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The genera *Colletotrichum*: an incitant of numerous new plant diseases in India

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ABSTRACT

Colletotrichum is one of the most common and unusual plant pathogenic fungal genera causing variety of diseases. The genus is primerily responsible for an significant disease; anthracnose inhabiting a wide range of host's worldwide. The objective of this paper is to review various diseases caused by *Colletotrichum* in India with special reference to plant diseases reported in present century (i.e. 2000-2012). About 25 plant diseases caused by different species of *Colletotrichum* namely, *C. gloeosporioides*, *C. capsici*, *C. falcatum*, *C. truncatum*, *C. sansevieriae*, *C. acutatum* and *C. coccodes* were reported in present century, in which *C. gloeosporioides* found more prevalent antracnose pathogen. The study showed that even a single species of *Colletotrichum* can affect multiple hosts. Therefore, the present compilation in my openion will not only provide useful information about new plant diseases caused by *Colletotrichum*, but also be helful for mycologists and plant pathologists in phytopathological research and will initiate new questions for future study.

Key Words: *Colletotrichum*, new plant diseases, 21st century, India.

INTRODUCTION

Fungi include number of plant pathogens of major importance, causing diseases on wide variety of woody and herbaceous plants and *Colletotrichum* is one of the most common and unusual plant pathogenic genera. It is disturbuted primarily to tropical and subtropical regions, causes anthracnose of a wide range of host's worldwide (Sutton 1992; Hyde et al. 2009). The symptoms of anthracnose invasion are sunken necrotic lesions on leaves, stems, flowers and fruit, as well as crown and stem rots, seedling blight etc. (Waller et al. 2002; Agrios 2005). All members of the genus cause major economic losses, especially to fruits, vegetables, and ornamentals.

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The genus is cosmopolitan in distribution and primary inoculum is disseminated by wind or rain, virtually every crop grown throughout the world is susceptible to one or more species of *Colletotrichum*. Species of *Colletotrichum* use diverse strategies for invading host tissue, ranging from intracellular hemibiotrophy to subcuticular intramural necrotrophy. In addition, these pathogens develop a series of specific infection structures, including germ tube, appressoria, intracellular hyphae, and secondary necrotrophic hyphae. However, *Colletotrichum* species are economicaly important, the fungi are highly significant for experimental studies of fungal development, infection processes, host resistance, signal transduction, and the molecular biology of plant pathogen interactions. The objective of this paper is to review various diseases caused by *Colletotrichum* in India with special reference to plant diseases reported during the year 2000 - 2012.

LITERATURE CITED FOR THE COLLECTION OF DISEASE REPORTS

In this paper about 18 scientific journals of plant pathology of different publishers were consulted. Indian phytopathology, journal of mycology and plant pathology, journal of mycopathological research, phytopathology, archives of phytopathology and plant protection, Australasian plant disease notes, international journal of plant protection, journal of general plant pathology, journal of plant disease sciences, journal of plant pathology, journal of plant pathology and microbiology, journal of plant protection research, journal of research in biology, mycologia balcanica, new disease reports, plant disease, plant disease research, indian journal of sericulture and plant health progress and references of published papers were also included. The research papers were examined and the detail of the disease including disease, affected host, causing pathogen and diseases symptoms extracted. To the best of our knowledge, we refered the available literature by consulting libraries as well as searching the data base with the help of keywords related to the present paper.

GENERAL CHARACTERISTICS OF THE PATHOGEN

Colletotrichum, as an asexual fungal genus, was included in morphological classifications of the *Ascomycota* as its sexual genus *Glomerella* (Cannon et al. 2012). Primary symptoms of pathogen appear as sunken, water-soaked lesions that expand rapidly on the infected plant surface first. Fully expanded lesions are soft, sunken and range in colour from dark red to tan to black, generally described as anthracnose disease. Cup-shaped fruiting bodies named acervuli whose fertile hyphae form a palisade on the surface of the conidiomata can be observed on diseased plant surface.

There are great variations in size and shape of conidia among different *Colletotrichum* spp. Conidia may be oblong with obtuse ends, and are generally broader (*C. gloeosporioides*), elliptic to fusiform (*C. acutatum)*, falcate, fusiform, and gradually tapered to each end (*C. dematium*), long, relatively narrow, and straight to slightly curved with abruptly tapered and obtuse ends, complex appressoria (*C. destructivum*), conidia with one end rounded and the other pointed (*C. fragariae*). This variation was also noticed in other *Colletotrichum* species (Hyde et al. 2009).

