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ECO-FRIENDLY MANAGEMENT OF CHILLI FRUIT ROT CAUSED BY COLLETOTRICHUM CAPSICI

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INTRODUCTION

Chilli (Capsicum annum L.), one of the spice crops belonging to the family, Solanaceae, is a well-known commercial crop used both as condiment or culinary supplement and vegetable. It is an important constituent of many foods, adding flavour, colour and pungency. Chillies are good sources of Vitamin 'A', Vitamin 'B' and Vitamin 'C' and minerals like calcium, phosphorus, ferrous, sodium and copper in trace amounts. Chillies produce alkaloids, capsaicinoids and carotenoids which make chilli hot and pungent.

India accounts for 25% of the world's total production of chilli. In India, it is grown over an area of 8.05 lakh hectares with an annual production of 12.98 lakh tonnes and productivity of 1611 kg/ha (Ministry of Agriculture, Govt. of India, 2008). Andhra Pradesh, Maharashtra and Karnataka are the major chilli growing states accounting for nearly 75 per cent of the country's area and crop production. Andhra Pradesh occupies an area of 3.53 lakh hectares with an annual production of 5.14 lakh tons. It is the leading state in chilli production, contributing 25 to 30% of the total production in the country followed by Maharashtra, Karnataka and Orissa. In Guntur district of Andhra Pradesh, the crop occupies an area of 63 thousand hectares with an annual production of 3.49 lakh tonnes.

Many diseases have been reported to affect chilli crop of which dieback and fruit rot, leaf spot, powdery mildew, damping off, root rot and wilt, Choanephora twig blight and mosaic diseases are of major importance. Among these, dieback and fruit rot caused by

Colletotrichum capsici (Syd) Butler and Bisby is prevalent in all chilli growing states of the country and causes losses ranging from 10 to 60 %. This disease is more conspicuous as it causes severe damage to fruits in the field as well as, sometimes, in transit and storage. Fruit rot may also occur on the fruits after harvest and cause decay of fruits. It has become a major constraint to chilli fruit production.

Symptoms

The disease has been observed to occur in three phases, they are.[1] seedling blight or damping off prevalent in the nursery,[2] leaf spotting and die-back initiated at different stages of growth and[3] Anthracnose or fruit rot.

Die back Symptoms

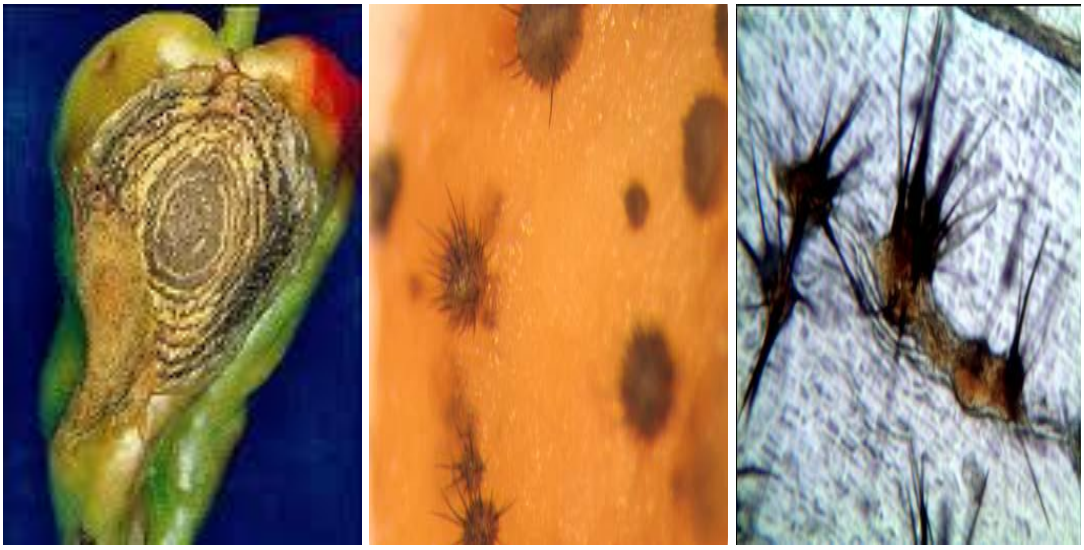
As the fungus causes necrosis of tender twigs from the tip to backwards the disease is called die-back. Infection usually begins when the crop is in flower. Flowers drop and dry up. There is profuse shedding of flowers. The flower stalk shrivel and dry up. This drying up spreads from the flower stalks to the stem and subsequently causes die-back of the branches and stem and the branches wither. Partia1lly affected plants bear fruits which are few and of low quality.

