Int.J.Curr.Microbiol.App.Sci (2018) *7*(11): 309-314

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 11 (2018)**
Journal homepage: http://www.ijcmas.com

Review Article https://doi.org/10.20546/ijcmas.2018.711.038

Status of Black Spot of Papaya (*Asperisporium caricae*): A New Emerging Disease

Shantamma*, S.G. Mantur, S.C. Chandrashekar, K.T. Rangaswamy and Bheemanagouda Patil

Department of Plant Pathology, College of Agriculture, UAS, GKVK, Bengaluru – 560065, Karnataka, India

**Corresponding author*

Keywords

Papaya (*Carica papaya* L.), *Asperisporium caricae*

Article Info

Accepted:
04 October 2018
Available Online:
10 November 2018

A B S T R A C T

Papaya is attacked by several diseases like, anthracnose, powdery mildew, black spot, brown spot and papaya ring spot. Among the emerging diseases in papaya, black spot disease caused by *Asperisporium caricae* is most lethal. Both leaves and fruit of papaya can be affected by the black leaf spot caused by *Asperisporium caricae*. The fruits were affected on the surface, reducing the fresh-market value. This disease can affect papaya plants at any stage of their growth. Periods of wet weather may increase the development of the disease. The use of fungicides is the most appropriate management option. This disease has been reported from different parts of the country and is found to be serious in recent years.

Introduction

Papaya (*Carica papaya* L.) is an important fruit crop, belongs to family *Caricaceae*. *Carica* is the largest of the four genera with 48 species, among which *Carica papaya* L. is most important and cultivated all over the world (Badillo, 1971 and Waller, 1992). Economically, *Carica papaya* is the most important species within the *Caricaceae*, being cultivated widely for consumption as a fresh fruit and for use in drinks, jams, candies and as dried and crystallized fruit (Villegas, 1997). Green fruit and the leaves and flowers may also be used as cooked vegetable (Watson, 1997).

Distribution

Asperisporium caricae is responsible for an important leaf and fruit spot disease of *Carica papaya* (papaw or papaya) (Stevens 1939) that is commonly referred to as black spot, blight or 'rust' of pawpaw (Ellis and Holliday 1972). Black spot of papaya is a widespread fungus disease found in the USA (Texas), Brazil, South Africa and other countries. In Hawaii, *A. caricae* has been found on the islands of Maui, Hawaii and Oahu.

Leaf spot disease was observed on *Pongamia pinnata* at Berhampore, West Bengal, India. Black circular spots (6-10 mm in size) on the ventral surface and concomitant yellow spots

on the dorsal surface were observed with ovate to elliptical bi-celled conidia, 15.64-23.46 X 3.91µm, with bright yellow colour. The causal agent was identified as *Asperisporium pongamiae* (Maji, 2004). This is thought to be the first report of this fungus on *P. pinnata.*

Leaf spot of grapes is caused by *Asperisporium minutulum*. It causes symptoms on living leaves, hypophyllous as olivaceous-brown or brown patches, puncti form to extended, mostly irregular in shape, sometimes covering large areas of the leaf surface (Konstanze and Braun, 2005). Colonies hypophyllous, loose to dense, punctiform, short, olivaceous-brown or brown, somewhat velvety, reminiscent of erumpent rust sori.

Cultivated hybrids of *Alstroemeria* spp. and wild species *A. psittacina* reported as new hosts for *Asperisporium* (Wolcan *et al.*, 2006).

Leyland cypress (*Cupressocyparis leylandii*) Passalora needle blight caused by *Asperisporium sequoiae* (Steven Jeffers, 2010). Typically, this disease only affects plant growth that was at least one year old. Symptoms usually appear during summer months. They include browning of needles and eventual needle drop. These symptoms started on lower branches near the trunk and then spread outward toward branch tips. Over time, the disease moves up the tree. The portion of a tree displaying symptoms may increase from one year to the next until only the tips of upper branches were still green or the tree dies completely.

Morphological descriptions

Sporulation of *Asperisporium caricae* was hypophyllous ranging from dark blackish brown to black. Stroma well developed, erumpent. Conidiophores olivaceous brown, geniculate, smooth in dense fascicles with several prominent conidial scars at the tip up to 52 µm long × 6 – 9 µm wide. Conidiogenous cellspolyblastic with thickened and darkened scars. Conidiasolitary, ellipsoidal, pyriform or clavate, 1-septate (mature), hyaline to mid pale brown, verrucose, 16–32×5–11 µm (Lavoura, 1913).