STATUS OF *COLLETOTRICHUM* REPORTED DURING 21ST CENTURY IN INDIA

Colletotrichum is one of the most important plant pathogens worldwide causing anthracnose diseases in a wide range of hosts. The different species of pathogen are reported from a vayiety of plant host including cereals and grasses, legumes, vegetables, perennial crops and tree fruits in India**.**

Colletotrichum gloeosporioides (Penz.) Penz. & Sacc.

Teleomorph: *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk.

The species is one of the most reported plant pathogen among *Colletotrichum* species in India. It is known to infect a variety of hosts with characteristic symptoms. There is a great variation in the symptoms produced by *C. gloeosporioides* on host plants. The symtoms may be regular to irregular, round to oval, watersoaked, and sunken spots. Similarly, the fungal characteristic on culture media also varies with the host. The growing fungal colonies on cultur media may be circular, wooly or cottony with characteristic colour. Vegetative hyphae observed were hyaline, simple, septate and branched. Conidiophores were long, hyaline, septate and unbranched. Conidia are straight, oblong or cylindrical with rounded or bulbous ends, hyaline, aseptate, one celled and dumbbell shaped. Setae are brown.

Detailed information on plant diseases caused by *Colletotrichum gloeosporioides* in India during current century is discussed below:

Leaf spot disease of turmeric, Indian Phytopathology 58(1):125 (2005)

Host: *Curcuma longa* (Turmeric)
Pathogen: *Colletotrichum gloeosporioides*
Notes: The leaf spot disease of turmeric (*Curcuma longa*) in South Gujarat, India was recorded for the first time. Dark brown, round to circular spots surrounded by yellow halo on leaves were observed and *Colletotrichum gloeosporioides* [*Glomerella cingulata*] was found disease causing pathogen. Spots were also observed on leaf petioles as diseases progressed.

Anthracnose disease in muga food plant, som (*Persea bombycina* Kost) in Assam. Indian Journal of Sericulture. 44 (1):134-135(2005); Journal of Mycology and Plant Pathology 38(3):322-324 (2008).

Host: *Persea bombycina* Kost
Pathogen: *Colletotrichum gloeosporioides*
Notes: Severe symptoms of anthracnose disease was observed on the leaves of *P. bombycina* in Jorhat, Assam, India which includes ash-coloured leaves, round to oval spots irregularly spreading to the entire leaf, brownish anthracnose lesions or streaks and premature leaf fall. Morphological examination and pathogenicity tests identified the causal organism as *Colletotrichum gloeosporioides* [*Glomerella cingulata*]. This is the first report of *C. gloeosporioides*causing anthracnose in *P. bombycina* in Assam. Lateron The leaf spot disease was observed on clones of *Persea bombycina* and a significant and positive co-relation was recorded between disease intensity and temperature.

Leaf spot disease of *Murraya koenigii*, Indian Phytopathology 53(4):495-497 (2000)

Host: *Murraya koenigii*
Pathogen: *Colletotrichum gloeosporioides*
Notes: The infection of *Colletotrichum* sp. was noticed on leaves of *Murraya koenigii* from parts of the wet zone of south India and Sri Lanka and causal agent was identified as *Colletotrichum gloeosporioides* [*Glomerella cingulata*].

Anthracnose disease of *Aloe vera*, Journal of Research in Biology 6: 408-410 (2011).

Host: *Aloe vera*
Pathogen: *Colletotrichum gloeosporioides* Penz. & Sacc.
Notes: Anthracnose symptoms caused by *Colletotrichum gloeosporioides* on *Aloe vera* leaves *were* reported from Gwalior. Disease appeared as round to oval, water-soaked dark green areas turned circular spots with tan to light brown, centre bordered by water soaked tissue. Centre of the lesion becomes reddish brown to brown color as the spots expand and loss of mucilaginous gel and death of infected leaves was also obsertved.

Anthracnose in bell pepper seed crop, Journal of Plant Disease Science 4: 126-127 (2009).

Host: *Capsicum* sp.
Pathogen: *Colletotrichum gloeosporioides Glomerella cingulata*]
Notes: Anthracnose symptoms included small or large lesions appeared on leaves and fruits of bell pepper. Stems and petioles may be girdled, and necrosis of inflorescences causes dieback and shrivelling.

***Colletotrichum gloeosporioides* on *Jasminum Grandiflorum*,** Journal of Plant Protection Research, 52(1):91-92 (2012).

