SERIOUS DISEASES OF TROPICAL FRUITS IN FLORIDA

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Abstract. A wide variety of tropical and subtropical fruits can flourish and produce fruit in Florida. In spite of the distance between their new home and origin they are not without diseases. The pineapple fruit rot caused by Ceratocystis paradoxa, Erwinia ananas, Fusarium moniliforme, Penicillium funiculosum and Pseudomonas ananas results in serious fruit loss. Colletotrichum gloeosporioides which causes cashew anthracnose, attacks leaves, stems, flower shoots, fruits, and nuts. Annona anthracnose caused by C. gloeosporioides is a serious preharvest and postharvest disease of atemoya and sugar apple fruit. Rhizopus artocarpri, which causes Rhizopus fruit rot, reduces production by attacking the male and female flowers. Colletotrichum gloeosporioides which causes carambola anthracnose is a serious postharvest disease of the fruit. The most limiting factor in producingパパイア and sugar apple fruit. Rhizopus artocarpri, which causes Rhizopus fruit rot, reduces production by attacking the male and female flowers. Colletotrichum gloeosporioides which causes carambola anthracnose is a serious postharvest disease of the fruit. The most limiting factor in producing atemoya and sugar apple fruit. Rhizopus artocarpri, which causes Rhizopus fruit rot, reduces production by attacking the male and female flowers. Colletotrichum gloeosporioides which causes carambola anthracnose is a serious postharvest disease of the fruit. The most limiting factor in producing atemoya and sugar apple fruit. Rhizopus artocarpri, which causes Rhizopus fruit rot, reduces production by attacking the male and female flowers. Colletotrichum gloeosporioides which causes carambola anthracnose is a serious postharvest disease of the fruit. The most limiting factor in producing atemoya and sugar apple fruit. Rhizopus artocarpri, which causes Rhizopus fruit rot, reduces production by attacking the male and female flowers.

This paper describes provisions of the more commonly found tropical fruit diseases in Florida. For each tropical fruit the reader will find its common name, scientific name, disease common name, scientific name of the pathogen, symptoms of the disease, and conditions necessary for disease development.

Pineapple (Ananas comosus L.) Merr.

Black rot (Ceratocystis paradoxa (Dade) C. Moreau), also known as water blister, soft rot, or water rot, is found throughout most of the commercial pineapple production areas of the world including Florida. The fungus attacks all of the foliar parts of the plant, but is rarely seen on the fruits in the field, except when the fruit is allowed to fully ripen. Black rot is mainly a post-harvest problem since the fungus generally enters through the cut stem at the base of the fruit, or at the side of the fruit through harvest, handling, and packing. In the early stages the disease is a wet, soft decay of the pineapple core and tissues that takes on a bright yellow color and has a characteristic smell of ethyl acetate. In the later stages of the disease symptom development continues until the very soft fruit, almost liquefies, with the skin becoming a brittle shell. Ultimately the liquids are entirely lost, leaving nothing but an empty shell composed of blackened vascular fibers. On the broken surfaces of the decayed tissues a black crust composed of macrospores is formed. The macrospores also form in the decayed tissues next to the core of the fruit, turning it black (5, 11, 14, 24, 25, 26, 27, 28, 29, 30, 35, 36, 45).

The moisture conditions in the field at time of harvest are most important in rot development. The disease develops in the fruit very rapidly at temperatures between 21 and 32°C, with little development below 10°C. Fruit should not be harvested after prolonged rains. When harvesting fruits the stems should be cut, not snapped (42).

Brown rot (Erwinia ananas Serrano, Fusarium moniliforme Sheldon, Penicillium funiculosum Thom, and Pseudomonas ananas Serrano) is also called, in most of the pineapple production areas, fruitlet black rot, fruitlet brown rot, ripe fruit rot, fruitlet core rot, and exogenous brown discoloration. The symptoms on the fruit vary, depending upon whether bacteria, fungi, or both, are involved in the disease making it difficult to distinguish between the rots by appearance. The organisms most commonly associated with this disease are saprophytes on decayed vegetation in the field. They are also found on the senescing flower parts in the cavities under the eyes on the fruit and enter through mechanical injuries, growth cracks, and insects feeding or ovipositing. The rot is not easily detected from the outside of the fruit, although premature ripening or an uneven color at ripening may occur. Eyes may become sunken and turn brown. Internal breakdown may be small light to dark brown, firm, moist, areas at the center of the eye or the fruitlet. Occasionally only the style or the central part of the fruitlet is diseased. In the later stages of decay the disease progresses to the core of the fruit and involves all the tissues surrounding the...
floral cavity. The rot usually does not spread from one fruit to another (4, 11, 14, 19, 20, 22, 24, 25, 26, 27, 35, 36, 38, 39, 40, 41, 43, 44, 46).

Cashew (Anacardium occidentale L.)

Anthracnose (Colletotrichum gloeosporioides Penz.) occurs in most of the tropical areas where the host is grown (14). The young lesions are red-brown water-soaked areas on leaves, stems, flower shoots, fruits, and nuts. The affected leaves become necrotic and die, flowers turn black and fall, fruit and nuts shrivel and decay. The young trees affected by successive and progressive dieback of terminal shoots for several years may die.