Sporodochia of *Asperisporium caricae* was hypophyllous, dark blackish brown to black, stroma well-developed, erumpent. Conidiophores closely packed together and covering the surface of the stroma, usually unbranched, hyaline to olivaceous brown, with several prominent conidial scars at the apex, up to 45 x 69 µm. Conidia solitary, ellipsoidal, pyriform or clavate, 1-septate, hyaline to mid pale brown, verrucose, 14-26 x 7-10 µm (Maublanc, 1913; Ellis and Holliday, 1972).

Morphological description of *Asperisporium caricae* was found that sporodochia and conidia were produced on the spot. The sporodochia were subcuticular or intra epidermal, olive-brown to dark brown 40-120µm in diameter. Conidiophores were densely fasciculate, simple, straight or curved, greenish-brown to olive-brown, 1-2 septate. Conidia were terminal, elliptic to ovoide, rounded at the top, truncate at the basal end, hyaline and one-celled at first, then turned to greenish-brown and become two celled, 12-28 x 7-14 µm with many rough warts (Kobayashi *et al.*, 1998).

Morphological findings of *Asperisporium minutulum viz.,* Mycelium internal, subcuticular to intra epidermal, branched, 2.5-5µm wide, septate, Conidiophores numerous, in dense fascicles, arising from stroma, emerging through stroma or erumpent through the cuticle, forming sporodochial conidiomata, erect, straight to slightly flexuous, short cylindrical or conical,

unbranched, Conidia formed solitary, straight, broadly ellipsoid to subspherical, 10-23 X (6-) 8-13 µm, 0-2 septate (Konstanze, S. and Braun, 2005).

Morphologically identified that *Asperisporium caricae* conidiophores are compact, covered with stroma, hyaline to brown in colour. Conidia are elliptic-oviod, rounded at the top, one or two septate, hyaline to brown in colour size of the conidia varied from 27-30µm (Shantamma and Mantur, 2014).

Symptomatology

The initial symptoms of black spot caused by *A. caricae* were small, water-soaked spots which develop on the upper surface of young leaves and later become greyish-white in colour. Black conidial masses form on these lesions on the underside of leaves. Affected leaves curl, become necrotic, brittle and subsequently die under severe disease pressure, which results in extensive defoliation. Lesions on fruit begin as small black spots that can enlarge to 2–6mm in diameter. The tissue beneath these lesions remains firm, but the value of harvested fruit with these symptoms is reduced (Peterson *et al.,* 1993).

Black pustules on the abaxial surface of the leaf were characteristic of this disease. The first symptoms were scattered small spots, visible on both leaf surfaces. On the upper surface, the lesions were rounded or somewhat angular, 1-4 mm in diameter, pale yellow, with dark margins. Later the lesions became necrotic and whitish. On the lower surface, the lesions were covered with masses of fungal spores which appear as dark dots. The pustules covered the whole lesion (Maublanc, 1913).

The disease occurs on the leaves and on the fruits. On upper surface of leaves, characteristic symptoms consist of round, light-brown (tan) necrotic spots, encircled by a yellow halo. On the lower surface of the leaves, in the areas corresponding to the spots, the powdery growth of the fungus of gray to black color was observed. In some cases, over these, a pale mycelium produced by a fungal hyper parasite of the pathogen may be observed. When it occurs, coalescence of the lesions is a common cause of leaf senescence and defoliation of the plants. Abundant spotting causes defoliation and over 50% leaf fall occurred. Young leaves generally did not presented symptoms. On the fruits, the presence of circular areas of watery aspect were observed initially, later disease became brown in color, prominent, with pal points, and that may attain 5mm of diameter. These lesions generally were epidermal and did not reach the pulp of the fruit, causing only a hardening of the skin of the part affected (Ventura, 2008).

Symptoms of the disease was observed, when the plants were still in initial phase of growth. The disease occurs both on the leaves and fruits. Symptoms start from older leaves progressively to the middle and upper leaves. On upper surface of older leaves symptoms consists of round, light-brown necrotic spots, encircled by yellow halo. On the lower surface of leaves, in the areas corresponding to the spots, growth of fungus of black color was observed (Shantamma *et al.,* 2012). On fruits, symptoms consists of initially and later it becomes brown in colour. Initially these lesions were epidermal and did not affect the pulp region of the fruit.

Survey for black spot of papaya

Symptoms of black spot of papaya was noticed on papaya plants of Coorg honey dew at horticultural experiment station, chethali and at horticultural farm Hessaraghatta

Bangalore and also on many locals grown papaya plants at Kushalnagar, Coorg samples collected from hills of Tamilnadu CO-1 also revealed the occurrence of same symptoms in the area from the initial survey it appeared that the malady was prevalent only during dry and hot months of the year (Ullasa, 1977).