Host: *Jasminum grandiflorum*
Pathogen: *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc.
Notes: Anthracnose disease symptoms as dark red mostly irregular shaped lesions were observed on leaves of *Jasminum grandiflorum*. Acervuli containing masses of spores and dark setae were observed within lesions. This is the first report from India and elsewhere showing that *C. gloeosporioides* causes anthracnose on *J. grandiflorum*.

Colletotrichum gloeosporioides* on *Pedilanthus tithymaloides, Journal on New Biological Reports 1(1): 03-05(2012).

Host: *Pedilanthus tithymaloides*
Pathogen: *Colletotrichum gloeosporioides*
Notes: The symptoms on *Pedilanthus tithymaloides* on the leaves initially appeared as a small brown-red, circular spots gradually enlarge with the central part being light brown and dark brown to black margin. The disease started in June-July, extend with the rainy season and lasts up to the end of winter season.

Anthracnose on noni, Archives of Phytopathology and Plant Protection 45(3): 276-279 (2012).
Host: *Morinda citrifolia* L. (Noni)
Pathogen: *Colletotrichum gloeosporioides*
Notes: The severe Anthracnose disease was observed on Noni in 2008–2009 in southern India. Based on their pathogenicity, morphological and cultural characters and ribosomal DNA spacersequences, the pathogen was identified as *Colletotrichum gloeosporioides*.

Anthracnose on *Pisonia alba*, Archives of Phytopathology and Plant Protection 46(2): 201-204 (2012).

Host: *Pisonia alba*
Pathogen: *Colletotrichum gloeosporioides*
Notes: Anthracnose on *Pisonia alba* plants was observed as irregular, black, necrotic spots that often coalesce to form large necrotic area on leaves. The first report of athracnose of *Pisonia alba* a fungus, consistently isolated from symptomatic leaves was identified as *C. gloeosporioides* on the basis of morphological and cultural characteristics.

Anthracnose on *Boehravia diffusa*, Archives of Phytopathology and Plant Protection 45(20): 2502-2506.

Host: *Boehravia diffusa*
Pathogen: *Colletotrichum gloeosporioides*
Notes: Leaf spot symptoms were observed on the leaves of *Boehravia diffusa* L. plants from different regions of Bilaspur, Himachal Pradesh, India. The symptoms initially appeared as a small light-pale coloured, circular spots enlarge gradually and ultimately leading to drying of the leaves. This is the first report of athracnose of *Boehravia diffusa* in India.

Anthracnose of mango, International journal of Science and Nature 3(2): 220-232 (2012).

Host: *Mangifera Indica* **(**Mango)
Pathogen: *Colletotrichum gloeosporioides*
Notes: The infection caused by *Colletotrichum gloeosporioides* on stem, leaves and young inflorescences is observed as sub circular or angular black lesions which enlarge and coalesce, frequently destroying leaf edges or entire inflorescences. Lesions develop primarily on young tissue and conidia are formed and can be observed in lesions of all ages. In older leaves lesions do not develop but latent infections are formed and the fungus remains dormant until the tissue ages. Infection on fruits occurred at relative humidity above 95% for 12 hrs.

Anthracnose of mango and genetic characterization of pathogen, India Journal Agriculture Science 1, 511-521 (1939); ICFAI J Biotechnology 2, 15-27 (2007); Journal of Biotechnology 9(26): 4009-4013 (2010).

Host: *Mangifera indica*
Pathogen: *Colletotrichum gloeosporioides* Penz.
Notes: Studies on anthracnose of mango caused by *Glomerella cingulata* (Stonem.) Spauld. Sch. (*Colletotrichum gloeosporioides* Penz.). was reported during 1939. Recently, about 25 isolates of C. *gloeosporioides* collected from different agroclimatic zones of India were evaluated for their pathogenic variability on mango seedlings (Desheri) and genetic characterization using random amplified polymorphic DNA (RAPD molecular techniques). All the isolates showed pathogenicity of a variable range.

Morphological and molecular characterization of *Colletotrichum* species causing anthracnose disease, Journal of Mycology and Plant Pathology 40: 322–330 (2010).

Host: Vegetable crops
Pathogen: *Colletotrichum* sp.
Notes: Twenty one isolates of *Colletotrichum* species isolated from infected plants of vegetable crops, spice and fruits grown in South Andaman, Middle and North Andaman districts of Andaman and Nicobar Islands, were characterized as *C. gloeosporioides* and *Colletotrichum* spp. based mainly on the morphology of conidia, appressoria and sequence analysis of internal transcribed spacer (ITS) region of the ribosomal DNA (ITS1-5.8S-ITS2).

