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Four New Records of Phytopathogenic Fungus *Cercospora* from India

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Abstract

During 2020-2021 occurrence of new records of Cercosporoid fungi causing leaf spots disease on wild plants of North-Eastern Uttar Pradesh and Burdwan district of West Bengal. The typical disease symptoms were observed on both surface of leaves. Disease spots dry, necrotic, dark olivaceous brown in colour. On the basis of morphological and microscopic characteristics of the fungus *Cercospora* sp. were found to be associated with the leaf spots disease. These Cercosporoid fungi have been described and illustrated, viz. *Cercospora phyllanthicola*; *C. ricinella*, *C. ternateae* and *C. traversiana* on *Phyllanthus indicus* L. (Euphorbiaceae), *Ricinus communis* L. (Euphorbiaceae), *Clitoria ternate* L. (Fabaceae) and *Trigonella coeruleae* L. (Fabaceae) respectively. The specimens were collected in different parts of Gorakhpur District (UP) and Vardwan (WB). Photographs and the line drawing of the new records from India have been provided.

***Key words*:** *Cercospora*, Hyphomycetes, Leaf spot, North-Eastern, Phytopathogenic, Taxonomy

Since the establishment of hyphomycetes genus *Cercospora*, till now more than 3654 species had been added to this form genus. Fresenius published the generic name *Cercospora* primarily accommodate the hither to undescribed species which he named *Cercospora apii*, (On *Apium graveolans*) and which he clearly indicated to be the type of the genus [1]. Although this type species was circumscribed by well developed, colored conidiophores, integrated, terminal to intercalary, sympodial, polyblastic, geniculate. conidiogenous cells bearing thickened conidial scars, typically acicular, hyaline conidia with truncate base, bearing rim like thickened hila. More than two thousand species names with maximum heterogeneity and diversity have been published till the beginning of the century. This immense heterogeneity in a single genus lead to the energetic of a complex such as *Cercospora* complex and *Cercospora- ramularia* complex [2]. This categorization is reasonably sound as regards their taxonomic values and two categories have been formed to represent two distinct complexes of form genus and species originating from the genus *Cersospora sensu-lato* including *Cerscospora sensu-stricto* as a genus with largest number of species.

Most *Cercospora* like fungi are predominantly distributed in tropical [3-7] and subtropical regions [8-11], where warm temperatures, high humidity, and extended growing seasons create favorable conditions for their growth, reproduction, and spread. These environmental factors facilitate rapid sporulation and infection cycles, making such regions hotspots for the diversity and prevalence of cercosporoid fungi. Consequently, a significant proportion of species belonging to this group has been reported from these climatic zones, often associated with a wide range of economically important host plants. In the Indian context, extensive contributions by mycologists have greatly enriched the knowledge of *Cercospora* and allied genera [12-15]. Owing to the country's diverse agro-climatic conditions, ranging from tropical to subtropical environments, numerous species have been discovered and described on a variety of cultivated and wild hosts. Indian researchers have played a crucial role in documenting new species, host records, and taxonomic revisions, thereby significantly contributing to the global understanding of cercosporoid fungi and their biodiversity. This report is devoted to the Illustration and description of four new records of *Cercospor*a viz. *Cercopora phythanthicola, Cercospora recinella*, *Cercopora ternateae* and *Cercospora traversiana*, from living leaves, of *Phyllanthus indicus*, L. (Euphorbiaceas), *Ricinus communis* L. (Euphorbiaceae), *Clitoria ternate* (Fabaceae) and *Trigonella coeruleae* respectively.

Some of the significant contributions on the taxonomy of Cercosporoid fungi, from Gorakhpur (Uttar Pradesh, India) include [16-17], Gorakhpur district, one of the 75 districts of Uttar Pradesh and Vardwan of West Bengal with offers varied climatic conditions because of the great variation in altitude [18]. Vegetation of the districts of two states can be broadly classified into major habitat for a variety of terrestrial biodiversity with distinct extents of ecosystem, abundance and distribution of species and coverage of protected areas. This low land area is mainly characterized by tall grassland, scrub savannah, Sal Forest, wetland and swamps. Whereas Vardwan (West Bengal) classified into research forest, protected forest and unclassed state forest constituting 13.33% of the geographical area of the state. It consists of fragmented forest landscape in dry deciduous forest. During field trips to different parts of Gorakhpur and Vardwan district, the author collected some specimens of *Cercospora* fungi. Based on macro and micro morphological details and comparison with literature, these were identified as four species belonging to four different genera. The aim of the present study is to describe and illustrate these four species, all reported from the first time from India.