Identified diseased papaya trees in several locations *viz.*, Kandy town (Hantana, Peradeniya, Gannoruwa, *etc*). Investigated for the presence, distribution and severity symptoms (Adikaram and Wijepala, 1995).

Survey conducted for papaya diseases in four provinces of the Philippines *viz.*, Batangas, Laguna, Cavite and Quezon by Cumagan and Padilla (2007).

Typical symptoms of black leaf spot were observed and collected in Silang and Indang, Cavite and Lipa, Batangas and south of Manila on *cv* 'Red Lady'. Symptoms of the disease and the causal organism were found similar to that previously reported.

A random survey was conducted for occurrence of black spot disease in papaya growing regions of South Karnataka caused by *Asperisporium caricae* during late winter season of 2011 (Shantamma *et al.*, 2014). A maximum severity of 69.5 per cent and 37.33 per cent on leaves and fruits respectively was recorded at Chikkanahalli in Mysore district.

Isolation and proving pathogenicity

Isolation of *Asperisporium alstroemeria* from infected leaves of alstroemeria flower on potato dextrose agar (Wolcan *et al.*, 2006).

Isolation of *Asperisporium caricae* from infected leaves of papaya on potato dextrose agar, Czapecksdox media and cooks No.2 (Adikaram and Wijepala, 1995).

Application of the inoculum suspension with the addition of a tensiactive solution or water (controls) with a brush, on potted plants of *Alstroemeria* hybrids cv. Rebeca. Inoculated plants were covered with plastic bags for 72 hours and kept in a greenhouse at 17–23^{0}C. Twenty-five days after inoculation, transluscent and chlorotic spots were observed on the alstroemeria leaves (Wolcan *et al.*, 2008).

In vitro evaluation of fungicide against *A. carica*

Laboratory studies were showed that *A. caricae* was more sensitive to difenoconazole (EC_{50} of 2 ppm) then tebuconazole (EC_{50} of 14 ppm) (Vawdrey *et al.*, 2008),

The effect of different fungicides on spore inhibition of *Asperisporium caricae* was studied (Shantamma and Mantur, 2014). Among those difenoconazole inhibited 100% spore germination at 150ppm followed by chlorothalonil and propiconazole.

Bitertanol and copper oxychloride have less effect on inhibition of spore germination of *A. caricae* was recorded at concentration from 2 to 1000ppm in both fungicides.

In vivo evaluation of fungicides against *A. caricae*

Several chemicals including strobilurins (Pyraclostrobin and azoxystrobin), triazoles (difenoconazole and tebuconazole), dithiocarbamates (Propineb, metiram, ziram and mancozeb) and pthalimide (chlorothalonil) were evaluated in three field experiments at North Queensland and Australia for the control of papaya black spot (Vawdrey *et al.*, 2008). Among these chemicals difenoconazole, pyraclostrobin and chlorothalonil were better than mancozeb and tebuconazole.

Effect of foliar applications of phosphites

with K, Ca, Mg and Cu evaluated indifferent doses on papaya black spot. In both field and greenhouse trials the Phosphite with other nutrients were found to reduce the incidence and severity of black spot disease (Dianese *et al.,* 2005).

Efficacy of fungicides were tested against *Asperisporium caricae viz.*, tebuconazole + trifloxystrobin, pyraclostrobin, azoxystrobin and difenoconazole (Liva *et al.*, 2011).

Eight fungicides were evaluated under field condition, for their efficacy in controlling the black spot disease. Out of eight fungicides evaluated difenconazole was most effective against pathogen on leaves followed by chlorothalonil. Whereas, bitertanol was least effective. On fruits also difenoconazole was most effective against the pathogen followed by chlorothalonil. Whereas bitertanol was least effective (Shantamma and Mantur, 2014).

Black spot disease in papaya is most lethal. Both leaves and fruits of papaya can be affected by *Asperisporium caricae*. Management of this disease is economically important. Fungicides *viz.*, Difenoconazole, Chlorothalonil, Propiconazole and Hexaconazole were very effective in managing this disease. Moreover, this report opens up for further research on black spot of papaya and its management.

References

Adikaram, N. K. D. and Wijepala, M., 1995, *Asperisporium* black spot in *Caricae papaya*: A new disease in Srilanka. *J. Nat. Sci. Council*, 23(4): 213-219

Badillo, V. M., 1971, Monografia de la familie Caricaceae. Associacion de Profesores, *Universidad Central de Venezuela*, 221pp.