Leaf spot disease of Kokum (*Garcinia indica*), Journal of Plant Disease Science 3(2):193-196 (2008).

Host: *Garcinia indica* (Kokum)
Pathogen: *Colletotrichum gloeosporioides* Penz
Notes: Antracnose disease of *Garcinia indica* (Kokum) seedlings were found infected by *Colletotrichum gloeosporioides* Penz. The management of leaf spot disease was also practiced and nine synthetic fungicides, five bioagents and seven plant extracts were found significantly superior over control.

Colletotrichum gloeosporioides* on *Zea mays, Indian Journal of Agriculture Science 6: 833-843 (1936).

Host: *Zea mays*
Pathogen: *Colletotrichum gloeosporioides* (Ces.) Wilson
Notes: A diseases on *Zea mays* caused by *C. gloeosporioides* (Ces.) Wilson was reported.

Grape anthracnose, Plant Disease Research 9: 222-224 (1994).
Host: *Vitis vinifera* (grape)
Pathogen: *Gloeosporium ampelophagum*, *Colletotrichum gloeosporioides*

Notes: Occurrence of *Gloeosporium ampelophagum* and *Colletotrichum gloeosporioides*, which are believed to be the essential causative agent of grape anthracnose during different months were reported in Punjab.

Flower and fruit drop of papaya, Journal of Mycology and Plant Pathology 34:164.

Host*: Carica papaya* (papaya)
Pathogen: *C. gloeosporioides* (Penz.) Sacc.
Notes: Flower and fruit drop of *Carica papaya* (papaya) was reported to be caused by *C. gloeosporioides* (Penz.) Sacc.

Anthracnose of Indian mulberry (*Morinda citrifolia* L.), Japanese Journal of Phytopathology, 75*,* 35–37 (2009); Phytoparasitica. 40(5): 485-491.

Host: mulberry (*Morinda citrifolia* L.)
Pathogen: *C. gloeosporioides*
Notes: Anthracnose of Indian mulberry (*Morinda citrifolia* L.) caused by *C. Gloeosporioides* was reported by Taba et al. 2009 and Kumar et al. 2012 in India.

Colletotrichum capsici (Syd.) E.J. Butler & Bisby, (1931)

Synonyms
Steirochaete capsici (Syd.) Sacc., (1921)
Vermicularia capsici Syd., (1913)

Colletotrichum capsici is another plant pathogic species of *Colletotrichum* reported to cause anthracnose disease in India. The fungal pathogen has been reported to cause anthracnose on chilli, grapes, musli, bell pepper, biteer guard, tuberose, french basil, peppers, tomatoes and a wide range of other plant hosts. The fungus appeared as grey coloured which became reddish brown due to copious sporulation after 5-7 days on growth medium. Acervuli are numerous, globose to saucer shape with large number of dark brown setae. Conidiophores are short, simple and hyaline. Conidia are aseptate, fusiform, sickle shape and single celled. Small circular- irregular reddish-brown/black lesions are produced by the fungus on the infected plant parts.

Fruit Rot of Chilli, Annals of Plant Protection Sciences, 17(2): 398-401 (2009)

Host: *Capsicum* sp.
Pathogen: *Colletotrichum capsici*
Notes: The symptoms of Chilli fruit rot, associated fungal pathogen and screening of partially purified plant products against *Colletotrichum capsici* both *in vitro* and *in vivo* were evakuated. Effect of plant products on maximum mycelial growth and spore germination of *C. capsici* was studied and three successive sprays of bitter temru fruit, datura leaves and Emcop-L. fungicides found effective in contiolling chilli fruit rot.

Leaf blight of *Chlorophytum borivilianum*, New Disease Reports 11: 36 (2005); Plant Pathology 55: 301 (2006).

Host: *Chlorophytum borivilianum*
Pathogen: *Colletotrichum capsici*
Notes: A severe leaf blight diaease of *Chlorophytum borivilianum* (Safed musli) was noticed in northern India. Minute, pin-head, circular, reddish-brown lesions were noticed along the midrib, veins and margins on the leaves, as longitudinal streaks. Premature leaf drying, and plants failure to produce healthy fingers (tubers) was also observed. The disease occurred in August and September, after the onset of the rainy season, and caused 30% losses in severely affected fields. Microscopic and morphological characteristics revealed *Colletotrichum capsici* as pathogen responsible for disease.

***Colletotrichum capsici* on bell pepper,** *Seed Research*, 1:656-659 (1990); Plant Disease 81: 693 (1997).

Host: *Capsicum annuum*
Pathogen: *Colletotrichum capsici*
Notes: The disease antracnose caused by *Colletotrichum capsici* on *Capsicum annuum* was recorded and different practices for disease control were also evaluated.