Fruit rot symptoms

In anthracnose or fruit rot caused by C. capsici, the ripe fruits turning red are mostly affected. The disease is characterised by the appearance of small black circular spots on the skin of the fruits that spread in the direction of the long axis, thus becoming more or less elliptical. As the infection progresses, the spots get either diffused and black, greenish or dirty grey in

colour or they are markedly delimited by a thick and sharp black outline enclosing a lighter black or straw coloured area. In some cases, the lesions are brown, and then turn black from the formation of setae and sclerotia. Severe infection results in change of fruit colour from red to straw or white. Numerous acervuli are scattered on the discoloured area of the infected fruit. When a diseased fruit is cut open, the lower surface of the skin is covered with minute, spherical, black stromatic masses or sclerotia of the fungus. A mat of fungal hyphae covers the seeds. Such seeds turn rusty in colour. Affected fruits are deformed, white in colour and lose their pungency. Ultimately, the diseased fruit shrivels and dry up.

Infected fruits showing characteristic symptoms viz., dipression in initial stage (top left) and target board appearance (top right)



Characteristic setae and acervuli produced on naturally infected chilli fruits

Severly infected chilli fruits

Pathogen Survival and Dissemination

The fungus survives in and on seeds. Anthracnose is introduced into the field on infected transplants or survives between seasons in plant debris or on weed hosts. Alternative hosts include other solanaceae (tomato, potato, eggplant) crops. Fruits are infected when spores of the fungus or infested debris are rain splashed onto chilli plants. New spores are produced within the infected tissue and are then dispersed to other fruits. Workers may also move spores with equipment or during handling of infected plants. Infection usually occurs during warm, wet weather. Temperatures around 27^0C are optimum for disease development, although infection occurs at both higher and lower temperatures. Severe losses occur during rainy weather because the spores are washed or splashed to other fruit resulting in more infections. The disease is more likely to develop on mature fruits, although it can occur on immature fruits as well.

Management

Effective control of Colletotrichum diseases usually involves the use of a combination of cultural control, biological control, chemical control and intrinsic resistance.

Cultural practices

1. Production of pathogen-free planting materials is the key control measure used to manage the disease. Planting of contaminated seed or transplants facilitates disease spread. Use of healthy pathogen-free chilli seed or transplants should be adopted.
2. Early removal of affected plants will control the spread of the diseases

3. Transplants should be kept clean by controlling weeds and solanaceous volunteers in the vicinity of the transplant houses
4. Stagnation of water should not be allowed in nursery beds and fields in order to avoid fungal infection. The field should have good drainage and be free from infected plant debris.

Use of resistant cultivars

1. Use of resistant varieties that will eliminate losses from diseases, use of chemicals and expenses incurred in disease control.
2. IIHR, Bangalore, TNAU, Coimbatore, and PAU, Ludhiana, have developed resistant varieties for anthracnose disease viz., IIHR 275-13-5, IIHR345-6, IIHR 332 -109, CC4, Ujwala, CA 87-4. S- 20-1, Lorai and BG-1.

Use of chemicals

1. Chemicals are the most common and practical method to control anthracnose diseases.
2. The fungicide traditionally recommended for anthracnose management in chilli is Maneb (2.5g per liter), although it does not consistently control the severe form of anthracnose on chilli fruits
3. The disease can be controlled by seed and foliar spray treatment with strobilurin fungicides like azoxystrobin (Quadris), trifloxystrobin (Flint) and pyraclostrobin (Cabrio) (at 1ml/liter) and difenconazole (1ml per liter) have recently been labeled for the control of anthracnose of chilli. Other chemicals like, chlorothalonil, copper, famoxadone, iprodione, procymidone, tolylfluanid and carbendizim are also controls the disease. The first foliar spray is given at the first pair of leaf stage and subsequent sprays done twice at 20-day intervals.

Use of botanicals

1. Plant products have been tested in many laboratories. Seed and spray treatment showed that the crude extract from rhizome, leaves and creeping branches of sweetflag (Acorus calamus L.), palmorosa (Cymbopogon martinii) oil, Ocimum sanctum leaf extract, and neem (Azadirachta indica) oil could restrict growth of the anthracnose fungus
2. Among the botanicals used against the fungus Colletotrichum spp., the most effective control of chilli fruit rot disease was found with sweetflag crude extract when applied in two intervals when the majority of the plants were at the first bloom stage and at the mature bloom stage.

Biological control

1. Antagonistic Pseudomonas fluorescens as seed treatment and as well as spray treatment @10^{8} $CFUg^{-1}$ were found to be effective against Colletotrichum capsici.
2. Trichoderma species are able to effectively control C. capsici infection in chilli.
3. Other biological control agents that have been tested for efficacy against Colletotrichum include Bacillus subtilis and Candida oleophila.