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AQUATIC HYPHOMYCETES DIVERSITY FROM SUTLEJ RIVER IN HIMACHAL PRADESH

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Abstract

Three species of aquatic hyphomycetes *Diplocladiella cornitumida* F.R. Barbosa, Gusmao and R.F. Castaneda, *Diplocladiella scalarioides* G. Arnaud ex M.B. Ellis, *Diplocladiella taurina,* Cazau, Aramb, and Cabello have been described from Sutlej river in Himachal Pradesh. *D. cornitumida* and *D. taurina* constitute new records for India, whereas *D. scalarioides* being reported for the first time from Himachal Pradesh.

Key words: Freshwater fungi, Hyphomycetes, Sutlej, taxonomy

Introduction

Freshwater fungi of streams include aquatic fungi along with members belonging to Ascomycota, Basidiomycota, Chytridiomycota, and Oomycota. Their taxonomy and identification have consistently been based on the morphology and development of asexually produced conidia. These fungi are particularly important because of their role in the ecology of streams. Mainly found in lotic ecosystem. These fungi actively engaged in decay of leaf litter and plays an important role for well being of ecosystem. The conidia have a different shape like, tetraradiate, sigmoid, multiradiate, branched, helical and spherical. During the survey of conidial fungi from the Sutlej river in Himachal Pradesh, three interesting aquatic fungi *viz*. *Diplocladiella cornitumida*, *Diplocladiella scalarioides*, and *Diplocladiella taurina*, have been collected and described out of which, *Diplocladiella cornitumida*, and *Diplocladiella taurina*, constitutes new records for India, whereas *Diplocladiella scalarioides* first time reported from Himachal Pradesh (Bilgrami *et al.,* 1991; Jamaluddin *et al.,* 2004). Himachal Pradesh (North Western Himalayas) has been extensively explored for macrofungi (Prasher *et al.,* 2011, 2012, Prasher and Ashok 2013, Prasher and Lalita 2013) and microfungi including hyphomycetes (Prasher and Singh 2012, 2013, 2014 (a, b & c) 2015 (a & b) Prasher and Verma 2012 (a & b) 2014 (a, b, c, & d) 2015 (a, b, c & d) 2016 (a & b) Prasher and Sushma 2014, 2016). However, till to date, there is no published record of Aquatic hyphomycetes. Keeping this in mind studies were initiated to describe the aquatic fungal diversity of Hill streams of Himachal Pradesh. This paper describes *Diplocladiella cornitumida*, *Diplocladiella scalarioides* and *Diplocladiella taurina*, from the Sutlej river in Himachal Pradesh.

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Materials and Methods

The foam from water bodies was collected in glass vials and brought to the laboratory for further studies. The samples were mounted in 4% KOH, lactophenol and cotton blue 0.01% in lactophenol (Kirk *et al.,* 2008). They were then studied using a transmission microscope (VRS-2f) for macroscopic and microscopic characters. All the measurements were taken with the help of Pro MED software. The specimens were deposited in the Herbarium, Department of Botany, Panjab University, Chandigarh, India (PAN).

Results and Discussion

Taxonomy

***Diplocladiella* G. Arnaud ex M.B. Ellis, More dematiaceous Hyphomycetes: 229 (1976)**

Colonies on natural substratum effuse, brown, shortly hairy. Mycelium mostly immersed, composed of septate,

Synopsis of *Diplocladiella* species

Sr. No.	Species	Appendages No.	Appendages Length	Main Axis	Cell No.	Shape	References
1.	*D. alta*	-	-	32.5-42 µm	8-celled	trapeziform	Kirschner & Chen (2004)
2.	*D. appendiculata*	2	20-33 µm	26-31 µm	8-celled	Y shaped	Nawawi (1987)
3.	*D. aquatic*	2	14-38	24-34 µm	10 celled	Y shaped	Lee *et al.*,,,,, (1998)
4.	*D. cornitumida*	2	9-11 µm	24-30 µm	7-8 celled	Y shaped	Barbosa, *et al.*,,,,, (2007)
5.	*D. heterospora*	2	20-60 µm	28-35 µm	Variable celled	obpyramidal	Castañeda (1988)
6.	*D. scalaroides*	2	25-54 µm	30-40 µm	8 celled	V shaped	Ellis (1976)
7.	*D. taurina*	2	20-23 µm	10-13 µm	8-celled	triangular	Cazau *et al.*,,,,, (1993)
8.	*D. tricladioides*	3	38-48 µm	20-23 µm	8-celled	obpyramidal	Nawawi (1985)