Leaf blight of French basil, Journal of Mycology and Plant Pathology 10: 99 (1981).

Host: French basil
Pathogen: *Colletotrichum capsici*
Notes: Necrotic lesions from French basil plant showing leaf blight symptoms were isolated on potato dextrose media (PDA) and fungus was identified *Colletotrichum capsici.* White to grey mycelial growth was observed on culture media which became reddish brown due to copious

sporulation after 5-7 days. Acervuli were numerous, globose to saucer shape with large number of dark brown setae 96-124 µm long. Conidiophores were short, simple and hyaline. Conidia were aseptate, fusiform, sickle shape and single celled with 10-21 (14) x 3-5 (4) µm size.

Blight of bitter guard, Indian Phytopathology 56(4): 503-504 (2003).

Host: *Momordica charantia* (bitter guard)
Pathogen: *Colletotrichum capsici*
Notes: Circular or irregular lesions from the margin or top of the leaves, small irregular pale yellow lesions on fruits and black necrotic lesions on the petioles of bitter gourd (*Momordica charantia*)were observed from Ranchi, Bihar during 1998-99 and 1999-2000. The *Colletotrichum capsici* was identified the causal organism after regular analysis of the disease and pathogen.

Blight of tuberose, Indian Phytopathology 59: 128-129 (2006).

Host: *Polianthes tuberosa* (Tuberose)
Pathogen: *Colletotrichum capsisi*
Notes: A new disease of tuberose (*Polianthes tuberosa*) was observed in New Delhi, India during the year 2003. The symptoms and pathogenicity showed that the causal agent is *Colletotrichum capsici*.

Anthracnose on grapes, New Disease Reports 25: 2 (2012).

Host: *Vitis vinifera*
Pathogen: *Colletotrichum capsici*
Notes: *Colletotrichum capsici,* the pathogen responsible for anthracnose on grapes was isolated with a frequency of 3.8% from commercial vineyards. The small dark brown spots were observed on the leaves and petioles. Then fungus was identified by using a *C. capsici* species-specific primer pair, CcINT and ITS4 along with morphological characters.

Colletotrichum falcatum Went, (1893)

Synonyms
Glomerella tucumanensis (Speg.) Arx & E. Müll., (1954)
Colletotrichum metake Sacc. (1908)
Physalospora tucumanensis Speg. (1896)

Colletotrichum falcatum is the causative agent of red rot and red streak of *Saccharum* (sugarcane). The fungus is anamorphic *Glomerella tucumanensis*. The red rot disease causes a substantial yield and quality loss of sugar cane and sugar by infecting mature stalks of sugarcane, leaf mid ribs and causing rot of planting material.

Pathotype of *Colletotrichum* on sugarcane, World Journal of Microbiology and Biotechnology 21 (6-7): 1135-1140.

Host: *Saccharum officinarum*
Pathogen: *Colletotrichum falcatum*
Notes: Genetic relationships between six pathotypes of *Colletotrichum falcatum*, prevalent in subtropical India were examined by using RAPD markers. A high degree of polymorphism (78.6%) was observed and more than 50% genetic divergence was found among the pathotype. UPGMA cluster analysis of genetic similarity indices grouped the six pathotypes into two clusters. Two pathotypes were observed in cluster I and four in cluster II.

***Colletotrichum falcatum* causing red rot of sugarcane,** Archives of Phytopathology and Plant Protection 45 (7): 823-830 (2012).

Host: sugarcane
Pathogen: *Colletotrichum falcatum*
Notes: *Colletotrichum falcatum,* one of the most destructive pathogen causing red rot disease of sugarcane (*Saccharum officinarum* L.) worldwide. The immunological method for detection of *C. falcatum* was tried to develop in this study.

Colletotrichum acutatum J.H. Simmonds (1968)

Synonyms
Colletotrichum acutatum J.H. Simmonds (1965)
Glomerella acutata Guerber & J.C. Correll, (2001)

The fungus is heterogeneous in nature and widely known as a fruit rot pathogen. On the basis of symptoms and morphological features, the fungus is difficult to distinguinsh from *C. gloeosporioides* as both exhibit extensive cultural variability and has overlapping host ranges.

Anthracnose disease of *Geranium* sp., Journal of Mycology and Plant Pathology 32(1):31-34 (2002).

