Proceedings of the Iowa Academy of Science

Volume 77 | Annual Issue Article 6

1970

# Coremia Production by Ceratocystis ulmi Growing On Fresh Plant Material

Abdol-Ghayoon Ebrahimi
*Iowa State University*

Harold S. McNabb Jr.
*Iowa State University*

# Coremia Production by *Ceratocystis ulmi* Growing On Fresh Plant Material[1]

ABDOL-GHAYOON EBRAHIMI AND HAROLD S. MCNABB, JR.[2]

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

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, potato-dextrose medium was commonly used for isolations from elm wood (6). Coremia production by *C. ulmi* (15) would usually be associated with the elm wood chip (7). An elm extract medium was developed that promoted a greater amount of coremia production on the surface of the medium (9). Another modification using the diseased branch and sugar-yeast extract medium has also been developed (5). In Europse, cherry-agar and, to a lesser extent, oat-meal-agar have been used in isolations (18). *Ceratocystis 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 of coremia production (12). Artificial media, both solid and liquid, have usually been those developed by Zentmyer (20) or modifications of them. Coremia production on such artificial media was only associated with isolates known for high coremia initiation, and in these instances, 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 (3, 10, 14, 16, 18). 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 (19) and diseased trees (4). Coremia production was the chief indication of the presence of *C. ulmi.*

[1] Journal Paper No. J-6414 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa. Project No. 1706. This research was supported in part by an Emergency Grant from the Executive Council of Iowa.

[2] Associate Professor of Plant Pathology, University of Jondi-Shapoor (Ahwaz), Iran, and former Post-Doctoral Associate, Iowa State University; and Professor of Forest Pathology, Iowa State University, Ames, respectively.

Coremia production was also observed on wood of *Pyrus malus* L. (17). Shafer and Liming (16) state, "Of the woods other than elm that were tested, all were suitable for production of perithecia 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 cm in diameter were freshly cut from active growing plants for use in this study. These sections were surface sterilized by dipping in 85-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 petri dishes (1) or upright in test tubes containing 2 ml of sterile, distilled water. Twenty species of plant material were used (Table 1).

Uniform potato-dextrose agar blocks containing mycelium from cultures of *C. ulmi* representing the wide number of isolates in our laboratory collection were placed in the middle of the section of the flattened surface. The material was incubated at 24° C.

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

## Results and Discussion

*Ceratocystis ulmi* produced coremia on all kinds 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 from the end of the sections. In some cases, coremia also were 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 attributable to the plant material present. Although visible indication of contamination by other organisms was nonexistent in most cases, the induction of coremia by other plant inhabiting organisms cannot be completely discounted (8).

Recent research by Hubbes and Pomerleau (11) suggested that under the influence of light, certain compounds in elm wood governed production of coremia of *C. ulmi*. Our study indicates either that such compounds are found in a wide variety of plant species

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

| Plant species | Days until coremia first appeared | Relative coremia abundance at 10 days |
|---|---|---|
| *Ulmus americana* L. (elm) | 3 | ++++ |
| *Celtis occidentalis* L. (hackberry) | 5 | ++++ |
| *Morus rubra* L. (mulberry) | 4 | +++ |
| *Malus* sp. (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 cuspidata* Sieb. & Zucc., cv. '*hickii*' (yew) | 3 | +++ |
| *Pinus nigra* Arnold (pine) | 2 | +++ |
| *Medicago sativa* L. (alfalfa) | 2 | ++++ |
| *Glycine max* (L.) Merr. (soybean) | 4 | +++ |
| *Zea mays* L. (corn) | 2 | + |

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 materials under high-moisture conditions is of importance in determining the ecological role that this fungus might have in nature. The possibility exists that *C. ulmi* can persist as a saprophyte on plant material other than elm. This potential has been discussed earlier in relation to apple wood (17). In this case the bark beetle of apple, *Scolytus sulcatus* LeC., was also indicated as being potentially a carrier (2, 13). The smaller European elm bark beetle, *S. multistriatus* Marsh., one of the carriers of *C. ulmi,* sometimes feeds upon mulberry. Therefore, even though research to date indicates little probability of *C. ulmi* being carried to and from 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.

## Literature Cited

1. Borecki, Z., & D. F. Millikan. 1969. *Phytopathology* 59:247-248.
2. Buchanan, W. D. 1940. *J. Econ. Ent.* 33:250-251.

3. Buisman, Christine J. 1932. *Tijdschr. PlZiekt.* **38**:1-5. (*Phytopath.* Transl. **5**:1-8.)
4. Campana, Richard, & Martin Rosinski. 1960. *Plant Disease Reptr.* **44**:908-911.
5. Epstein, Abraham H. 1959. *Plant Disease Reptr.* **43**:1195.
6. Fate, Leston R., Clyde E. Dike & O. N. Liming. 1947. *Phytopathology* **37**:7.
7. Fenner, Lawrence M., & O. N. Liming. 1947. *Phytopathology* **37**:7.
8. Grossbard, Erna. 1954. *Phytopathology* **44**:110-111.
9. Hart, John H. 1960. *Plant Disease Reptr.* **44**:806-807.
10. Holmes, Frances W. 1965. *Neth. J. Plant Path.* **71**:97-112.
11. Hubbes, Martin, & Rene Pomerleau. 1969. *Canad. J. Bot.* **47**:1303-1306.
12. Kessler, K. J., Jr. 1966. *Phytopathology* **56**:1165-1169.
13. Pechuman, L. L. 1938. *J. Econ. Ent.* **31**:537-543.
14. Rosinski, M. A. 1961. *Amer. J. Bot.* **48**:285-293.
15. Schwarz, M. B. 1922. *Daz Zweigsterben der Ulmen, Trauerweiden und Pfirsichbaume.* Thesis, Univ. Utrecht. (Transl. *Bartlett Res. Lab. Bull.* **1**. 1928).
16. Shafer, Theima, & O. N. Liming. 1950. *Phytopathology* **40**:1035-1042.
17. Smucker, S. J. 1942. *Phytopathology* **32**:441-442.
18. Tchernoff, V. 1965. *Acta Botanica Neerlandica* **14**:409-452.
19. Walter, J. M. 1935. *Phytopathology* **25**:37-38.
20. Zentmyer, G. A. 1942. *Science* **95**(2472):512-513.