COREMIA PRODUCTION OF *CERATOCYSTIS ULMI* GROWING ON FRESH PLANT MATERIAL*

ABDOL-GHAYOOM EBRAHIMI and HAROLD S. McNABB, JR.

Associate Professor of Plant Pathology, University of Jondi-Shapoor (Ahwaz), Iran on Post-Doctorate Leave at Iowa State University; and Professor of Forest Pathology, Iowa State University, Ames, respectively

Introduction

The pathogen causing Dutch elm disease, *Ceratocystis ulmi* (Buisman) C. Moreau, has been grown in the laboratory on a number of natural and artificial media. In North America PDA medium was commonly used for elm wood isolations (FATE *et al.*, 1947). Coremia production by *C. ulmi* (SCHWARZ, 1922) would usually be associated with the elm wood chip (FENNER & LIMING, 1947). An elm extract medium was developed that promoted a greater amount of coremia production on the medium surface (HART, 1960). Another modification using the diseased branch and sugar-yeast extract medium has also been developed (EPSTEIN, 1959). In Europe cherryagar, and to a lesser extent, oatmeal-agar, have been used in isolations (TCHERNOFF, 1965). *C. ulmi* has grown and produced conidia on the sap of *Acer rubrum* L., *Ulmus americana* L., *Prunus serotina* Ehrh., *Betula lenta* L., and *Diospyros virginiana* L., but no mention was made in this study of coremia production (KESSLER, 1966). Artificial media, both solid and liquid, have usually been that developed by ZENTMYER (1942) or modifications of it. Coremia production on such artificial media was only associated with isolates known for high coremia initiation and then production was sparse.

Elm wood material, such as twigs placed in test tubes or branch disks placed in petri dishes, has been used for the production of perithecia in progeny studies with the fungus (BUISMAN, 1939; HOLMES, 1965; ROSINSKI, 1961; SHAFER & LIMING, 1950; TCHERNOFF, 1965). Profuse coremia are found growing on the bark and wood of elm under such conditions. Elm wood has also been used in the isolation of *C. ulmi* from elm bark beetles (WALTER, 1935) and diseased trees (CAMPANA & ROSINSKI, 1960). Coremia production was the chief indication of the presence of *C. ulmi*. Coremia production was also observed on wood of *Pyrus malus* L. (SMUCKER, 1942). SHAFER and LIMING (1950) state: "Of the woods other than elm that were tested, all were suitable for production of perithecia

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in some instances, but none were so consistently or so productively useful as elm wood." They make no mention of what woods they tested or of coremia production.

Our studies on the growth of a number of isolates of *C. ulmi* led us to some preliminary trials on the growth and coremia production of *C. ulmi* on freshly cut and surface-sterilized plant material. This report presents the results of these trials.

Materials and Methods

Sections of small branches (woody material) or stems (herbaceous material) approximately 1 cc in diameter were freshly cut from active growing plants for use in this study. These sections were surface sterilized by dipping in 70 percent ethyl alcohol three times, flaming after each dip. After one side of each section was flattened with a sterile sharp knife, the sections were placed on water agar in petridishes (BORECKI & MILLIKAN, 1969) or upright in test tubes containing 2 ml sterile, distilled water. Twenty species of plant material were used (Table 1).

Constant amounts of mycelium from cultures of *C. ulmi* representing the wide number of isolates in our laboratory collection were placed in the middle of the section on the flattened surface. Small amounts of the PDA medium accompanied the mycelium. The material was incubated at 24° C.

Observations were made each day following initial incubation for the determination of coremia production.

Results and Discussion

C. ulmi produced coremia on all species of plant material used in this study (Table 1). Differences were indicated both in the initial appearance and amount of coremia produced (Table 1). Coremia were produced on the surface of the bark and wood, and growing from the end of the sections. In some cases, coremia were also found on the agar adjacent to the plant material. Coremia production in the test tubes and the lack of coremia production on some water agar checks indicated that coremia induction was attributed to the plant material present. Although visible indication of contamination by other organisms was nonexistant in most cases, the induction of coremia by other plant inhabiting organisms cannot be completely discounted (GROSSBARD, 1954).

The recent research by HUBBES and POMERLEAU (1969) suggested that under the influence of light certain compounds in elm wood governed production of coremia of *C. ulmi*. Our study indicates that either such compounds are found in a wide variety of plant species or that many other compounds have the same effect upon coremia production by *C. ulmi*.

The significance of *C. ulmi* growing and producing coremia on a variety of plant material under high moisture conditions is of importance in determining the ecological role this fungus might have in nature. The potential exists that *C. ulmi* can persist as a saprophyte on plant material other than elm. This potential with apple wood has been discussed earlier (SMUCKER, 1942). In this case the bark beetle of apple, *Scolytus sulcatus* Lec., was also indicated as having the potential as a carrier (BUCHANAN, 1940; PECHUMAN, 1938). The smaller European elm bark beetle, *S. multistriatus* Marsh., one of the carriers of *C. ulmi*, has also rarely been found to feed upon mulberry. Therefore, even though research to date indicates little probability of *C. ulmi* being carried to hosts other than elm, the potential is present. Our study indicating that *C. ulmi* is able to grow and produce coremia on a wide variety of plant material adds significance to this potential.

Table 1. Coremia production of *Ceratocystis ulmi* growing on surfacesterilized, fresh, plant, stem material representing 20 species.

Plant species	Elapsed days until coremia appearance	Relative coremia abundance at 10 elapsed days
Ulmus americana L. (elm)	3	++++
Celtis occidentalis L. (hackberry)	5	++++
Morus rubra L. (mulberry)	4	+++
Malus 'Purple Wave' (crab apple)	3	++++++
Tilia cordata Mill. (linden)	2	++
Gleditsia triacanthos L. (honeylocust)	4	++
Acer nigrum Michx. f. (maple)	3	++++++
Quercus muehlenbergii Engelm. (oak)	3	+++
Populus alba L. (poplar)	3	++++
Elaeagnus angustifolia L. (Russian olive)	3	+++
Fraxinus quadrangulata Michx. (ash)	3	++
Platanus occidentalis L. (sycamore)	4	++
Juglans nigra L. (black walnut)	3	++
Syringa vulgaris L. (lilac)	3	++
Juniperus virginiana L. (juniper)	4	+++
Taxus hickii (yew)	3	+++
Pinus nigra Arnold (pine)	2	+++
Medicago sativa L. (alfalfa)	2	++++
Glycine max (L.) Merr. (soybean)	4	+++
Zea mays L. (corn)	2	+

Abstract

A group of representative isolates of *Ceratocystis ulmi* grew and produced coremia on surfaced-sterilized, fresh, plant, stem material representing 20 species. These were *Ulmus americana, Celtis occidentalis, Morus rubra, Malus* 'Purple Wave', *Tilia cordata, Gleditsia triacanthos, Acer nigrum, Quercus muehlenbergii, Populus alba, Elaeagnus angustifolia, Fraxinus quadrangulata, Platanus occidentalis, Juglans nigra, Syringa vulgaris, Juniperus virginiana, Taxus hickii, Pinus nigra, Medicago sativa, Glycine max,* and *Zea mays*.

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