Host: *Pelargonium graveolens* cv. Bourbon (Geranium)
Pathogen: *Colletotrichum acutatum*
Notes: A severe anthracnose disease of geranium (*Pelargonium graveolens* cv. Bourbon) was observed in northern India. The average disease incidence was recorded in plian areas of Pantnagar, the tarai region of Uttar Pradesh and it was reported 35.09% during the first week of July that spread rapidly and become 93.75% by the end of first week of August while 99.07% by the end of first week of August.

Blight of *Piper Betle*, Journbal of Plant Diseae Science 247- 248 (2010).

Host: ***Piper Betle***
Pathogen: *Colletotrichum* sp.
Notes: The association of a *Colletotrichum* sp. with blight disease of *Piper betle* was reported during a survey in India.

PCR-based detection of *Colletotrichum acutatum* on strawberry, Plant science 45(4): 650-655 (1996).

Host: *Fragaria ananassa* (Strawberry)
Pathogen: *Colletotrichum acutatum*
Notes: This work was carried out with primers CaInt2 and ITS4 for the accurate identification of *Colletotrichum acutatum* on *Fragaria ananassa* (Strawberry).

***Colletotrichum cutatum* from rubber plant.** Mycological Research, 106(2):215-221 (2002).

Host: *Hevea* sp.
Pathogen: *Colletotrichum acutatum*
Notes: *Colletotrichum* leaf disease of *Hevea* sp. was observed with three different disease symptoms: raised spots, anthracnose and papery lesions. Morphological and microscopic characterization attributed to *Colletotrichum gloeosporioides* (teleomorph *Glomerella cingulata*) as pathogen but RAPD analysis of *Colletotrichum* isolates indicated that the association of two species of *Colletotrichum* spp. initating the development of three different symptoms: *C. acutatum* causing raised spot symptoms, and *C. gloeosporioides* causing both anthracnose and papery lesions. This was the first record of *Colletotrichum acutatum* on *Hevea* sp. in India.

The other *Colletotrichum* species reported to casue plant dieases in current cuntery in India sunnerised.

Anthracnose disease of grapes, The Asian and Australian Journal of Plant Sciences and Biotechnology 3: 71-77 (2009).

Host: *Vitis vinifera*
Pathogen: *Colletotrichum* sp.
Notes: *Colletotrichum* spp. causing anthracnose disease of grapes were characterized using morphological criteria, species-specific PCR and ITS sequencing. *C. gloeosporioides* (93.33%) was established as the dominant pathogen as compared to *C. acutatum* (6.66%). This was the first report of occurrence of *C. acutatum* and existence of diverse molecular groups among *C. gloeosporioides* and *C. acutatum* population associated with grape anthracnose in India.

Colletotrichum coccodes (Wallr.) S. Hughes, (1958)

Synonyms
Colletotrichum antirrhini F.C. Stewart, (1900)
Colletotrichum atramentarium (Berk. & Broome) Taubenh., (1916)
Colletotrichum kruegerianum Vassiljevsky, (1950)
Colletotrichum melongenae Lobik, (1928)
Colletotrichum opuntiae (Ellis & Everh.) Sawada, (1959)

Colletotrichum coccodes is a plant pathogen usually causes anthracnose on tomato and black dot disease of several plant hosts.

Anthracnose of chilli, Plant disease 95(12): 1584 (2011)

Host: *Capsicum annuum* L.
Pathogen: *Colletotrichum coccodes*
Notes: Chili growing areas of Himachal Pradesh were surveyed for the prevalence of fruit rot/anthracnose caused by a complex of *Colletotrichum* species. Disease incidence ranged from 12.5% to 45.0% based on total plants sampled in the field. Symptoms of disease in the field included light brown, sunken lesions containing salmon-colored masses of conidia and microsclerotia on the fruit.

Anthracnose of Indian mulberry, Phytoparasitica 40(5): 485-491(2012).

Host: *Morinda citrifolia*
Pathogen: *Colletotrichum* spp.
Notes: Eleven *Colletotrichum* isolates were obtained from infected mulberry leaves from six sites in the south Andaman district of Andaman and Nicobar Island, India. The symptoms appeared as leaf spots with dark brown to tan centers and diffuse with irregular margins and rapidly expanding.

Fruit rots of brinjal, Plant Disease Research 26 (2): 161 (2011)

Host: *Solanum melongena* L (brinjal)
Pathogen: *Colletotrichum* and *Fusarium* spp.
Notes: The occurrence of *Colletotrichum* sp. was reported along with *Fusarium* sp. to cause fruit rots of brinjal in Himachal Pradesh.

