Fusarium Fungi as a Pathogen Causing Hop Wilt

J. SABO[1], T. ĐURIĆ and S. JASNIĆ*

Institute of Field and Vegetable Crops, 21000 Novi Sad, Yugoslavia

[*]E-mail: sabo@ifvcns.ns.ac.yu

Abstract

Foliar chlorosis and wilting of plants have been noticed in many hop gardens around the Vojvodina Province, Yugoslavia. *Fusarium* fungi have been isolated most frequently from samples of infected plants. They appear to be predominantly responsible for the observed infections. The fungi first colonize the underground plants parts (roots, crown and rootstocks) and the basal part of the stem, from where disperse and attack the neighboring vascular tissues. The interrupted delivery of water and nutrients to the terminal plant parts causes chlorosis, necrosis and wilting first of the apical leaves and then of lower leaves. The infected bins are thinner than the healthy ones and are easily snapped from the underground parts. If infected, individual bins or entire plants may wilt. Laboratory researched and pathogenicity tests revealed several *Fusarium* species: *F. oxysporum*, *F. culmorum*, *F. solani*, *F. proliferatum* and *F. acuminatum* as the causal agents of hop wilting. *F. oxysporum* and *F. culmorum* were most frequently isolated.

Keywords: *Fusarium*; hops

INTRODUCTION

Apperance of hop wilt observed 40 years ago, when *Fusarium* fungi were isolated and identified in Vojvodina district as main causative pathogen (AĆIMOVIĆ 1963). Symptoms appeared during May an June. The fungi first attack roots; later on they spread on upper parts of the plant.

Hop wilt caused by fungi (*Fusarium, Phytophthora, Verticilium*) is very common disease in most of the European country in which hops is growing (SALMON & WORMALD 1922; BLATTNÝ 1928; SCHMIDT *et al*. 1969; SOLARSKA 1977; ROYLE 1978; NEVE & GOODWIN 1982; DARBY 1984; HORSKÝ 1987; PICHLMAIER & ZINKERNAGEL 1992).

Foliar chlorosis, decreased growing rate and wilting of hop plants have been noticed in many hopyards around the Vojvodina during 1995 and 1996 years. The underground parts of plants were covered with white film. Up to 10% of plants were infected. This was the reason we started to investigate the possible pathogen responsible for the disease.

MATERIALS AND METHODS

The study had been performed during 5 years. Pathologically changed parts of the hop plants (average 2–3 mm) were collected and incubated on potato dextrose agar (PDA) on 25°C. After colonies appeared they were moved to a new agar in order to obtain pure culture. The first colonies were examined microscopically for orientational identification.

The next step was to breed this fungi on carnation leaves agar (CLA). Further analysis of colonies was performed on both media.

Main, morphological and taxonomy characteristics of fungi were determined according to BURGESS *et al*. (1988, 1994).

RESULTS

Based on fungus characteristics obtained isolated were classified as: *Fusarium proliferatum* (Figures 1 and 2), *F. oxysporum* (Figures 3 and 4), *F. solani* (Figures 5 and 6), *F. culmorum* (Figures 7 and 8) and *F. acuminatum* (Figures 9 and 10).

DISCUSSION AND CONCLUSIONS

The aim of this work was to investigate the possible pathogens causing hop wilt. As hop wilt as a common cause of decreased yield. Investigations of contaminated plants revealed that hop wilt was caused