Cumagun, C. J. R., Padilla, C. L., 2007, First record of *Asperiosporium caricae* causing black spot of papaya in the Philippines. *Australasian Pl. Dis. Notes*, 2:89-90.

Dianese, A. C., Blum, L. E. B, Datura, J. J., Lopes, L. F. Sneha, M. C. and Fretias, L. F., 2008, Evaluation of phoshites in reducing smallpox (*Asperisporium caricae) papaya* (*Carica papaya*). *J. Tropi. Fruits*, 30: 3.

Ellis, M. B, Holliday, P., 1972, *Asperisporium caricae*, *CMI Descriptions of Pathogenic Fungi and Bacteria*, 347: 1–2.

Kobayashi, Chiharu nakashima and Takuya nishijima, 2002, Addition and re-examination of Japanese species belonging to the genus Cercospora and allied genera. V. collections from the Nansei Islands (2). *Mycoscience*, 43: 219-227.

Konastanze. S., and Braun, U. 2005. Taxonomic revision of the genus *Cladosporium* species reallocated to *Asperisporium, Dischloridium, Fusicladium, Passalora, Pseudo-asperisporium* and *Stenella. Fungal Diversity*, 20: 187-208.

Livia, 2011. Evaluation of fungicides to control *Asperisporium caricae* papaya crop. *J. Tropi. fruits*. V. 341

Maji, M. D., 2004. A leaf spot disease of *Pongamia pinnata*, *Indian Phytopath*., 57(2): 249.

Maublanc, A., 1913, Disease of the leaves of papaya (*Carica papaya*). *Societ Mycologique de France*, 29 (1): 353-358.

Minnis, A. M., Kennedy, A. H., Grenier, D. B., Rehner, S. A., Bischoff, J. F., 2011, *Asperisporium* and *Pantospora* (*Mycosphaerellaceae*) epitypifications and phylogenetic placement. *Persoonia*, pp.18-27.

Peterson, R. A., Coates, L. M., Persley, D.M., 1993, *Diseases of fruit crops*. pp, 70-76. Department of Primary Industries: Brisbane.

Shantamma and Mantur, S. G., 2014, *Mysore journal of Agricultural Sciences*. Vol. 48, pp. 56-60.

Shantamma, 2012, Studies on Black spot of papaya, Thesis

Shantamma, S. G. Mantur, K. T. Rangaswamy, Bheemanagouda. Patil and Shivakumar Chinchure, 2014, Survey for black spot of papaya in selected districts of Southern Karnataka. *Eco. Env. & Cons.* pp. (373-376).

Steven, J., 2010, Leyland cypress diseases. *NC Cooperative Extension*.

Stevens, H. E., 1939, Papaya diseases. In: *Proc of the Florida State Horti. Soci.*, 52: 57–63.

Ullasa, B. A. and Rao, V. G., (1973) Occurrence of *Asperisporium* leaf spot of papaya in India. *Arq. Inst. Biol. Sci. Paulo*, 40: 153

Vawdrey, L. L., Grice, K.R.E. and Westerhuis, D., 2008, Field and laboratory evaluation of fungicides for the control of brown spot (*Corynespora cassaiicola*) and black spot (*Asperisporium caricae*) of papaya in north Quensland, Australia. *Australian Pl. Pathol*, 37:552-558.

Ventura, J. A., 2008, Management of diseases of papaya, In: *The papaya*, pp, 231-310.

Villegas, V. N., 1997, Edible fruits and nuts - *Carica papaya* L. In *EWM Verheij*, RE Coronel, eds, Volume 2. Wageningen University, Netherlands, 12pp.

Waller, J. M, 1992, *Colletotrichum* diseases of perennial and other cash crops. In: *Colletotrichum: Biology, Pathology and Control*, pp, 167-185.

Watson, B., 1997. Agronomy/ agroclimatology notes for the production of papaya. *MAFFA, Australia*, 6: 45-47.

Wolcan, S., Rollan, C. and Ronco, L., 2006, Leaf spot of cultivated and wild *Alstroemeria* spp. caused by *Asperisporium alstroemeriae*. *Australasian Pl. Disease Notes*, 1:33-35.

How to cite this article:

Shantamma, S.G. Mantur, S.C. Chandrashekar, K.T. Rangaswamy and Bheemanagouda Patil. 2018. Status of Black Spot of Papaya (*Asperisporium caricae*): A New Emerging Disease. *Int.J.Curr.Microbiol.App.Sci.* 7(11): 309-314. doi: https://doi.org/10.20546/ijcmas.2018.711.038