

Diversity and Taxonomy of Two New Species of *Cladosporium* from India

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Abstract: The present paper deals with the diversity and taxonomy of Phytopathogenic fungi on families Fabaceae and Caricaceae including addition of two new species of *Cladosporium* viz, *C.caricae-papayae* and *C.cassicolum* causing foliar disease on *Caricapapaya* (Caricaceae) and *Cassia fistula* (Fabaceae) respectively. The present species are described, illustrated and compared with closely related species. These novel species are characterized by branched, longer, smooth conidiophores, and smooth, longer conidia. Description and nomenclatural details are deposited in Mycobank (www.Mycobank.org).

Key Words: Foliicolous Hyphomycetes, *Cladosporium*, new species

Cladosporium Link (1816) being one of the largest genus of foliicolous hyphomycetes since its establishment. This genus is cosmopolitan found usually as sponges, colonizing a variety of organic substrates of plant origin as well as weak pathogen. Many of the species are plant pathogenic i.e. causal agent of leaf spots and other lesions (Sachubert 2005) or they occur as hyperparasites on other fungi (Heuchert et al. 2005). A monograph revision of *Cladosporium* S.lat. was presented by Bensch et al. 2012. A review of history of *Cladosporium* has been given by David 1997.

Extensive survey of this leaf spots fungi have been carried out by various workers (Chupp, 1954; Ellis, 1971, 76; Bilgrami et al., 1979; Sarbhoy et al., 1964 1986; Subramaniam 1971, 1983; Ainsworth et al., 1973a,b; Kendrick, 1985; Sharma et al., 1998 and Zhang et al., 2000). Many novel taxa of *Cladosporium* have been described from India by Butler & Bisby 1954, Jamaluddin et al. 2004. Recently some new species of *Cladosporium* were added to the Indian mycota from Uttar Pradesh (Kumar et al. 2006, 2007; Singh et al. 2008; Bhartiya et al. 2016, 2017). During a continuing investigation on micro-fungi from subtropical forests of Uttar Pradesh, a species with morphological characteristics of the genus *Cladosporium* was collected on living leaves of *Carica papaya* and *Cassia fistula*. These were found to be distinct from earlier described taxa and therefore; proposed as new species and are described and illustrated in the present paper.

I. Materials and Methods

Collections were made during 2021-2023 of forest vegetation of proposed area. During all the visits leaf spots fungi were taken in separate polythene bags. These samples were in between blotting papers. Pressed specimens were exposed to the heat or dry air of hot air oven. Dried specimens were sprayed with alcoholic solution of $HgCl_2$.

Morph taxonomic studies of each specimen was done under compound microscope. The fungal leaf spot was carefully scrapped with the help of razor, blade or Sharpe scalpel. This scrapping was mounted in lacto phenol cotton blue on microscopic slide. Drawings were made with the help of camera Lucida showing all the possible details of morphology and ontogeny of reproductive propagates under different magnification of compound microscope.

II. Results

Taxonomy

Caricae-papayae HD Bhartiya sp. nov. (Fig. 1)

Maculae amphigenae, irregulars, diende exten saeper totum folii, interdum, holo, fusabrunnea. Coloniae amphiphyllosae, effusae, fusa brunnea. Mycelium exhyphis immersum vel superficialae, externae, septatis, ramosis, angustum, laevibus, tunicatis, medio olivacea, 7.0 μm crassa, Stromata nulla Conidiophora oriunda, singulata ad externae mycelial hyphis ad group (1-5). macronematous, mononematous, 1-6 transversis septatis, ramosis, laevibus tunicatis, erecta vel suberecta, recta vel flexuosa, inflates ad apicibus, fus aolivacea, 29-155 $\times$ 3.5 - 5 μm . Cellulae conidiogenae integrae, terminalis vel intercalares, polyblaticae, sympodiales, cicatricatae, conidial tusa crassata Conidiae simplice, holoblastica, sicca, acropleurogenosa, ellipsoideae, fusiformibus, ovals, solitaria vel catenata, cylindrica 0-3 septatis, apicem obtusis, basim truncate vel roundata, obconico truncata, protuberantea, hilo crassata, pallid olivacea, 6-29 $\times$ 4-7 μm .

In foliis vivis of *Carica papaya* L. (Caricaceae); Gorakhpur (U.P.) India, HD Bhartiya Dec, 2022; GPU Herb No. 8510 isotypus, HCIO 43096 holotypus.