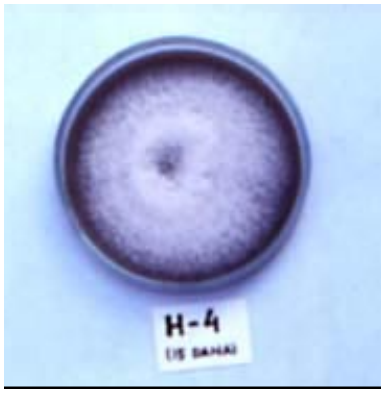

Figure 1. *F. proliferatum* on PDA

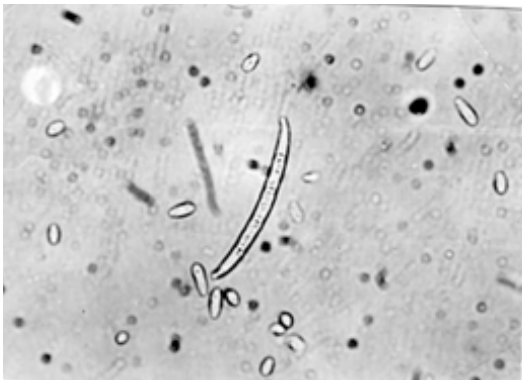

Figure 2. *F. proliferatum* – macro- and microconidies

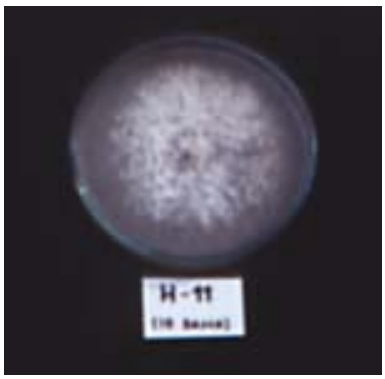

Figure 3. *F. oxysporum* on PDA

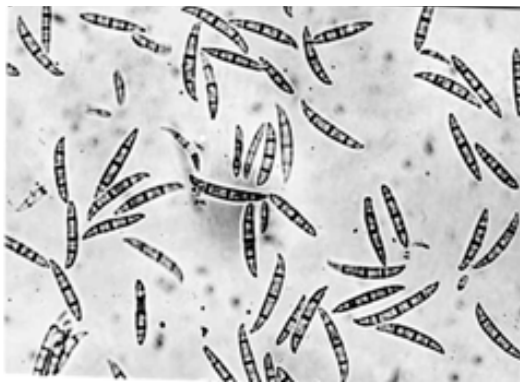

Figure 4. *F. oxysporum* – macroconidies

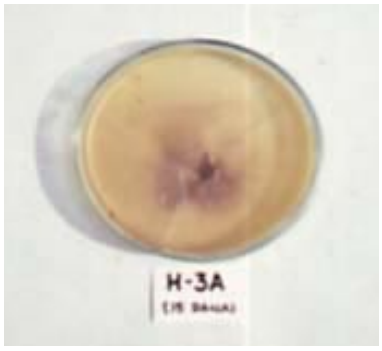

Figure 5. *F. solani* on PDA

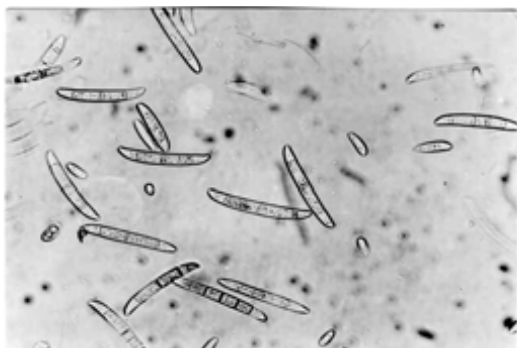

Figure 6. *F. solani* – macro- and microconidies

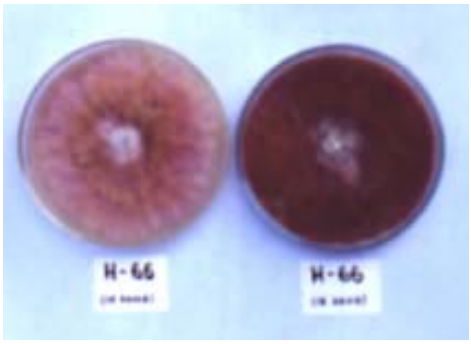

Figure 7. *F. culmorum* on PDA

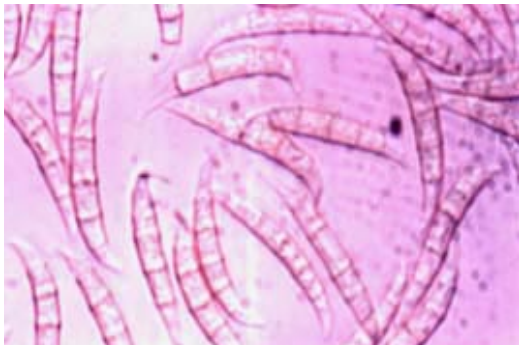

Figure 8. *F. culmorum* – macro- and microconidies

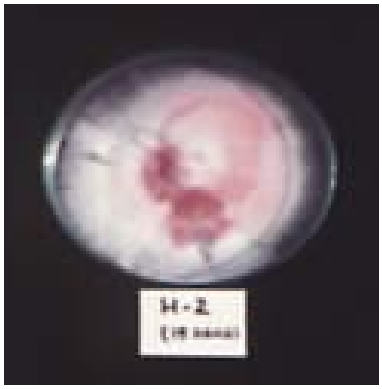

Figure 9. *F. acuminatum* on PDA

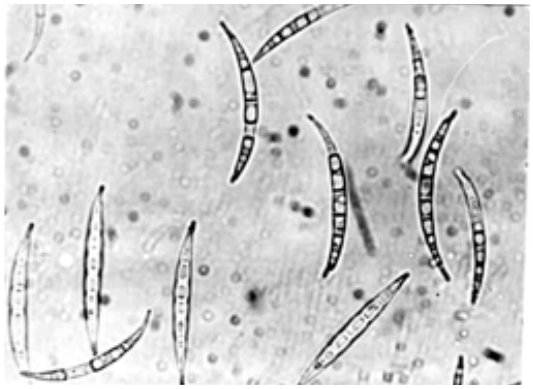

Figure 10. *F. acuminatum* – macroconidies

fungi *Fusarium oxysporum*, *F. culmorum*, *F. solani*, *F. proliferatum* and *F. acuminatum*.

This species are all pathogens. The strongest pathogenic activity have showed *F. oxysporum*, *F. solani*, *F. acuminatum* and *F. proliferatum*.

References

AĆIMOVIĆ M. (1963): Problematika suzbijanja bolesti hmelja i dosadašnji rad na njenom rešavanju. Zbornik radova instituta za polj. istraživanja. Jubilarna sveska povodom 25 – godišnjice rada ustanove 1938–1963. Novi Sad: 163–171.

