Development of resistance in *Gloeosporium ampelophagum* and *Colletotrichum capsici* to fungicides

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Abstract. *Gloeosporium ampelophagum* and *Colletotrichum capsici* were trained in vitro for development of resistance to different fungicides. In general, the resistance developed by both the fungi was of low order even after 10–14 generations of training. *G. ampelophagum* developed two-fold resistance to fentin and wettable ceresan, four-fold resistance to zineb and copper sulphate and 200-fold resistance to ziram. The resistance developed to ziram did not persist throughout the training period. *Colletotrichum capsici* acquired two-fold resistance to zineb and copper sulphate and two and a half-fold resistance to mercuric chloride.

Keywords. Resistance; fungicides; *Gloeosporium ampelophagum*; *Colletotrichum capsici*.

1. Introduction

The reviews on development of resistance to fungicides by Ashida (1965), Georgopoulos and Zaracovitis (1967) and Georgopoulos (1969) have highlighted the problem in a forceful way. This problem has assumed such an alarming proportion in recent years, that the American Phytopathological Society organized a symposium in 1976 on “Resistance of plant pathogens to chemicals”. The potential for the development of resistance in a fungus to a fungicide can be conveniently studied *in vitro* with obvious advantages. The ability of the grape anthracnose fungus, *Gloeosporium ampelophagum* Pers. to develop resistance to fentin, wettable ceresan, zineb, ziram and copper sulphate and that of *Colletotrichum capsici* Butler and Básby, the chilli fruit rot and die-back fungus to zineb, copper sulphate and mercuric chloride were investigated and the results are presented.

2. Materials and methods

Monosporic isolates of *G. ampelophagum* and *C. capsici* from grapevine and chilli respectively, were employed. The fungicides used were zineb, ziram, fentin

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(Brestan), wettable ceresan (methoxy ethyl mercuric chloride), mercuric chloride (Hg Cl₂) and copper sulphate (CuSO₄ · 5H₂O). Richards’ medium (50%) adjusted to pH 6.0 was used as basal medium. Fungicides were incorporated in μg/ml into 25 ml of medium taken in 250 ml Erlenmeyer flasks. In order to train the test fungi to the above fungicides, the parent isolates of the fungi were sub-cultured at frequent intervals in media containing progressively increasing amounts of the fungicide starting from sub-toxic levels. Each such subculture is termed a generation. The cultures of G. ampelophagum and C. capsici were incubated at room temperature (26-30°C) for eight and ten days respectively. The mats were harvested by filtering in tarred filter papers. Dry weights of mats were obtained after drying to constant weight at 70°C for 48 hrs. The mat weights presented in tables 1 and 2 represent a mean of three replicates.

3. Results

3.1. Development of resistance in G. ampelophagum

The fungus was trained for 10-14 generations in different fungicides and the initial and final tolerance levels after training are presented in table 1.

3.1a. Zineb: G. ampelophagum developed six-fold resistance (500 to 3000 μg/ml) by the end of the sixth generation. However, at the end of eleventh generation it tolerated only 2000 μg/ml.

3.1b. Ziram: The fungus developed 200-fold resistance (5 to 1000 μg/ml) by the end of the eighth and the twelfth generations. However, the fungus showed erratic behaviour in some of the generations producing growth in higher concentrations, while no growth was observed in lower concentrations. Due to such erratic growth in the third, eleventh, thirteenth and fourteenth generations, the fungal mats were not harvested.

3.1c. Fenitin: The fungus acquired two-fold resistance (1-2 μg/ml) in the first generation itself, which persisted up to the end of the fourteenth generation. Though the fungus tolerated 5 μg/ml and 10 μg/ml in some of the generations, it did not persist long.

3.1d. Wettable ceresan: After continuous training for 14 generations, the fungus developed only two-fold resistance to wettable ceresan (5-10 μg/ml). However, it could tolerate up to 50 μg/ml in the eighth generation which did not persist.

3.1e. Copper sulphate: The fungus acquired four-fold resistance (500 to 2000 μg/ml) after continuous training for ten generations.

3.2. Development of resistance in C. capsici

The initial and final tolerance levels of C. capsici to different fungicides after ten to twelve generations of training are presented in table 2.

3.2a. Zineb: The fungus developed two-fold resistance and tolerated 1000 μg/ml of zineb at the end of twelve generations as against an initial tolerance of