



## Four interesting Hyphomycetes from Himachal Pradesh

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### ABSTRACT

*Dictyosporium heptasporum* (Garov.) Damon, *Torula ellisii* Yadav & Lal, *Torula herbarum* (Pers.) Link and *Ceratosporium fuscescens* Schwein (anamorphic fungi- hyphomycetes), collected from Himachal Pradesh (North-Western Himalayas), are being described and illustrated. *Dictyosporium heptasporum* and *Torula ellisii* are being recorded for the first time from Himalayas.

**Key words:** Anamorphic fungi, Hyphomycetes, Himalayas, India.

### INTRODUCTION

This communication is in continuation with our earlier reports on new records of anamorphic fungi from Himachal Pradesh, North-Western Himalayas (Prasher & Verma 2012a, b). During the surveys of saprobic conidial fungi occurring on dead wood, branches, bark, twigs and leaves four interesting hyphomycetes viz. *D. heptasporum*, *T. ellisii*, *T. herbarum* and *C. fuscescens* were collected. These are described and illustrated. *Dictyosporium heptasporum* and *Torula ellisii* are new records for Himalayas (Bilgrami et al. 1991 and Jamaluddin et al. 2004).

### MATERIALS AND METHOD

Decaying culms, leaves, twigs, bark and dead wood have been collected into separate ziplock plastic bags and brought to the laboratory. The specimens have been mounted on glass slides either in 4% KOH or Lactophenol Kirk et al. (2008). The specimens were studied microscopically under Matrix stereo trinocular microscope (VL-Z60) and transmission microscope (VRS-2f) for macroscopic and microscopic characters. All the measurements have been taken with the help of Pro MED software. The specimens have been deposited in herbarium of Department of Botany, Panjab University (PAN). The map was constructed with

DIVA-GIS 7.5.0 software (Hijmans et al. 2011) by using the geographical co-ordinates recorded at the site from where the samples collected to depict the distribution of species.

### RESULTS

#### Taxonomic description

*Dictyosporium heptasporum* (Garov.)  
Damon, Lloydia 15: 118 (1952) **Fig. 2**

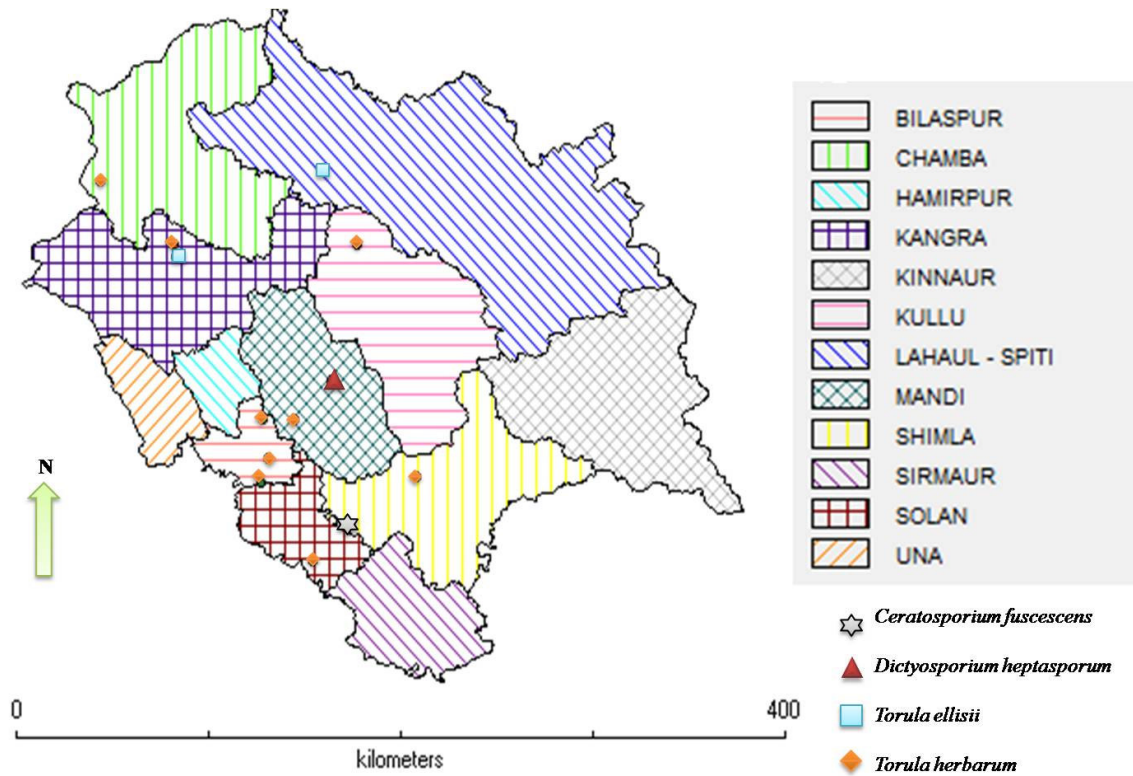
=*Cattanea heptaspora* Garov., Rc. Ist. Lomb.,  
Milano, ser. 2 8: 125 (1875)