Infection spot amphigenous, irregular, later spreading on entire leaf surface, sometime necrotic, dark brown. Colonies amphiphylous, effuse, dark brown, Mycelium of hyphae immersed to superficial, external, septate, branched narrow, smooth walled, mid olivaceous, 7.0 μm width. Stromata absent Conidiophores arising singly from external mycelial hyphae and in loosely arranged group of 1-5 from a few basal cells, macronematous, mononematous, 1-6 transversely septate, branched, smooth walled,

erect to suberect, straight to flexuous, swollen at the apex, dark olivaceous, 29-155 x3.5-5 μ m. Conidigenous cells integrated, terminal to intercalary, polyblastic, sympodial, cicaterized, bearing darkly thickened conidial scars Conidia holoblastic, dry, acropleurogenous, variable in shape (ellipsoidal, fusiform, oval) solitary to catenate in branched chain, cylindrical, 0-3 septate, apex obtuse, base truncate to rounded, obconico truncate, protuberant, hila thickened, light olivaceous, 6-29 x 4-7 μ m.

On living leaves of *Carica papaya* L.(Caricaceae); Gorakhpur(U.P.) India, HD Bhartiya, Dec. 2022; GPU Herb No. 8510 isotype, HCIO43096 holotype.

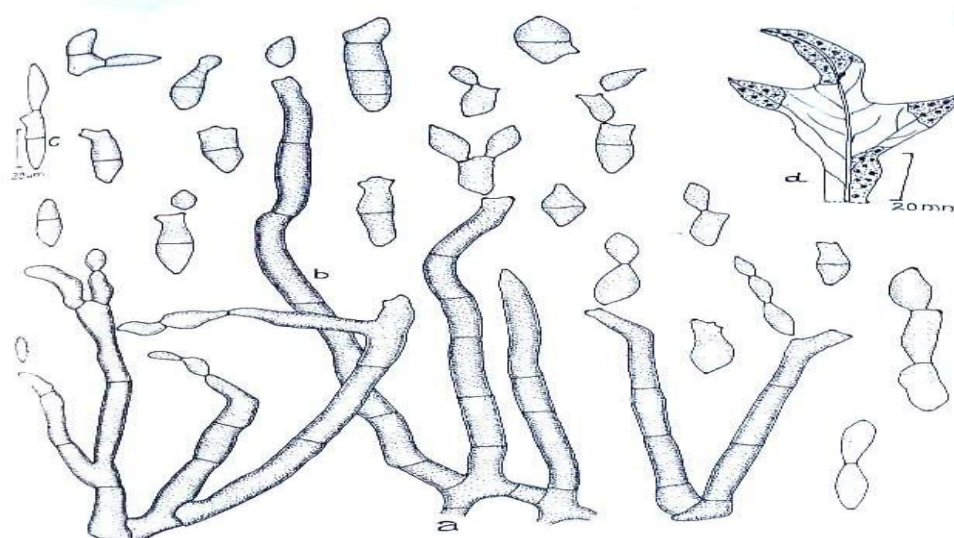


Fig. 1 *C. caricae-papayae* sp. nov.
a. Mycelium, b. Leaf spots;
c. Conidia, d. Leaf spots;
Bars : a-c = 20 μ m * d = 20mm.

III. Discussion

Through survey of pertinent literature it reveals that only one species of *Cladosporium* has earlier been described on same host species. Therefore, morph taxonomic features of proposed collection is compared with *C. cladosporioides* given under:

A comparative account of morphotaxonomic features of *Cladosporium* species reported on host species *Carica papaya*

Table 1. Comparison of the *Cladosporium* species with *C. cladosporioides*

Fungus Name	Stromata	Conidiophore	Conidia
<i>C. caricae- papayae</i> sp. nov.	Absent	Single loosel arranged group of (1-5) macronematous, mononematous, 1-6 sepaic, branched. Erect to subrect. straight to flexuous, swollen at the apex, dark olivaceous, 29-155x3.5-5 μ m	Holoblastic, ellipsoidal. fusiform, oval, solitary to calénate, cylindrical, 0-3 septate, apex obtuse. base truncate to rounded, obconicotruncate, protuberant, hila thickened light olivaceous, 6-29x 4-7 μ m.
<i>C. cladosporioides</i> (Fresen.) de Vries 1952	Absent	Macronematous. mononemaious, smooth or verruculose, 350 μ m. long put generally much shorter, 2-6 μ m. Thick olivaceous brown.	Ramo-conidia, 0-1 septate smooth or minutely verruculose, 30 μ m. long, 2-5 μ m. thick, conidia, in long chain, ellipsoidal or limoniform 3-11x2-5 μ m (mostly 3-7x2-4 μ m). pale olivaceous brown.