BLATTNÝ C. (1928): O některých chorobných zjevech u zdřevnatělých částí chmele a u mladých výhonů. Český chmelař, Žatec, **23**: 189–191.

BURGESS L., LIDDEL C., SUMMERELL B. (1988): Laboratory Manual for *Fusarium* Research. Sydney: 14–17.

BURGESS L., SUMMERELL B., BULLOCK S., GOTT K., BACKHOUSE D. (1994): Laboratory Manual for *Fusarium* Research. Sydney. 3rd ed.

DARBY P. (1984): *Fusarium* canker. Rep. Dep. Hop Res. Wye College for 1983: 25–26.

HORSKÝ V. (1987): Uplatnění fungicidů při výrobě chmelových kořenáčů. Ústav rozvoje biotechnologií, Praha. Chmelařství, **60**: 151–152.

NEVE R.A., GOODWIN J. (1982): *Fusarium* canker. Rep. Dep. Hop Res. Wye College for 1981: 23.

PICHLMAIER J., ZINKERNAGEL V. (1992): *Phytophthora citricola* (Sawada) as causal agent of black root and crown rot of hop. Z. Pfl.-Krankh. Pfl.-Schutz, **99**: 505–518.

ROYLE D.J. (1978): Annual Report for 1977. Dep Hop Res. Wye College, Ashford Kent, UK: 39–46.

SALMON E.S., WORMALD H. (1922): Hop canker or growing-off. J. Min. Agric., **XXIX**: 354–359.

SCHMIDT H.E., NAUMANN K., HOLTZ S. (1969): Welkeers cheinungen des hopfens in gebiet der Deutschen Demokratischen Republik, hervorgerufen durch, *Fusarium sambucinum* Fuck. Nachr. Bl. Dt. P .-Schutzdienst. Berl., **23**: 121–126.

SOLARSKA E. (1977): Wiedniecie infekcyjne chmielu i proby jego zwalczania. Ochr. Róstl., **21**: 18–19.