=*Speira heptaspora* (Garov.) Lindau, Rabenh.  
Krypt.-Fl., Edn 2 (Leipzig) 1.9: 201 (1908)

Colonies on the natural substratum conspicuous, black, scattered in the form of compact sporodochia. Sporodochia 132–416 µm in diameter. Conidiophores hyaline, thin walled, short. Conidia 62–75×19–27µm, cylindrical in lateral view, clavate, cheiroid in ventral view, smooth walled, consisting of a subhyaline, cubical truncate basal cell 4–6.5µm in diameter, on which 5–8 discrete mostly 7 discrete vertical rows of cells are inserted in different plane. These rows of cells are tightly appressed together as a cylinder and separate only under pressure. Each row somewhat recurved or distinctly hooked apices 14–18 eusepate, slightly constricted at septa, unbranched. Width of the separated arm is 6–7.5µm. Conidia devoid of appendages.

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**Fig. 1.** Map showing the distribution of *Ceratosporium fuscens*, *Dictyosporium heptasporum* *Torula ellisii* and *Torula herbarum* in Himachal Pradesh.

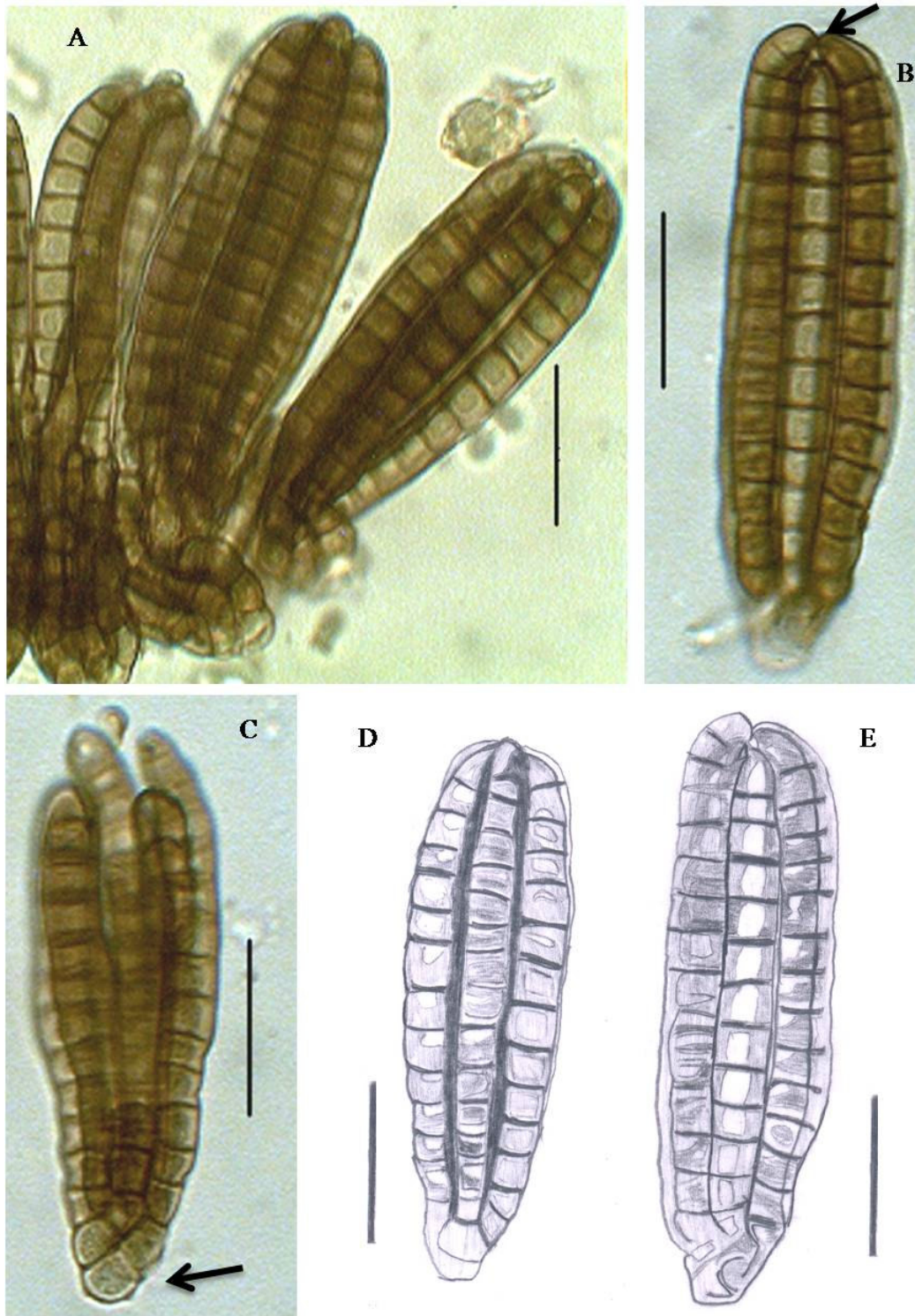
**Remarks:** The genus *Dictyosporium* is characterized by having micronematous conidiophores forming compact sporodochia or sometime effuses colonies. Conidia are holoblastic, cheiroid, with compact rows of cells which may be either flattened in one plane (complanate) or non flattened in different plane (not complanate) with or without hyaline appendages. Currently there are forty four accepted species of *Dictyosporium* Whitton et al. (2012) which include thirty species having conidia without appendages and fourteen species with conidia having hyaline appendages. Twenty nine species have complanate type of conidia and fourteen species have non complanate type conidia and one species *D. inflatum* have arms closely appressed at the base (*Dictyosporium* type) and diverse towards the apex (*Digitodesmium* type) Kirschner et al. (2012). Twelve species have been reported from India (Bilgrami et al. 1991 and Jamaluddin et al. 2004 Manoharachary et al. 2007 and Patil & Borse 2012)