The differentiating features of proposed collection having more septate, branched, flexuous and swollen at the apex conidiophores as compared to the less septate, unbranched and longer in the latter. Conidia are also septate (0-3), obtuse, obconicotruncate and more length and width than *C. cladosporioides*.

These morph taxonomic features of novel taxa warrant its illustration and description as a taxon of separate species rank.

C. cassicolum HD Bhartiya sp. nov.

(Fig. 2)

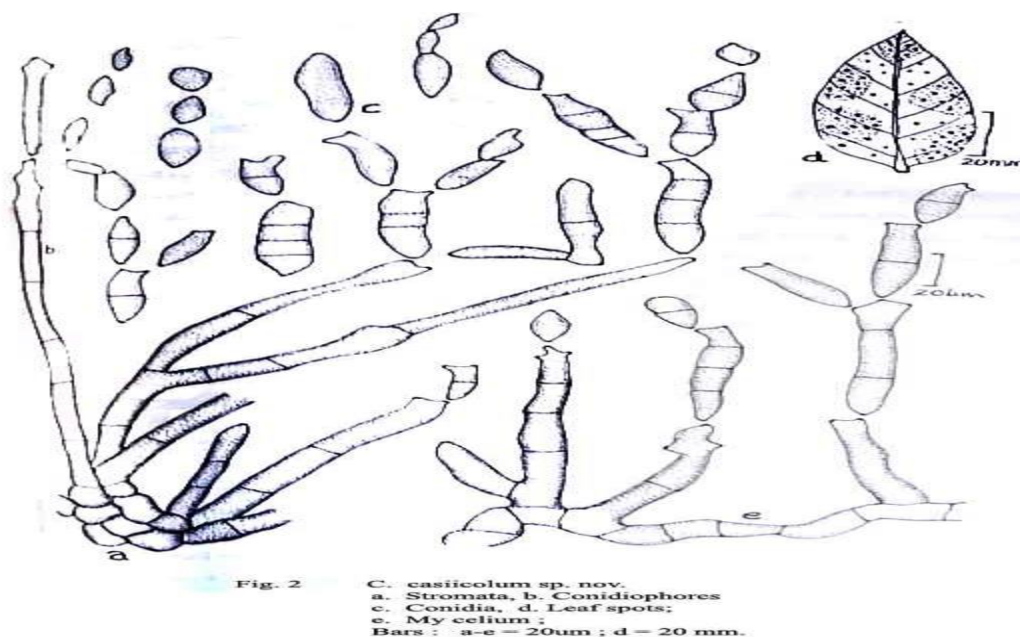
Maculae amphigenae, circularis vel irregularis, diende coalescentes spergentes per marjoram partem, fusa brunnea, marginae ad griseo brunnea. Coloniae amphiphyllosae, effuse, griseo albo Mycelium ex hyphis externae, superficial laevel immersum, laevibus tunicatis, brunnea, 10 μ m crassa. Stromata evolutum formata, pseudoparenchymatosa, irregularis, pallid brunnea, 23-29 μ m crassa, 10-15 μ m longa Conidiophora oriunda, singulata in fasciculo (1-4) edstromata vel terminales or laterals mycelia hyphis, macronematosa, mononematosa, ramosis, 2-5 transversis septatis, recta vel curvata, flexuosa, laevibus tunicatis, erecta vel suberecta, fusa olivacea, 25-162 x 4.5-5 μ m. Cellulae conidiogenae integratae, terminiales vel intercalares, polyblasticae, sympodialae, cicatricatae, conidial crassata.

Conidia holoblasticae, sicca, acropleurogenosa, catenata, cylindrica, globosa vel subglobosa, tusiformibus, ellipsoidea, spice msuabcuta vel obtusis, basim obconicotruncata vel roundata, 0-3 transversis septatis, hilo fusa crassata, interdum, protuberantea, laevibus tunicatis, pallid olivacea, 9-35 x 3.5-6.5 μ m.

