine trees (in the case of the *Pinus halepensis* Miller it exists an evident mycorrhization), could be sufficient for *A. mellea* to become, under the Spanish conditions, a virulent pathogen for the cypress. Anyway, the most important damages have been observed so far in cypress trees growing as windbreaks and ornamental hedges, generally overirrigated.

The presence of cankers and bark crackings in Spanish cypresses means today a limited number of the parasitic diseases affecting them, but there are most worrying due to its potentiality. It is not usual to find trees showing this symtomatology. The air dryness caused by the lack of rain and high temperatures do not favour their formation because the development of the fungi producing them is reduced. Three fungi are responsible for these cankers and cracking in Spain: *Diplodia mutila* (Fries) Mont. (teleomorph: *Botryosphaeria obtusa* (Schw.) Shoemaker) (TUSET, 1979), *Dothiorella* Sacc. (teleomorph: *Botryosphaeria berengeriana* De Not.) and *Seiridium cardinale* (Wag.) Sutton & Gibson.

D. mutila (a synonymous is *Sphaeropsis malorum* (Berk) Berk) (STEVENS, 1933; PUNITHALINGHAM & WALLER, 1973) is widely spread in the East and Southeast arid areas in our country. This fungus is a cosmopolitan parasite affecting several crops as citrus, grapevines, pomaceous and stone fruits. Its pathogenic capacity is very variable. It may act as a typical weakly parasite or may produce important damages (TUSET *et al.*, 1979).

In the cypress, *D. mutila* generally acts as a rather active pathogen causing bark cracking in stems and branches. These crackings can reach a big size (up to 40 cm. length). The foliage above the affected area appears yellowish, dried and dead. Production of resin is variable. An strong exudation is generally observed. In some trees, the damage is severe.

On the affected bark, black pycnidial conidiomata are produced. These pycnidia appear isolated and are subepidermic at the beginning of their formation, becoming erumpents when maturing. These are stromatic, thin walled and measuring 250-510 μ diameter. Conidia are holoblastic, hyaline while young but later becoming sienna, rounded at apex, truncated end, unicellular and bicellular (the latter ones are more frequent), constricted at the septum and with walls slightly rough, size 19.2-26.8 x 7.7-11.8 μ . Conidiogenous cells are holoblastic, measuring 9.4-17.3 x 2.3-4.6 μ .

This year we have found this disease in various reafforested areas in the Castellon province. The number of affected trees has been very small, only five specimens of *C. sempervirens* showed this symtomatology. However, the possibility of this disease to spread in this species is considerable due to its damage severity.

SOLEL *et al.* (1987) indicate in Israel a disease on Italian cypress (*C. sempervirens*) causing bark cracking, gum oozing and bark discolouration. This disease is very similar to the sighted in Spain by us. The causal organism is a form of *Diplodia pinea* (Desm.). Kickx (synonymous *Sphaeropsis sapinea*), that they describe as *S. sapinea* f. sp. *cupressi*.

At present, the taxonomic status of the fungi *D. pinea* (*S. sapinea*) and *D. mutila* (*S. malorum*) is needed of a revision, because we believe that morphological differences indicated in the descriptions of both fungi are not sufficient to maintain the two taxa as distinct. The special form (f.sp.) in this type of fungi -with a very marked saprophytism- is not credible.

Small cankers in stems and branches of *C. sempervirens* specimens generally used for windbreaks, are caused by *Dothiorella*. This fungus, anamorph of *B. berengeriana*, is an important pathogen in quince, peach and grapevines in our country. Its pathogen activity on cypress is not important so far. This fungus has not been found on cypresses placed in reafforested areas.

S. cardinale, which causes the common cypress canker, follows *D. mutila* in activity on our cypresses, specially on *C. macrocarpa* and *C. sempervirens* f. *horizontalis* species. The environmental Spanish conditions such as: lack of rain and high temperatures during long periods, do not favour a big development of this fungus in comparison with other Mediterranean countries (Italy, Greece, etc.). This fungus shows little aggressivity and, for

this reason, it causes damages which are not very important so far.

S. cardinale has been isolated in cypresses placed in humid areas, generally gardens, or in reafforestations close to swamps, always in isolated specimens showing on the top and branches small cankers, exudation of resin and, in some cases, branches dieback.

NEW PROSPECT ON CYPRESS DISEASES

Besides a greater knowledge of the non parasitic diseases, deepening in their etiology and trying to separate those factors that determine the different cypress disease patterns, the research that we shall also develop during the next years in our Department will include:

1. - *Biological control on A. mellea*. Isolates of different *Trichoderma* and *Myrothecium* species, all them appraised as *in vitro* and *in vivo* antagonists, shall be utilized in the *A. mellea* control. Former results obtained with these fungi both *in vitro* and *in vivo*, have stimulated us to continue these studies. The cypress tree may be a very interesting host plant for this research program.

2. - *Intensification of the studies of fungi causing cankers and bark crackings*. The presence observed during the last years of different cankers and bark crackings in our cypresses due to the fungi *D. mutila*, *Dothiorella* and *S. cardinale*, encourage us to know more in detail this type of disorders. On *D. mutila*, taxonomy, pathogenicity and epidemiology of the Spanish isolates shall be the objectives of our future research program. Its control shall be also and aim of this study.

On *S. cardinale*: with regard to our cooperation in the EEC project nº 8001-CT91-0005-1. together with our former partnership with the AGRIMED Cypress Group, we are committed in keeping and conserving the experimental field (2 Ha. of extension). This plantation, made in 1988, includes at present 28 clones of the 4 different cypress species (all them with good resistance to *S. cardinale*), and will amplified in 30 additional clones in 1992. This important cypress collection of French and Italian obtention, is placed in Jerica (province of Castellon), at 700-800 meters of height, in an area free of these trees. It will supply, on one hand, valuable data on its vegetative development (that is, on its adaptability), and, on the other hand, more precise knowledge on its resistance pattern to this important pathogen, based on artificial inoculations with Spanish isolates of *S. cardinale*; all this under the peculiar Spanish environmental conditions.

SUMMARY

The rather dry enviromental conditions and the little expansion of cypress growing (at present there is a clear increasing) are the causes that condition the phytopathological problems of this species in Spain, diminishing generally their importance.

These phytosanitary problems, observed along the last years, may be placed in the groups: i) non parasistic diseases, such as intense defoliations, dried branches and twigs, stunted plants, severe chlorosis, etc; ii) parasistic diseases. In this case, besides aphids and the soil fungus *Armillaria mellea*, the aerial fungi are the pathogens more frequently isolated.

Differents cankers an bark crackings are refered to *Diplodia mutila*, *Dothiorella* (anamorph of *Botryosphaeria berengeriana*) and *Seiridium cardinale*. *D. mutila* has been isolated in several areas in our contry and by its pathogenic activity (bark crackings, gummosis exudation, dried branchlets and branches) may be in the future a clear problem of the cypress. *S. cardinale*, isolated in several localities, is a potential pathogen also. For this reason, an experimental field made with a selection of clones of several cypress species has been established in Jerica (province of Castellon) to know its adaptability and its resistance to *S. cardinale* in the Mediterranean Spanish enviromental conditions.

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Fig. 1 - Specimen of *C. sempervirens* affected by *D. mutila*.
Pianta di *C. sempervirens* attaccata da *D. mutila*.



Fig. 2 - Bark cracking and gum oozing due to *D. mutila*.
Fessurazioni corticali e fuoriuscita di resina dovuta a *D. mutila*.



Fig. 3 - General view of the cypresses experimental field in Jerica, Castellón.
Campo sperimentale di cipressi a Jerica, Castellón.