The fungus can survive on dead plant material, and serve as a source of inoculum under more favorable environmental conditions. The conidiospores are spread easily by water and wind during periods of high humidity such as rain or overhead irrigation and attack the new growth (42).

Annona (Atemoya cherimola x A. squamosa) and (sugar apple A. squamosa L.)

Anthracnose (Colletotrichum gloeosporioides Penz.) is probably the most common and widespread disease of the annona. The fungus is one of the most widely distributed in Florida as well as in other tropical and subtropical areas of the world and if not controlled causes severe production losses.

The various manifestations of the disease on the annona include blossom blight, fruit russetting or staining, fruit rot, and mummified fruit. Damage from the disease is influenced greatly by relative humidity. However, even in relatively dry seasons considerable latent infection may occur. The fungus grows saprophytically and sporulates abundantly on twigs and mummified fruits.

Blossom blight may vary in severity from slight to complete, according to prevailing weather conditions. The infected petals show dark-colored lesions, which often enlarge, turn black and cause flower drop. The young infected fruits either fall or mummify. On nearly mature to ripe fruits in the early stages of disease development, the lesions are small and relatively inconspicuous with a plug of hardened tissue underneath, with no external rotting. In the later stages the small spots enlarge, blacken and may coalesce to cover large areas. These infections generally penetrate deep within the fruit and cause pulp preharvest or postharvest decay of the fruit. Surface russetting or staining results from spores being washed down upon the fruit from an infected flower, fruit or twig. Infections on young leaves start as small, light green, angular to irregular spots which enlarge, causing scorching and premature fall (3, 6, 14, 21, 33).

Botryodioidia theobromae Pat. which causes Diplodia rot on fruits of Annona reticulata, was described in Australia in 1953. In Florida the disease manifests itself by mummifying the fruit. The early symptoms are small brownish to black lesions that rapidly enlarge over half or more of the fruit (14, 33, 37).

Leaves of the atemoya, cherimoya, custard-apple, ilama, and sugar-apple are commonly attacked by this rust fungus Phokospora cherimoliæ Cumm. in the summer and fall. When infestation becomes severe, the leaves turn yellow and fall. The disease is recognized by the numerous small, raised, yellow spots covered with 2 golden-yellow mass of spores, which are on the under surface of the leaves. On the upper surfaces of the leaves, the small spots are yellow and more or less smooth (14, 16, 17).

Jackfruit (Artocarpus heterophyllus Lam.)

Rhizopus rot of jackfruit (Rhizopus artocarpì Rac.) has been reported in Florida, India, and the Philippines. In all cases the fungus attacks the male and female flowers. The early stages of the disease on infected male inflorescence and young fruit first appear as a water soaked area, then as the fungus develops, a greyish mass appears, gradually becoming denser, forming a black growth with black sporangia. The young sporangiophores form a whitish fringe on the edge of the black growth. The mycelium eventually covers the entire male inflorescence and fruit. The infected fruit rot slowly, mummify and eventually fall from the tree (9, 10, 15, 31).

Carambola (Averrhoa carambola L.)

Anthracnose (Colletotrichum gloeosporioides Penz.) is the most serious disease affecting carambola. The loss results from the rotting of the ripe fruit before and after harvest. In the early stages the lesions appear as small, circular, slightly sunken spots in the skin. As these spots increase in size the central portion becomes dark because of the presence of the mycelium just beneath the skin. Eventually the entire fruit becomes infected, often developing a watery rot when invaded by other organisms. The fruit has 4 or 5 prominent longitudinal ribs which are easily damaged in high winds, allowing easy access for C. gloeosporioides. Examination of the pulp beneath spots reveals the presence of many spores of the fungus. Green fruit will become infected, but the lesions do not develop until ripening begins. When the fruit is ripe and the weather favorable, spots develop on the ripe fruit and the spores are splashed onto other fruit.

Cercospora leaf spot disease (Cercospora averrhoæa Petch.) has been found in Florida and other tropical areas where occurrence is associated with high humidity. The lesion is roughly circular, slightly depressed, reddish, with gray to white centers (2).

Corynespora leaf spot (Corynespora cassiicola Berk. & Curt.) probably occurs in most of the production areas of the tropical world. In Florida the lesions are primarily found on the leaves, and occasionally on the petioles and the larger branches of the male inflorescences. Young infections first appear as a faint yellow spot which develops with a small necrotic speck in the center. The developing lesions are tan or light brown. The mature lesions are subcircular to irregular in shape and range from 1 to 2 mm in size. On the upper leaf surface the lesions are usually grayish to off-white, with the necrotic area depressed as to appear as a brownish ring. The necrotic lesions on the lower surface appear as a tan spot. The necrotic area is slightly depressed with a narrow light reddish-brown border. The lesions occur on both upper and lower surfaces of the leaf. In the lesions dark reddish-brown conidiophores with conidia are found in abundance (13).

Papaya (Carica papaya L.)

