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SHORT NOTES

First report of *Cadophora malorum* on *Asparagus officinalis* in Italy⁽¹⁾

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Summary. In this note *Cadophora malorum* infections on asparagus plants cultivated in different localities in the Foggia area (southern Italy) are reported. Pathogenicity tests demonstrated that *C. malorum* showed the capacity to infect healthy plants of asparagus even if this capacity is less pronounced than that of *Fusarium oxysporum* f. sp. *asparagi* and *F. proliferatum*.

Key words: asparagus, root rot, decline, wilt, *Phialophora malorum*.

Introduction

Root rot, decline and wilt of *Asparagus officinalis* L. are caused by soil-borne pathogens widespread throughout the world. These diseases represent a serious constraint to asparagus production in several areas of northern Apulia, southern Italy. Infected plants show loss of vigor, stunting, wilting and darkening of foliage. Yield losses of about 5–10% are common and, in addition, severe infections result in poor crop quality. Several pathogens have been implicated in the etiology of these soil diseases, including *Fusarium proliferatum*

(Matsushima) Nirenberg (Elmer, 1995; Schreuder *et al.*, 1995), *F. oxysporum* Schlecht f. sp. *asparagi* (Cohen and Heald 1941), *Phytophthora megasperma* Drech, *P. megasperma* var. *sojae* A.A. Hildebrand, *P. richardiae* Buisman and *P. cactorum* (Lebert & Cohn) J. Schrot. (Molot, 1962; Boesewinkel, 1974; Falloon, 1982; Fantino and Ponti, 1990). In this paper, the occurrence of another fungus, *Cadophora malorum* (Kidd & Beaumont) W. Gams [= *Phialophora malorum* (Kidd & Beaumont) McColloch] in asparagus is reported.

Materials and methods

Samples from 1,750 plants were randomly taken from 58 fields in southern Italy (Foggia province) during the springs of 1997 and 1998. Thirty infected plants were selected from each field for isolation of fungi.

⁽¹⁾ Dedicated to Prof. A. Graniti on the occasion of his 75th birthday

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Fig. 1. a) Asparagus plant artificially inoculated with *Cadophora malorum*; b) young asparagus spears ready to be harvested; c), d), e), spears with natural infections of *C. malorum*; f) colony of *C. malorum*; g) phialides of *C. malorum*.

Small segments of roots and spears were washed in running water for 2 h and then surface sterilized by immersion for 1 min in 75% ethanol, 3 min in 3% sodium hypochlorite and 0.5 min in 75% ethanol. Portions approx. 0.5 cm long were placed on Petri dishes containing potato dextrose agar (PDA) or 1.5% Oxoid malt extract agar (MEA) (Difco, Detroit, MI, USA) supplemented with 250 mg l⁻¹ streptomycin sulphate to suppress bacterial growth.

Fungi isolated from the root and spear segments were directly identified by microscopic examination. For more rigorous identification and pathogenicity tests, monoconidial colonies were prepared and stored at 4°C.

Pathogenicity tests were performed in a greenhouse at 22±2°C, using healthy asparagus seedlings cv. UC 72. These plants, six weeks old, 15 cm tall, were removed from their plastic pots (8×12×12) containing a sterilized and fertilized 1:1 peat-sand mixture, and inoculated by immersion of their roots for 3 min in water suspensions containing 5×10⁶ cfu ml⁻¹ of one of the following fungi, all preserved in the Istituto di Produzioni e Preparazioni Alimentari, Bari (Italy) collection: *Fusarium oxysporum* f. sp. *asparagi* (strain IPPA 129), *F. proliferatum* (strain IPPA 132), and *Cladophora* (= *Phialophora*) *malorum* (strain IPPA 140) previously grown on PDA for 30 days at 25°C. All plants were then planted in new plastic pots containing the same type of peat-sand mixture used before the inoculation. The control plants were placed in plastic pots after their roots were soaked for 3 min in sterile water. In the pathogenicity tests, 4 replicates per isolate were used. All test plants were finally harvested 18 weeks after inoculation and examined.

Results

Several *Fusarium* isolates (43% of total fungus isolates), mostly *F. solani*, *F. oxysporum*, and *F. proliferatum*, were obtained from the asparagus spears and roots. Another fungus, *C. malorum* was frequently isolated (27%) from the vascular root tissue of crowns and spears of several naturally infected asparagus plants. Identification of *C. malorum* was achieved by microscopic observation of the colonies after 20 days the growth *in vitro* on MEA at 22°C according to Schol-Schwarz (1970). Colonies were 3.5 cm diameter,

olivaceous from underneath, with scant, pale-olivaceous aerial mycelium. Phialides occurred singly or in clusters on stalk-cells, and were slender, flask-shaped, hyaline, 5–12.5×2–2.5 µm; stalks with sturdy verticillate phialides were observed in old cultures. Conidia were predominantly ellipsoid and slightly apiculate 4–6×2–3 µm, but sometimes cylindrical or somewhat curved. The chlamydospores described as typical of this species by Schol-Schwarz (1970) were not observed. Other isolates obtained from asparagus plants in all the fields surveyed belonged to the following genera: *Alternaria*, *Epicoccum*, *Stemphylium*, *Phoma*, *Pythium*, *Rhizoctonia*, *Cladosporium* and *Mucor*.

The isolates of *F. oxysporum* f. sp. *asparagi* and *F. proliferatum* were very virulent, infecting 90% of the plants in the pathogenicity test. They colonized both vascular and epidermal tissues and caused stem, crown and root rot, and eventually the death of affected plants. The isolate of *C. malorum* infected only 20% of tested plants. The main symptom induced was a brownish discoloration which extended from the roots to the hypocotyl, sometimes 10–15 cm above the soil surface. Control plants remained symptomless.

Discussion

The present study shows that *Fusarium solani*, *F. oxysporum* f. sp. *asparagi* and *F. proliferatum* are the predominant pathogens of asparagus spears in the area investigated. The last two species killed the asparagus plants in the pathogenicity tests.

The finding that *C. malorum* causes wilting in asparagus when it occurs together with *F. oxysporum* f. sp. *asparagi* and *F. proliferatum* indicates that all the above fungi contribute to asparagus decline. No attempt was made at this time to inoculate the plants with species of *Fusarium* and *C. malorum* simultaneously.

This study provides evidence for considering *C. malorum*, hitherto not known as a pathogen of asparagus, as one of the causes of decline of this crop in southern Italy.

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