unbranched, smooth, pale brown hyphae. Stroma none. Setae and hyphopodia absent. Conidiophores mononematous, micronematous smooth pale brown to mid brown geniculate. Conidiogenous cells polyblastic, integrated, sympodial, geniculate, cicatrized. Conidia triangular, 2-horned, pale to mid brown, smooth, horns mostly 2 septate with the small terminal cell paler.

Type species: *Diplocladiella scalaroides* G. Arnaud ex M.B. Ellis

***Diplocladiella cornitumida* F.R. Barbosa, Gusmão & R.F. Castañeda, Mycotaxon 102: 43 (2007) Plate 1.**

Conidia solitary, acropleurogenous, broadly Y-shaped, smooth-walled, brown, sometimes with a filiform, unbranched, subhyaline cellular appendage at each end; appendages 8-10 × 1 µm, body of conidia 26-29 µm wide (appendages excluded), basal cell short cylindrical, subhyaline to pale brown, 1.5-3 × 2 -3.5 µm; supra-basal cell trapezoid, 5-6 × 7-8 µm with 2 divergent arms, 7 celled, bilaterally asymmetrical; one arm somewhat conical, 14-15 × 8-8.5 µm, other arm irregularly conical, tumid, 14-16 × 12-13 µm.

Collection Examined: India, Himachal Pradesh, Bilaspur, Sutlej river, conidia found in foam sample, 25 December 2016, Punita, PAN 34911.

Remarks: The above-described species matches well with the description of *Diplocladiella cornitumida* as described by Barbosa, *et al.,* (2007). This species is the first time reported from India (Bilgrami *et al.,* 1991 and Jamaluddin *et al.,* 2004).

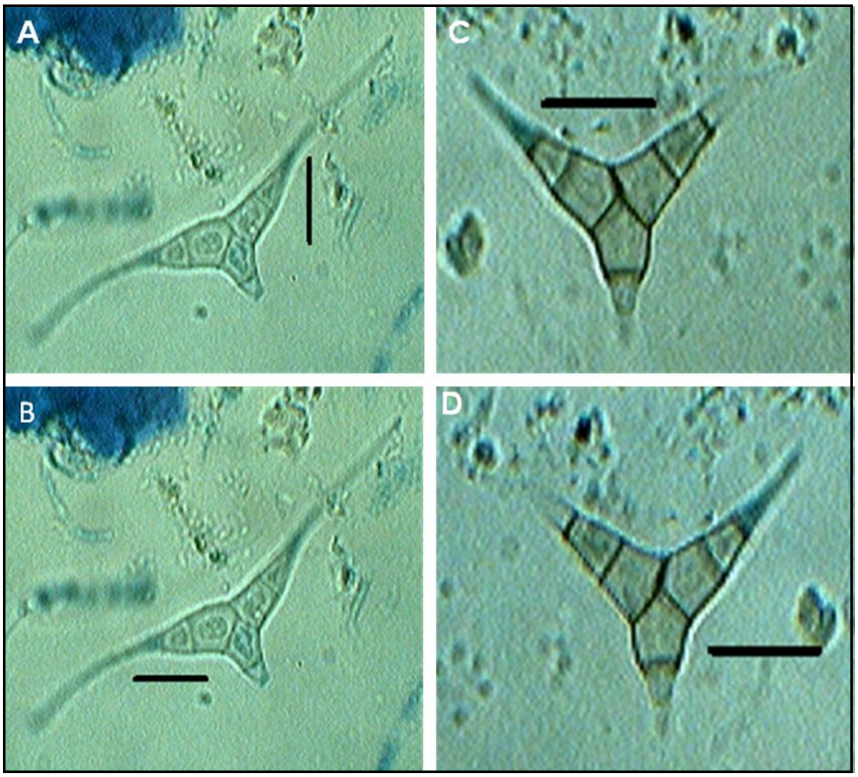

Plate 1: (A-B) Diplocladiella cornitumida (C-D) Diplocladiella scalarioides Scale bar: A-D=10µm

***Diplocladiella scalaroides* G. Arnaud ex M.B. Ellis, More dematiaceous Hyphomycetes: 229 (1976) Plate 2.**

Conidia V-shaped, brown, 8-celled; consisting of two arms radiating from the basal part; arms subulate, divergent each other, usually 2-septate, 26-28 µm long, 4-4.5 µm wide at the base, apical cell long attenuated hyaline, two lower cells olive green; basal part more or less obconical, 1-septate, 8.5-9 µm long, 2-3 µm wide at the base, the upper cell olive green, lower cell hyaline.