This collection corresponds well with the original description of the *Dictyosporium heptasporum* in morphological details (Ellis 1971). *D. heptasporum* constitute a new record for Himachal Pradesh as well as Himalayas. This species has been already reported from the various parts of the country i.e. Bangalore, Karnatka, Agra, Rajasthan and Jabalpur (Bilgrami et al. 1991 and Jamaluddin et al. 2004)

**Collection examined:** Rajnish Kumar Verma, PAN 30108, on fallen leaves of *Vanda* sp., Mandi, Himachal Pradesh, July 17, 2011.

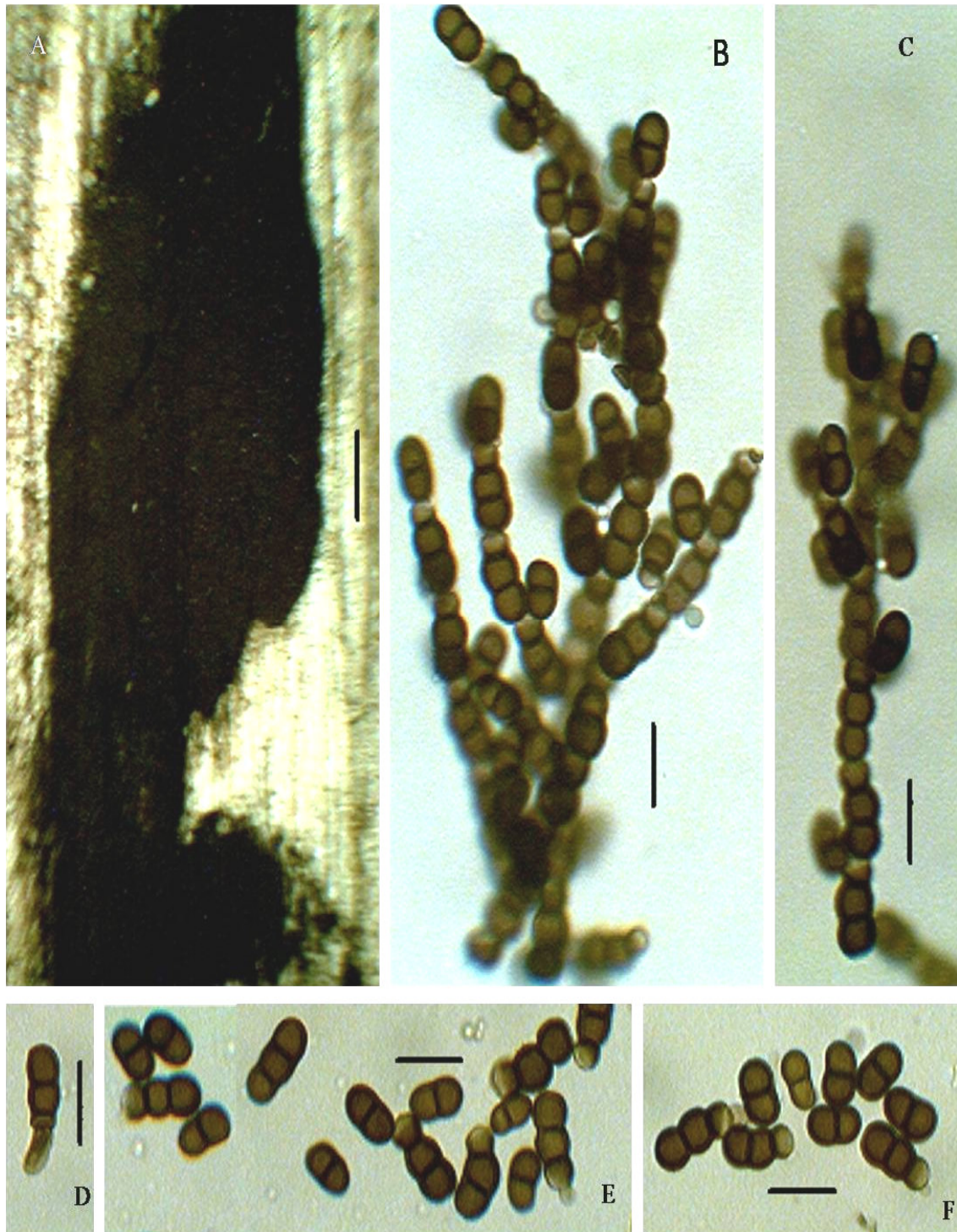
*Torula ellisii* Yadav & Lal, 1966, *J. Indian bot. Soc.*, **44**: 404 **Fig. 3**