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MATERIALS AND METHODS

The present study was conducted in the forest areas of Gorakhpur Forest Division (Uttar Pradesh, India) and adjoining districts, along with selected regions of Vardwan district in West Bengal, which represent diverse ecological conditions ranging from lowland grasslands, scrub savannah, *Shorea robusta* (Sal) forests, wetlands, and swampy habitats in Gorakhpur to fragmented dry deciduous forests in Vardwan. Extensive field surveys were carried out during different seasons to collect plant specimens infected with cercosporoid fungi, particularly those exhibiting distinct leaf spot symptoms. Diseased leaves were carefully detached from host plants and placed in separate, labeled polythene bags to prevent contamination, and relevant field data such as host identity, locality, date of collection, and ecological conditions were recorded. The collected specimens were subsequently brought to the laboratory and dried using standard herbarium techniques employed for phanerogamic plants to ensure proper preservation of fungal structures. For authentication and reference, representative portions of each specimen were submitted to the Herbarium Cryptogamiae Indiae Orientalis (HCIO), New Delhi, and accession details were incorporated into the study. For microscopic examination, free-hand sections of infected leaf tissues were prepared using a sterile blade and mounted in lactophenol cotton blue, a commonly used staining medium that enhances the visibility of fungal structures. Observations were carried out under a compound light microscope equipped with a camera lucida for detailed illustrations and an ocular micrometer for precise measurement of morphological features. Critical characteristics such as the morphology of conidiophores and conidia, including their size, shape, septation, color, and arrangement, were carefully examined and measured from multiple samples to ensure accuracy and consistency. The identification and classification of the fungal specimens were based on detailed macro- and micro-morphological observations and their comparison with standard taxonomic literature, monographs, and previously published works on cercosporoid fungi, including significant contributions from earlier studies conducted in Gorakhpur and other regions. Based on these analyses, the collected specimens were identified as distinct species belonging to different genera of cercosporoid fungi, and their nomenclature was assigned following current taxonomic standards. All findings were systematically documented through detailed notes, illustrations, and microphotographs to support accurate taxonomic characterization and future reference.

RESULTS AND DISCUSSION

Taxonomy
Cercospora phyllanthicola [19]
MycoBank 440842

Infection spots amphigenous, circular to irregular, later coalescing to form a patch, dark olivaceous brown, 0.5-12 mm in diam. Colonies amphiphyllous, effuse. Mycelium of hyphae internal, branched, septate, hyaline. Stomata poorly developed, pseudoparenchymatous, compact, 12.5-21µm in diameter Conidiogenous cells integrated, terminal to intercalary, sympodial, geniculate, scars thickened. Conidiophores arising singly or in groups of 1-5, macronematous, mononematous, septate, unbranched, 1-4 geniculate, straight to curved, unbranched,1-24 transversely septate, apex acute to subobtuse, cylindrical,17-222x2-3.5 um.

On living leaves of *Phyllanthus indicus* L. (Euphorbiaceae), HD Bhartiya, October, 2021: Gorakhpur (UP) India; GPU Herb. No. 8037, HCIO 4269