Collection Examined: India, Himachal Pradesh, Bilaspur, Sutlej river, conidia found in foam sample, 25 December 2016, Punita, PAN 34912.

Remarks: This species has already been reported from Andhra Pradesh on submerged leaves (Manoharachary and

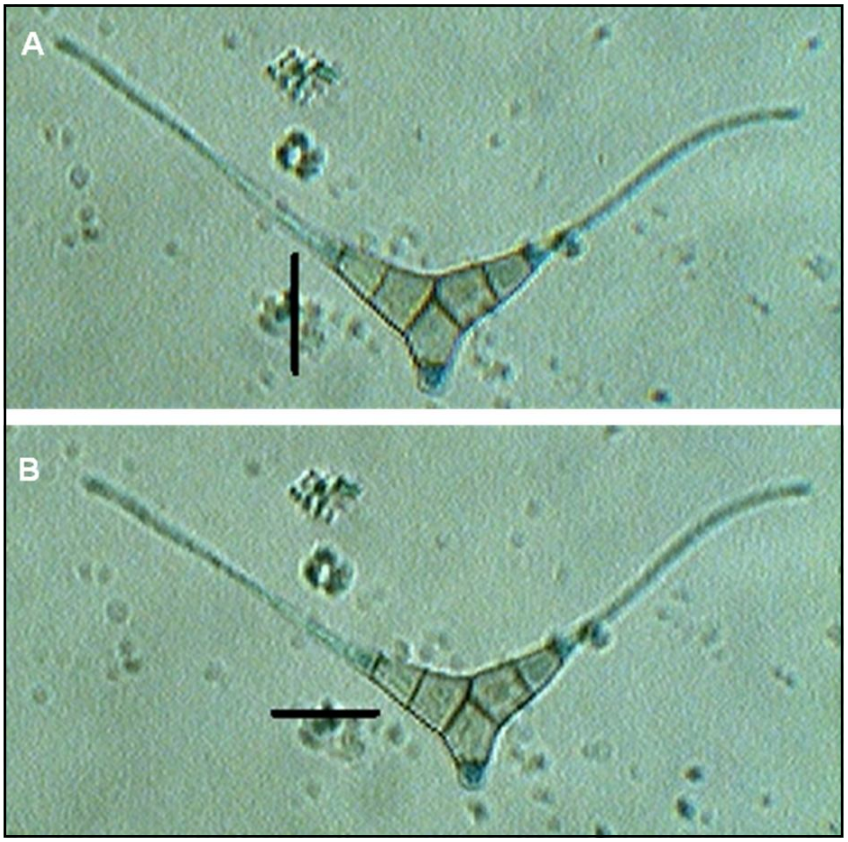

Plate 2: (A-B) Diplocladiella taurina Scale bar: A-B=10µm

Rao, 1983); Maharashtra, Karnataka, and Gujarat in foam (Borse and Patil, 2007., Sridhar and Kaveriappa., 1989., Patil and Borse, 2015); but first time reported from Himachal Pradesh (Bilgrami *et al.,* 1991 and Jamaluddin *et al.,* 2004).

***Diplocladiella taurina* Cazau, Aramb. & Cabello, Mycotaxon 46: 237 (1993) Plate 3.**

Conidia solitary, holoblastic, fuscous to dark brown, triangular, 8-celled, distoseptate, consisting of the main axis with 2 divergent arms, bilaterally symmetrical, with two middle oblique septa, separating arms. The main axis 2-celled, 11-12 µm long (measured from the truncate base to the curvature of the arms). The arms (excluding the appendages) are 8-9 × 3.5-4 µm wide at the base, narrowing to 1.5 µm at the lighter colored apical cell, ending in a long, thin, hyaline, aseptate appendage, 21-23 µm long × 1-2 µm at the base and 1 µm at the apex.