Anthracnose (Colletotrichum gloeosporioides Penz.) fruit and foliar infections occur wherever papaya is grown. Foliage symptoms are known to occur or have been reported from the Bahamas, Florida, Caribbean Islands, Central America, Hawaii, India, and Surinam. Early symptoms on the leaves appear as small water-soaked spots of irregular shape. The spots continue to enlarge and turn light brown in color, occasionally coalescing. The centers of the older lesions turn gray white in color and occasionally drop out, giving a shot hole appearance. Imbedded in the necrotic centers of the older lesions are numerous acervuli, appearing as small black specks (14).

The fungus infects the young green fruit but symptoms do not develop until the fruit matures. Symptoms on fruit first appear as water-soaked spots that develop into sunken lesions in which tan to pink spore masses appear in acervuli. Lesions generally enlarge to 5 mm in diameter and turn dark in color. The infection extends into the flesh of the fruit usually giving the appearance of a plug (14).

Disease severity is increased under conditions of excessive moisture and high temperatures. The pathogen is easily spread by rain or irrigation with wind. Ringspot virus is the most limiting factor to papaya production in Florida. The disease has been reported from Africa, Australia, the Caribbean area, China, Hawaii, India and South America (12, 14). The earliest symptoms appear as a chlorosis in the topmost young leaves, which is followed by vein clearing, rugosity, and a motting of the laminae. Leaf malformation and reduction of the laminae, which becomes extremely filiform, resembling phenoxy injury, appears in the later stages. Occasionally, elongated dark green streaks develop on the petioles and the upper half of the stem. The infected plants become stunted, petioles are shortened, and fruit set is reduced. The fruits on infected plants occasionally exhibit green or dark brown rings. The virus is easily transmitted mechanically and by the aphids Aphis spiraeola, A. gossypii, A. ursacivora, A. rumicis and Myzus persicae (14).

Control of ringspot through applications of insecticides for the control of aphids has not been successful since the aphids do not colonize the papaya. Resistant cultivars have shown some promise in Florida, Hawaii, and Taiwan. The most promising method of control is cross protection, where the young seedlings are inoculated with a mild strain of the virus.

Loquat (Eriobotryae japonica Lindl.)

Leaf Spot (Entomosporium mephist (DC. ex Duby) Sacc. [E. Macalatum Lev., E. thuemenii (Cke.) Sacc.; Diplocarpon mes- pili (Sauer) Sutton, perfect state, non Fabreae maculata Atk.] spot was reported from Brazil in 1930, and is known to occur in Australia and Florida. Leaf spots are dark colored, circular, up to 3 mm in diameter with a distinct halo. The lesions on the leaves, young twigs and fruits occasionally coalesce and become misshapen. The conidial stage is the circular, up to 3 mm in diameter with a distinct halo. The mycelium of the fungus grows inside the leaf tissues and sporulation splashes the bacteria to the flowers, tender shoots, and suckers. The bacteria is also spread mechanically, mainly through pruning (18, 34).

Barbados Cherry (Malpighia glabra L.)

Cercospora leaf spot (Cercospora bunchosiae Chupp and Muller) has been reported from Florida and Hawaii. The occurrence of this disease is associated with the high humidity in the summer months. The leaf spots are brown, roughly circular, slightly depressed, with gray centers, which may vary in size up to 10 mm in diameter. The lesions are surrounded by yellow halos and appear on both surfaces. The lesions on the young tender leaves are larger than those on mature leaves (7, 14, 23).

Mamey (Calocarpum sapota (Jacq.) Merr.

Algal leaf spot (Cephalotus virescens Kunze) disease on mamey has only been reported from Florida, but does occur on many genera and species of plants in South Florida. The lesions on the leaves, twigs, and small branches are generally covered with a thin gray-green to reddish-gray velvety layer of algal growth during most of the year. During the rainy season this growth turns a dark red color because of the fruiting bodies, which appear as an outgrowth of dense, fine hairs with tiny globular heads at the tips. The lesions on the leaves are mostly circular, on the twigs and branches they coalesce to cover the surface for some 30 to 50 mm. The new growth and large branches are affected. The infected branches are stunted with bark cracked and scaly and foliage is sparse (32).

Jujube (Ziziphus jujuba Mill.)

Cercospora spot (Cercospora jujubae Chowdhury), which causes Cercospora leaf spot is known in India and Florida. Cercospora jujubae and disease it causes are different from other Cercospora species that are known to Florida. The mycelium of the fungus grows inside the leaf tissues and also on the outside on the under surface of the leaf giving the appearance of a sooty mold. The early symptoms first appear as tiny dark brownish black irregular areas of fungus mycelium and spores on the underside of the leaf. The top of the leaf turns a light yellow. The individual areas continue to enlarge, eventually coalescing and cover the underside of the leaf (8).

Literature Cited


STATUS OF PESTS OF MINOR TROPICAL FRUIT CROPS IN SOUTH FLORIDA

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Abstract. The recent increase in the acreage of minor tropical fruit crops in south Florida has produced new pest problems and increasing problems with established pests. An overview

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