In foliis vivis of *Cassia fistula* L. (Fabaceae); Gorakhpur (U.P.) India, HD Bhartiya, Nov. 2022; GPU Herb No. 8510 isotypes HCIO 43096 holotypus

Infection spots amphigenous, circular to irregular later coalescing to form a large patches, dark brown in margin and greyish brown spots, Colonies amphiphyllous effuse, greyish white. Mycelium of hyphae external, superficial to immersed, smooth walled, branched, septate composed of subhyaline to light brown, 10 μ m width. Stromata well developed, pseudorenychmatous, irregular, light brown, 23-29 height Conidiophores arising single or in fascicles (1-4) from stromata and terminal to lateral mycelial hyphae, macronematous, mononematous, branched, 2-5 transversely septate, straight to flexuous, curved, smooth walled, erect to suberect, tapering towards the distal end, dark olivaceous, 25-162 x 4.5-5 μ m. Conidiogenous cells integrated, terminal to intercalary, polyblastic, sympodial, cicaterized, scars thickened. Conidia holoblastic, dry, acropleurogenous, catenate, cylindrical, spherical to subspherical, variable in shape (fusiform, ellipsoidal) apex subacute to obtuse, bases obconicotruncate to rounded, 0-3 transversely septate, hilla darkly thickened, Sometime protuberant, smooth walled, light olivaceous, 9-35 x 3.5. 6.5 μ m.

On living leaves of *Cassia fistula* L. (Fabaceae); Gorakhpur, (U.P.) India, HDBhartiya Nov. 2022; GPU Herb No. 8506 isotype, HCIO 43092 holotype.



IV. Discussion

Earlier literature on the taxonomy of this fungus speaks the fact that only three species of *Cladosporium* viz., *C. oxysporum* (Berk and Curt, 1868), *C. cladosporioides* (Fresen) de Vries, 1952] and *C. cassiae surathensis* Yen (1981) on *Cassia fistula*, *Cassia siamea* and *Cassia suranthesis* have earlier been recorded on the same host genus but on different species.

A comparative account of morphotaxonomic features of *Cladosporium* sp. reported on the host species *Cassia fistula* *Cassia fistula*.

Table.2. Comparison of *Cladosporium gassicolum* sp.nov.species with allied taxa to confirm its novelty as under:

Fungus Name	Stromata	Conidiophore	Conidia
<i>C. cassicolum</i> sp.nov.	Well developed, pseudoparenchymatous, light brown 23-29um. Width, 10-15 um. Height	Single or tascrcles. Macronematous, mononematous, branched, 2-5 septe, straight to curved, flexuous, erect to suberect, dark olivaceous, 25. 162x4-55 um	Holoblastic, catenate, cylindrical, spherical to subspherical, fusiform, ellipsoidal, apex subacute to obtuse, base obconicotruncate to rounded, 0-3 septate, hila darkely thickened, protuberant, light olivaceous, 9-35x3.5-6.5um.
<i>C. oxysporum</i> Berk and Curt.(1868)	Absent	Macronematous, straight or slightly flexuous, distinctly node, smooth, 500um long or sometime even longer in cluture. 3-5 um thick terminal and intercalary, 6-8um pale or mid pale brown.	Terminal swelling simple or branched chain, cylindrical, rounded at the end, ellipsoidal, limoniform or subspherical, smooth, subhyaline or pale olivaceous brown 5-30x3-6um.
<i>C. cladosporioides</i> (Fresen.) de Vries, 1952	Absent	Macronematous, micronematous, smooth or verruculose, 350um. Long but generally much shorter, 2-6 um. Thick	Ramo-conidia, 0-1 sptate smooth or occasionally minutely, verruculose, 30um. Long 2-5 um. Thick, Conidia formed in long chain mostly 0-3 septate, ellipsoidal or limoniform 5-11x2-5 um. (mostly 3-7x 2-4 um) pale olivaceous brown.
<i>C. cassia sura-nithensis</i> Yen (1981)	Absent	Bruns, simples, generale 2-3 groupes in fascicules, eriges, droil legement cylindrical, 1-4 transversely septate, apex rounded, or nes de nombreuses, cicaterized, lateral, dinsertion des spores brunt nair, et de 2-5 cicatrices, 20-50x3-6um.	Ovales, ellipsoidal parfois, cylindrical continuous divide externum, transversely a deuxelornees cicaterized brunnea. noir protuberant a levr sextremited, des conidia secondairres de forme normale, 7-14x3-4um.