Collection Examined: India, Himachal Pradesh, Bilaspur, Sutlej river, conidia found in foam sample, 15 November, 2016, Punita, PAN 34907.

Remarks: The above-described species matches well with the description of *Diplocladiella taurina* as described by Cazau *et al.,* (1993). This species is the first time reported from India (Bilgrami *et al.,* 1991 and Jamaluddin *et al.,* 2004).

Discussion: The genus *Diplocladiella* was erected by Arnaud (1954) with *Diplocladiella scalaroides* as type species. A valid and complete description of the genus and the species is provided by Ellis (1976). Presently these are 8 species in the genus as (www.indexfungorum.org, accessed 13.05.2019). Four species have already been recorded from India (Bilgrami *et al.,* 1991; Jamaluddin *et al.,* 2004., Nawawi 1987, 1985, and Ellis 1976). In the present study, 3 species of this genus are documented. Of these 2 species *viz.* (*D. cornitumida* and *D. taurina)* constitute a new record for India and one species (*D. scalaroides)* constitute a new record for Himachal Pradesh / Himalayas.

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References

Arnaud, G. (1954). Mycologie concrete: Genera II (suite et fin). *Bull Soc Mycol France,* **69:** 265–306.

Barbosa, F.R., M.F.O. Marques, L.F.P. Gusmão, R.F. Castañeda Ruiz, L.C. Maia, (2007). Conidial fungi from Brazilian semi-arid. Deightoniella rugosa sp. nov., Diplocladiella cornitumida and some new records to neotropical. *Mycotaxon*, **102:** 39-50.

Bilgrami, K.S., S. Jamaluddin and M.A. Rizwi (1991). Fungi of India List and References. Today and tomorrow's Printers & Publishers, New Delhi, India.

Borse, B.D. and R.S. Patil (2007). Aquatic fungi from North Maharashtra-I. *Bioinfolet*, **4:** 101-104.

Castañeda, R.F. Ruiz (1988). Fungi Cubensis Ill. Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro de Humboldt" Cuba.

Cazau, M.C., A.M. Arambarri, M.N. Cabello, (1993). New hyphomycetes from Santiago River. VI. (Buenos Aires Province, Argentina). *Mycotaxon*, **46:** 235-240.

Ellis, M.B. (1976). More Dematiaceous Hyphomycetes.

Common wealth Mycological Institute, Kew, Surrey, England.

Jamaluddin, M.G. Goswami and B.M. Ojha (2004). Fungi of India 1989-2001. Scientific Publishers, Jodhpur, India.

Kirk, P.M., P.F. Cannon, D.W. Minter and J.A. Staplers (2008). Ainsworth and Bisby's Dictionary of Fungi. CAB International, U.K.

Kirschner, R. and C.J. Chen (2004). Two new species of the staurosporous hyphomycetous genera Ceratosporium and Diplocladiella from Taiwan. *Mycologia*, **96(4):** 917-924.

Lee, O.H.K., T.K. Goh, and K.D. Hyde (1998). Diplocladiella aquatica, a new hyphomycete from Brunei. *Fungal Diversity*, **1:** 165-168.

Manoharachary, C., and M.M. Rao (1983). Ecological studies on hyphomycetes associated with submerged leaves from India. Indian Phytopathology.

Nawawi, A. (1985). Some interesting hyphomycetes from water. *Mycotaxon*, **24:** 217-226.

Nawawi, A. (1987). Diplocladiella appendiculata sp.nov. a new aero-aquatic hyphomycete. *Mycotaxon*, **28(2):** 297-302.

Patil, V.R., B.D. Borse and S.Y. Patil (2015). Aquatic fungi from North Maharashtra-XV. Foam spora. *Sci. Park Res. J.*, **2:** 1-5.

Prasher, I.B. and D. Ashok (2013). A Checklist of wood-rotting fungi (non-gilled Agaricomycotina) of Himachal Pradesh. *Journal on New Biological Reports*, **2(2):** 71-98.

Prasher, I.B. and Lalita (2013). A Checklist of wood-rotting fungi (non-gilled Agaricomycotina) of Uttarakhand. *Journal on New Biological Reports*, **2(2):** 108-123.