Colletotrichum truncatum (Schwein.) Andrus & W.D. Moore

Synonyms
Colletotrichum dematium f. *truncatum* (Schwein.) Arx [as 'truncata'], (1957)
Vermicularia truncata Schwein.

Colletotrichum truncatum, an important plant pathogen reported to cause a variety of plant diseases. In present century it is reported to cause,

New seedlings rot disease of clusterbean. Journal of Arid Legumes 2 (2): 414. (2005).

Host: Clusterbean
Pathogen: *Colletotrichum truncatum*
Notes: Rot symptoms were appeared as small, semi-circular to irregularly shaped, sunken, cankerous lesions in 10-day-old seedlings of clusterbean in the Pali-Marwar region of Rajasthan, India. About 58% of the seedlings were found affected with the disease. The average severity of the disease was calculated as 38% on the basis of percent leaf area affected. The pathogen was identified as *Colletotrichum truncatum* and this was new host record for *C. truncatum* in India.

Colletotrichum dematium (Pers.) Grove

Synonyms
Colletotrichum bakeri (Syd. & P. Syd.) Mundk., (1938)
Colletotrichum lysimachiae Duke, (1928)
Colletotrichum pucciniophilum Togashi, (1936)
Colletotrichum dematium is another antracnose causing a plant pathogen. It was reported on *Azadirachta indica* and *Calotropis procera* as causative agent of antracnose disease.

Leaf blight of *Azadirachta indica*, African Journal of Agriculture Research 2(10): 538-543 (2007).

Host: *Azadirachta indica*
Pathogen: *Colletotrichum dematium*
Notes: *Colletotrichum dematium* was reported as new leaf blight pathogen causing moderate to severe foliar disease in *Azadirachta indica. Fusarium solani* was also reported on *A. indica* to cause same disease. After comparing the virulence, *F. solani* was highly virulent against seedlings of *A. indica* compared to *C. dematium*. Disease (*in vitro)* management with seven fungicides was also assessed.

Leaf spot disease of *Calotropis procera* caused by *Colletotrichum dematium,* Indian Forester 119(8): 672-673 (1993).

Host: *Calotropis procera*
Pathogen: *Colletotrichum dematium*
Notes: Severe fungal infection was observed on leaves of *Calotropis procera* in forests and forest nurseries of Madhya Pradesh. Symptoms of disease and causative organism are briefly described and *Colletotrichum dematium* was identified as causative pathogen. The disease was aggravated by humid conditions. This is the first report of the disease in Madhya Pradesh, India.

Colletotrichum sansevieriae Nakamura

Colletotrichum sansevieriae is a host specific species of *Colletotrichum* isolated mostly form family Agavaceae. It was reported form *Sansevieria trifasciata* arrond the world including India.

Table 1 *Colletotrichum* species infecting different plants hosts in India

Plant infected	*Colletotrichum* species	References
Vitis vinifera	*C. capsici*	Sawant et al. (2012)
Saccharum officinarum	*C. falcatum*	Bukhari et al. (2012)
Chlorophytum borivilianum	*C. capsici*	Sattar et al. (2005); Sattar et al. (2006)
Capsicum sp.	*C. capsici*	Paul and Behl (1990)
Boehravia diffusa	*C. gloeosporioides*	Gautam et al. (2012)
Persea bombycina	*C. gloeosporioides*	Handique et al. (2008)
Clusterbean	*C. truncatum*	Kumar and Henry (2005)
Azadirachta indica	*C. truncatum*	Bhanumathi and Rai (2007)
French basil	*C. capsici*	Alam et al. (1981)
Sansevieria trifasciata	*C. sansevieriae*	Gautam et al. (2012)
Solanum melongena	*Colletotrichum* sp. and *Fusarium* sp.	Kumar (2011)
Pisonia alba	*C. gloeosporioides*	Vidyalakshmi and Divyaa (2013)
Murraya koenigii	*C. gloeosporioides*	Basnayake et al. (2000)
Momordica charantia	*Colletotrichum* sp.	Ekka and Dubey (2003)
Curcuma longa	*C. gloeosporioides*	Patel et al. (2005)
Carica papaya	*C. gloeosporioides*	Bag (2004)
Aloe vera	*C. gloeosporioides*	Avasthi et al. (2011)
Capsicum sp. (Bell pepper)	*C. gloeosporioides*	Gupta et al. (2009)
Morinda citrifolia	*C. gloeosporioides*	Hubballi et al. (2012)
Geranium sp.	*C. acutatum*	Sattar et al. (2002)
Tuberose	*C. capsici*	Dubey et al. (2006)
Capsicum sp. (Chilli)	*C. coccodes*	Roat et al. (2009); Sharma et al. (2011)
Pedilanthus tithymaloides	*C. gloeosporioides*	Gautam et al. (2012)
Persea bombycina	*C. gloeosporioides*	Das et al. (2005)