As gathered from the data presented in the table the proposed novel taxa is found distinctly different in having conidiophores and conidia. Theconidiophores of *C. Cassicolum* sp. nov.are shorter than the type species andthe allied taxa, *C. oxysporum* and *C.cladosporioides*. However, theconidiophores of *C. cassiae-surathensis* are the smallest amongst all the taxa.The conidia of the novel taxa are having more septate than the others.Length and width of the proposed taxa is again greater than the rest allied taxa.

Therefore, to accommodate the present collection, its description andillustration as taxa of novel species rank is considered.

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Literature Cited

1. Ainsworth et al; (1973).A dictionary of the fungi (5th). CMI. Kew, England.
2. Bilgrami, K.S., Jamaluddin and Rizvi, M.A. (1979).Fungi of India 1.Listand reference, today and Tomarrow's printers and publishers, New DelhiPP.467.
3. Chupp; C. (1954).A monograph of the fungus genus Cercospora, Hffaca.NewYork.
4. De Vries, G.A. (1952). Contribution to the knowledge of the genus*Cladosporium* Link ex Fr. Thesis Uni.Of Utretch, 16:121.
5. Ellis, M.B. (1971). Dematiaceous Hyphomycetes. CMI. Kew, Surry, England, 594pp.
6. Ellis, M.B. (1976). More Dematiaceous Hyphomycetes. CMI. Kew, Surry, England, 507pp.
7. Kendric, B. and Nagraj, (1979). 'he whole Fungus Vol.].Link, HF. (1816).Observation in ordinesPlantarumNaturrales.Ul. Mag. Zes. Nature f. Fr. Berlin., 7:37-38.
8. Sarbhoy, A.K. (1964). Leaf litter fungi found on Pinuslongifolia. Salib.Sydovia, 18:41-43.

9. Sharma et al.(1998). 'Three new species of *Cladosporium* viz., *C.glochidionis*, *C. malvacearum* and *C. kapildharens* from M.P., India. *Indian Phytopath* 51(2): 152-160 Zhang Zhong-Yi, Zhang Hong and Li Tian- Fei.(2000). Taxonomy of the genus *Cladosporium* in China XXII. *Mycosystema* 19(3): 308-311.
10. Index Fungorum (2015) Index Fungorum, accessed 1 February 2015, <http://www.indexfungorum.org>
11. Jamaluddin. Goshwami MG. Ojha BM (2004) *Fungi of India 1989-2001*, Scientific Publishers Jodhpur, India, pp 326.
12. Kirk PF, Cannon PF, Minter DW, Stalpers JA (2008) *Dictionary of the Fungi*. 10th ed. Wllingford, UK, CAB International. pp. 711.
13. Kumar A, Kumar A, Kharwar RN (2006) Two new phytoparasitic hyphomycetes from Varansi, India. *Indian Phytopathology* 59(1) 85-90
14. Kumar S, Singh R, Pal VK, Upadhyaya PP, Agarwal DK (2007) Addition to new species of *Foliicolous* hyphomycetes from North Eastern Uttar Pradesh. *Indian Phytopathology* 60(3). 350-355.
15. MycoBank (2015) MycoBank (Fungal Database nomenclature and species bank), accessed 1 February 2015, <http://www.mycobank.org>
16. Bhartiya HD, Kumari N, Kumar S And Singh R (2016) Diversity, Distribution and Taxonomy of *Cladosporium* associated with *Celastraceae*, *Plant Pathology and Quarantine* 6(1) 48-52 pp. 2016.
17. Bhartiya HD, Kumari N, Kumar S and Singh S (2015) Diversity and Taxonomy of Phytopathogenic *Cladosporium* on *Rubiaceae*. *Plant Pathology and Quarantine* 5(1) 15-18 pp. 2015.
18. Bhartiya HD, Kumari N and Singh Anu (2019) *Cladosporium clero dendri-viscosi*. A new species on family *Verbenaceae* from North Eastern Uttar Pradesh, India, *Journal of Emerging Technologies and Innovative Resaerch*. Vol 6(5) 1075-1078 pp. 2019.