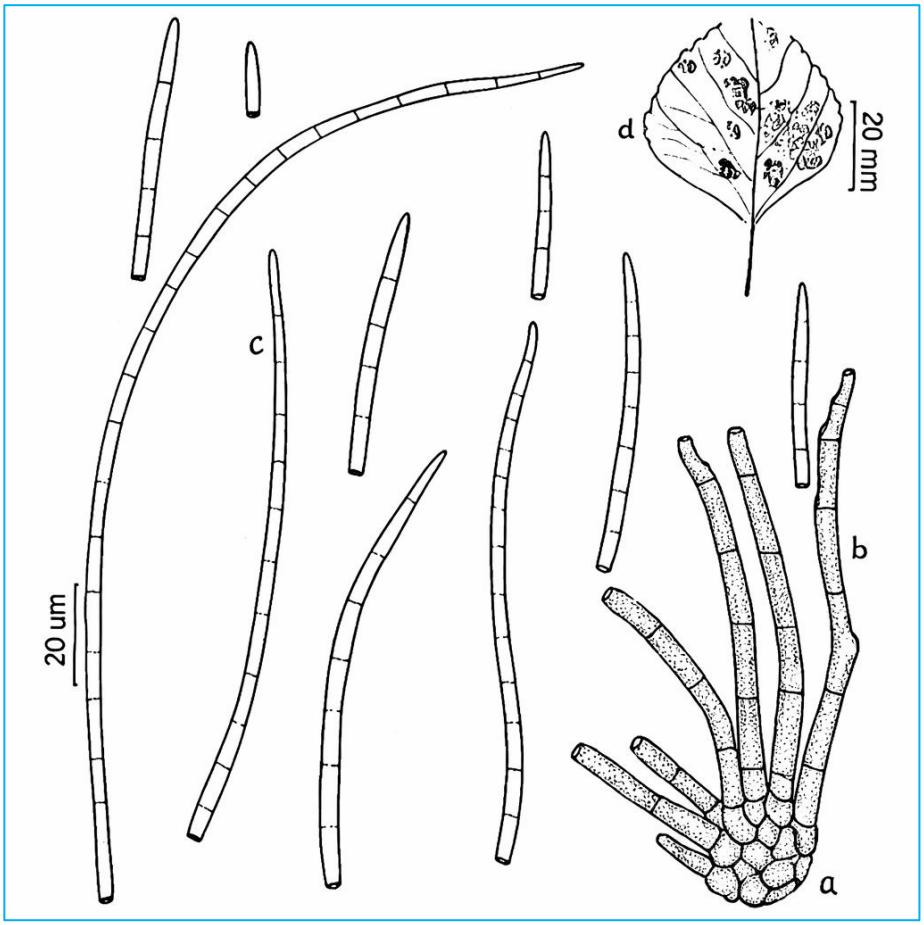

Fig 1 *Cercospora phyllanthicola*

Notes

It is evident from the literature that a total of 11 *Cercospora* species have earlier been recorded on same host genus but on different species. Of these, 9 *Cercospora* species have been recombined into other generic segregate as species *Pseudocercospora* by Deighton [5], [20] at different periods. These are *Cercospora phyllanthicola* Khan and Kamal [19] on *Phyllanthus niruri* from Pakistan and *Cercospora tarrii* Deighton [21] on *Phyllanthus maderaspatna* from Africa. *Cercospora phyllanthicola* here is very closed to the proposed collection, but it also shows differences in size of stromata, septation of conidiophores and size of conidia. The minor differences might be attributed to environmental factors. Therefore, it warrants description and illustration as new host record for India.

Cercospora ricinella [22]
Mycobank 209413

Infection spots amphigenous, circular, spreading on entire leaf surface, necrotic, white to light brown in colour, 3-7 mm in diam. Colonies amphiphyllous effuse. Mycelium of hyphae internal, branched, septate dark brown to olivaceous brown. Stromata well developed, epidermal, pseudoparenchymatous, dark, brown, 16-24mm. Conidiophores arising in fascicles of 1-20, macronematous, mononematous, 1-5 septate, unbranched, straight to curved, apex globose, scars thickened, light brown, 16.5-100x3-6 mm. Conidiogenous cells integrated, terminal to intercalary, geniculate, scars thickened. Conidia solitary, dry, hyaline, straight to substraight, subacute to blunt, cylindrical, 24-98x3-5mm.

On living leaves of *Ricinus communis* L. (Euphorbiaceae), H.D. Bhartiya. 10 December 2021: Gorakhpur (UP) India, GPU Herb, No. 8061 and HCIO No. 42910

Notes

As perusal of literature indicates that only three species of *Cercospora* are reported from all over the world including viz. *C. albido-maculans* Winter [8] from US, *C. ricinella* Saccardo and Berlese [22] from Argentina on the same host species *Ricinus communis*, later *C. albido-maculans* and *C. ricini* have been found to be synonymy with *C. ricinella* Saccardo and Berlese [22], while the *C. ricinella* remains existing in its original status. The present collection shares a few morphological similarities with earlier reported species. The minor differences observed in the morphology of the present collection can be attributed to environmental conditions. Hence *Ricinus communis* is new fungal record for India as it has not yet been reported on *Ricinus commaunis* from anywhere in India.