***Colletotrichum sansevieriae* on *Sansevieria trifasciata*,** Plant Pathology & Quarantine 2(2): 190–192 (2012).

Host: *Sansevieria trifasciata*
Pathogen: *Colletotrichum sansevieriae*
Notes: An infection was noticed on leaves of *Sansevieria trifasciata* in 2011 at Jiwaji University Campus, Madhya Pradesh, India. Morphological, cultural and microscopic characteristics resulted in identification of the causal agent as *Colletotrichum sansevieriae.* This is the first report of *C. sansevieriae* on *S. trifasciata* from Madhya Pradesh, India. The infection started from the tip and engulfed the whole leaf. Both young and mature leaves were found affected. Complete drying of diseased leaves was observed as the disease progressed.

The observations persented here are mainly highlight new disease events of the current century in India, but the pathogen *Colletotrichum* has been reported very earlier. *Colletotrichum gloeosporioides* was detected on *Zea mays* in the year 1936 (Choudhuary 1936). A new disease of coriander caused by *Colletotrichum* sp. causing citrus die-back in India was reported by Sehgal et al. (1965). Similarly, Chandra and Tandon (1965) also reported the *Colletotrichum chlorophylumi* as leaf spot fungi in the same year. Leaf blight disease of french basil caused by *Colletotrichum capsici* was reported by Alam et al. (1981). Histopathology of *Colletotrichum dematium* infected chilli seeds were carried out by Chitkara et al. (1990). Grapes antracnose (Kumar et al. 1994) and *Colletotrichum capsici* on bell pepper (Roy et al. 1997) are some more reported incidences of *Colletotrichum* during the end of last century.
During current century about 25 *Colletotrichum* diseases were reported in India. Different species of *Colletotrichum* namely *C. gloeosporioides*, *C. capsici*, *C. falcatum*, *C. truncatum*, *C. sansevieriae*, *C. acutatum* and *C. coccodes* were reported to be prevalent in present century.The study showed that even a single species of *Colletotrichum* can affect multiple hosts like *C. gloeosporioides* on *Boehravia diffusa, Persea bombycina*, *Pisonia alba*, *Murraya koenigii*, turmeric, papaya, *Aloe vera,* bell pepper, noni, *Pedilanthus tithymaloides*, *Persea bombycina*.

Fig. 1. Symptoms of *Colletotrichum* spp. causing anthracnose disease on A. *Adhatoda vasica* **B.** *Pedilanthus tithymaloides* **C.** *Aloe vera* **D.** *Achyranthes aspera* **E.** *Vitis vinifera* **F.** *Diospyros kaki* **G.** *Capsucum annum*, **H.** *Musa* sp. **I.** *Sansevieria trifasciata* **J.** *Zinnia* sp. **K.** *Capsucum* sp. **L.** *Boehravia diffusa* **M.** banana fruits.

Likewise, *C. capsici* on grapes, *Chlorophytum borivilianum*, french basil, tuberose and *C. truncatum* on *Azadirachta indica* and clusterbean. *Colletotrichum falcatum* is however, host specific on sugar cane (*Saccharum officinale*) and *C. sansevieriae* on Agave family (Fig. 1). The different *Colletotrichum* species infecting different plants hosts in India are listed in Table 1. The host range of *Colletotrichum* species is therefore an important area to explore in future research

Colletotrichum was also studied for other aspects like, taxonomy (Wijesekara and Agarwal, 2006); as endophytic fungi (Bhagya et al. 2011); and as biopesticide (Zou *et al.*, 2000; Gangadevi and Muthumary 2008). The *C. gloeosporioides*, among all species of the genera was reported most frequently but the morphological and microscopic characters alone are not sufficient for accurate characterization. Recently Hyde et al. (2009) addressed *Colletotrichum*: a catalogue of confusion. Therefore, molecular identification is also practiced in recent studies on new reports.

Conclusion

The *Colletotrichum* is ubiquitous genera having wide host range in India. The present effort to highlight the new plant diseases caused by *Colletotrichum* in India during twenty first century will therefore not only provide useful information about new plant diseases caused by

Colletotrichum, but also be helful for mycologists and plant pathologists in phytopathological research and will initiate new questions for future study.

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