Prasher, I.B. and G. Singh (2012). *Monodictys* spp. (Anamorphic fungi) new to North India. *Plant Sciences Feed*, **2(8):** 135-137.

Prasher, I.B. and G. Singh (2013). Two Hyphomycetes new to India. *Journal on New Biological Reports*, **2(3):** 231-233.

Prasher, I.B. and G. Singh (2014a). Four Hyphomycetes New to India. *Vegetos*, **27(3):** 146-150.

Prasher, I.B. and G. Singh (2014b). Anamorphic fungi new to Shiwaliks-Northwest India. *Journal on New Biological Reports*, **3(2):** 141-145.

Prasher, I.B. and G. Singh (2014c). Lasiodiplodia indica A new species of coelomycetous mitosporic fungus from India. *Kavaka*, **43:** 64-69.

Prasher, I.B. and G. Singh (2015a). A new species of Cheiromyces and new records of Hyphomycetes from North-India. *Nova Hedwigia*, **101(3-4):** 355-365.

Prasher, I.B. and G. Singh (2015b). New and interesting hyphomycetes from North-Western Himalayas. *Kavaka*, **44:** 83-86.

Prasher, I.B. and Sushma (2014). Hermatomyces indicus sp. nov. (Hyphomycetes) from India. *Nova Hedwigia*, **99(3-4):** 551-556.

Prasher, I.B. and Sushma (2016). Some Interesting Hyphomycetous fungi from Himachal Pradesh. *Kavaka*, **46:** 23-26.

Prasher, I.B. and R.K. Verma (2012a). Periconia Species New To North-Western Himalayas. *Journal on New Biological Reports*, **1(1):** 1-2.

Prasher, I.B. and R.K. Verma (2012b). Two Hyphomycetes New To Himalayas. *Plant Sciences Feed*, **2(8):** 122-124.

Prasher, I.B. and R.K. Verma (2014a). Hyphomycetes New to North- Western Himalayas and siwaliks, in Science, Technology and Enviornment Perspectives and Trends edited by A. S. Ahluwalia and Rajan Gaur Pages 37- 43.

Prasher, I.B. and R.K. Verma (2014b). Four interesting Hyphomycetes from Himachal Pradesh. *Journal on New Biological Reports*, **3(3):** 159-166.

Prasher, I.B. and R.K. Verma (2014c). Taeniolina echinata-A new species of Hyphomycetes (anamorphic) fungus from North India. *Kavaka*, **43:** 11-13.

Prasher, I.B. and R.K. Verma (2014d). Two new species of Dictyosporium from India. *Phytotaxa*, **204(3):** 193-202.

Prasher, I.B. and R,K. Verma (2015a). Some new and interesting Hyphomycetes from North Western Himalayas, India. *Nova Hedwigia*, **100(1-2):** 269-277.

Prasher, I.B. and R.K. Verma (2015b). Neosporidesmium appendiculatus sp. nov. from North-Western India. *Mycological Progress*, **14:** 87.

Prasher, I.B. and R.K. Verma (2015c). Hyphomycetes from Himachal Pradesh, India. *Journal on New Biological Reports*, **4(1):** 70-75.

Prasher, I.B. and R.K. Verma (2015d). Two new species of Acroconidiella from India. *Journal on New Biological Reports*, **4(2):** 111-114.

Prasher, I.B. and R.K. Verma (2016a). Hyphomycetes diversity of Himachal Pradesh-I. *Journal on New Biological Reports*, **5(1):** 52-58.

Prasher, I.B. and R.K. Verma (2016b). The genus Monodictys from Himachal Pradesh. *Kavaka*, **47:** 138-142.

Prasher, I.B., Lalita and D. Ashok (2011). Polyporoid fungi of District Bilaspur (Himachal Pradesh). *Journal of Indian Botanical Society*, **90(3-4):** 268-273.

Prasher, I.B., Lalita and D. Ashok (2012). Polyporoid fungi of district Mandi (Himachal Pradesh). *Journal of Indian Botanical Society*, **91(1-2):** 384-386.

Sridhar, K.R. and K.M. Kaveriappa (1989). Observations on aquatic hyphomycetes of the Western Ghat streams, India. *Nova Hedwigia*, **49(3-4):** 455-467.