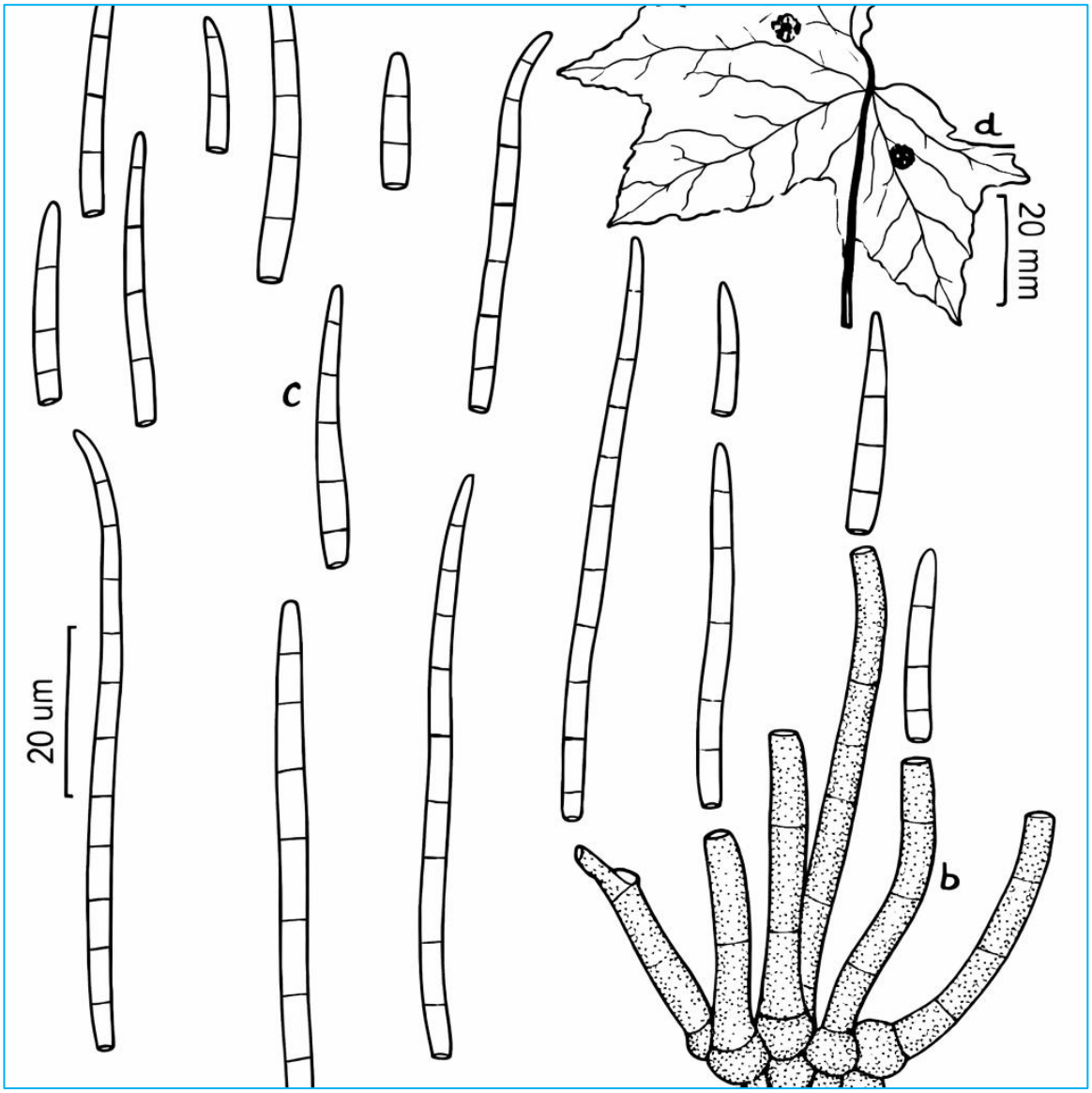

Fig 2 *Cercospora ricinella*

Cercospora ternatae [23] New Ceylon

Mycobank152684
Annals of the Royal Botonic Gardens Peradenized 4: 299-307

Infection spots amphigenous, circular to irregular, later coalescing to forum a patch, grayish white to dark, olivaceous, 0.5-18mm in diamo colonies amphiphyllou, effuse. Mycelium of hyphae internal, branched, septate, hyaline. Stromata well developed, spseudoparenehymatous, compact light olivaceous, to dark brown, 12-17.5mm. Conidiogenous cells terminal to intercalary, sympodia, geniculate, scar distinet. Conidiophores arising singly or in fascicles of 1-6, unbranched, 1-15 transversely septate, straight to curved, macronematous, mononematous, cylindrical, apex globose, light brown, 21.5-269x3-6mm. Conidia dry. Solitary, hyaline, straight to curved, 1-11 transersely septate, apex acute to obtuse, cylindrical, 17.5-115x2-3mm.

On living leaves of *Clitoria ternate* L. (Fabaceae) H.D. Bhartiya, 18 October 2021: Vardwan (WB) India: GPU Herb. No. 8052, HCIO 42901.

Notes

Cercospora viz. *C. clitoridis* Fragasso & Ciferri (1925), *C. pentolevuca* Saccardo (1879) and *C. ternateae* Petch [23] on the host genus of these, *C. clitoridis* has become synonym of *Cercospora ternatae* and *Cercospora plantoleuca* is not a true whereas *Cercospora ternateae* Petch [23] is existing in its original forms which has been reported from Ceylon. The present collection is very close to it and can be assigned to the same. The minor differences observed in symptoms, size of conidiophores and conidia of present collection is might be attributed to environmental factors. Therefore, it is described and illustrated as new fungal record for India.

Cercospora traverriana [24]
MycoBank 546814
Annales Mycologici 2(1): 18 (1904)

Infection spots amphigenous, circular to subcircular, later coalescing to form large patches, dark brown on upper surface. 2.0-10.5mm. Colonies amphiphyllous, effuse. Mycelium of hyphae internal branched, septate, dark. Olivaceous. Stromata well developed, pseudoparenchmatous, compact, dark olivaceous, 8-19.5 conidiogenous cells integrated, terminal to intercalory sympodial, geniculate, tip swollen, conidiophores arising two or in fascicles of 2-18, macron ematous, mononematous, rarely branched, septate, straight to curved, light olivaceous to dark olivaceous, 7.5-91x1.5-4mm. Conidia solitary, dry acicular, unbranched, 2-17 transversely septate, slightly curved, apex acute to subacute, cylindrical 16-88.5x1.5-3mm.

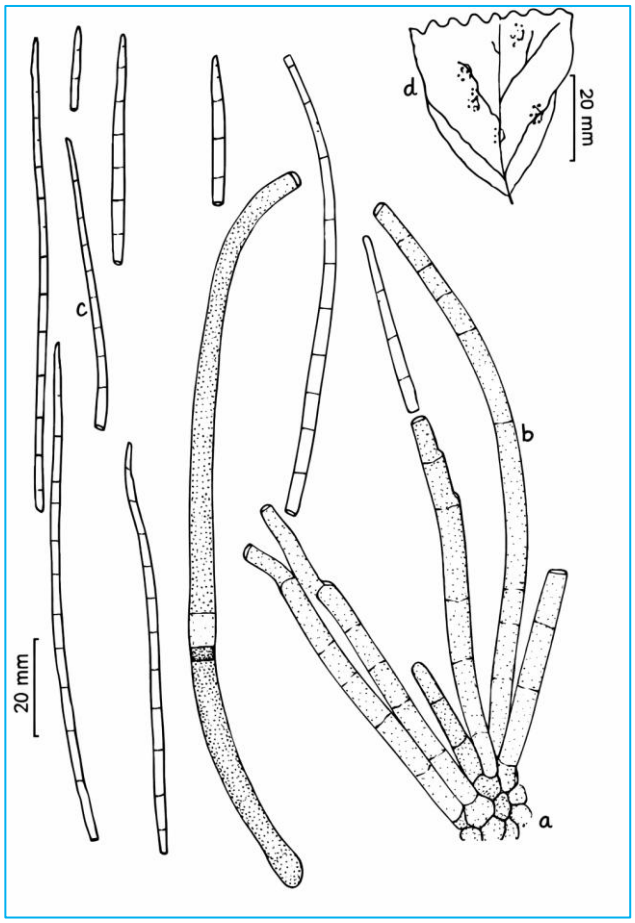

Fig 3 *Cercospora tematеae*

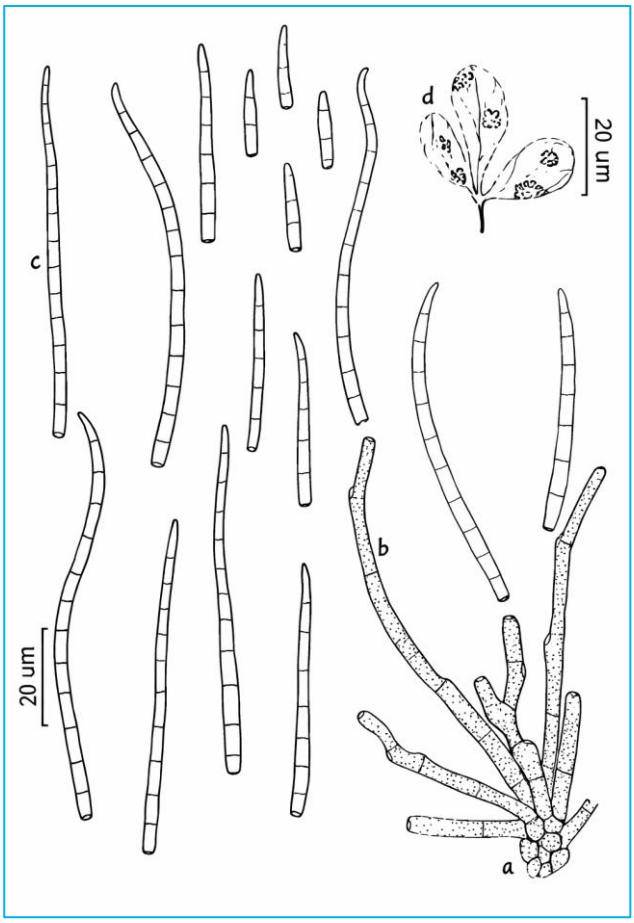

Fig 4 *Cercospora traversiana*

On living leaves of *Trigonella coeruleae* L. (Fabaceae), H. D. Bhartiya, 8 October 2021 ; Gorakhpur (UP) India ; GPU Herb. No. 4069, HCIO 42918.

A survey of literature indicates that only four species of *Cercospora* have been described earlier on the same host genus but on different species but no reported from India [8]. *C. radiate* var. *trifoli coeruli*. (1879), *C. traversiana* var. *trigonellae* Savn. & Sancluville (1933) and *C. trigonella* Maublanc (1915) on *Trigonella coerulae, Trigonella foenumgraecum* and *Trigonella foenum-graecum* respectively, have become synonym of *C. traversiana* Saccardo [24].

Therefore only *C. traversiana* is a compare with present collection. True *Cercospora* reported on host species resembles the present collection may be conspecific but it also some minor

differences in shape and size of conidiophores and conidia. To this variation due to attribute of environmental conditions. Moreover, it is a new fungal record from India.

CONCLUSION

The present investigation provides a comprehensive taxonomic account of four *Cercospora* species, namely *Cercospora phyllanthicola*, *Cercospora ricinella*, *Cercospora ternatae*, and *Cercospora traversiana*, recorded on different host plants belonging to the families Euphorbiaceae and Fabaceae. Detailed morphological characterization, including infection patterns, stromatal development, conidiophore structure, and conidial morphology, enabled accurate identification and comparison with previously described taxa. Critical evaluation of existing literature revealed that several earlier reported *Cercospora* species on related host genera have undergone taxonomic revisions, with many reassigned to *Pseudocercospora* or synonymized, highlighting the dynamic nature of cercosporoid taxonomy. The present collections exhibit close affinity with previously described species; however, minor variations in morphological traits such as size and septation of conidiophores and conidia were observed. These differences are likely influenced by environmental conditions and host specificity rather than representing distinct taxa. Importantly, all four species documented in this study constitute new fungal records for India on their respective host plants, thereby expanding the known geographical distribution and host range of the genus *Cercospora*. This study underscores the significance of detailed morphological assessment in fungal taxonomy and contributes valuable baseline data for future phylogenetic and molecular studies. Furthermore, the documentation of new host-pathogen associations has implications for plant pathology and biodiversity assessment, particularly in understanding the epidemiology and ecological adaptability of cercosporoid fungi in diverse agro-climatic regions of India.

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