Colonies on natural substrate effuse, black, powdery. Conidiophores pale brown, smooth, up to 7 µm long and up to 3 µm thick except for the conidiogenous cells which are 3.1-5.1µm in diameter. Conidia catenate, cylindrical, rounded at the ends or broadly



**Fig. 2.** *Dictyosporium heptasporum* **A.** Crush mount of Sporodochia **B.** Conidia with hooked apices **C.** Conidia with truncate basal cell **D, E.** Conidia with closely appressed arms. Scale Bar A-E = 20  $\mu$ m.





**Fig: 3** *Torula ellisii* A. Colonies on natural substratum B, C. Conidia in chain D. Conidiophore, conidiogenous cell and attached Conidia E,F. Conidia Scale Bar a= 500  $\mu$ m b-f= 10  $\mu$ m.

ellipsoidal, mid dark brown or reddish brown, smooth, slightly constricted at septa, almost all 1 septate rarely 2 septate and  $7.11-10.34 \times 4.2-6.31 \mu\text{m}$ .

**Remarks:** The genus *Torula* is characterized by micronematous or semi-macronematous unbranched or regularly branched straight or flexuous conidiophores. Conidiogenous cells polyblastic or some time monoblastic integrated and terminal determinate, usually spherical, which bear conidia simple or branched chains arising from the upper half of the conidiogenous cell, cylindrical with rounded ends, ellipsoidal or subspherical, brown or olivaceous brown, smooth, verruculose or echinated with 0, 1 or several transverse septa, strongly constricted at septa. Terminal cell of the conidia is a conidiogenous cell (Ellis 1971).

The above collection resembles the *T. ellisii* in morphological details (Ellis 1976). This is new record for Himachal Pradesh as well as Himalayas, though the species has been already reported from Mehboob Nagar and Andhra Pradesh (Bilgrami et al. 1991 and Jamaluddin et al. 2004).

**Collection examined:** Rajnish Kumar Verma, PAN 30358 on dead and decaying angiospermic twig Dharamshala, fallen twigs PAN 32602 Keylong, Himachal Pradesh.

*Torula herbarum* (Pers.) Link, Mag. Gesell. naturf. Freunde, Berlin 3(1-2): 19 (1809) **Fig. 4**

= *Monilia herbarum* Pers., Syn. meth. fung. (Göttingen) 2: 693 (1801)  
= *Torula herbarum* (Pers.) Link, Mag. Gesell. naturf. Freunde, Berlin 3(1-2): 19 (1809) f. *herbarum*  
= *Torula herbarum* f. *quaternella* Sacc., Annls mycol. 11(6): 556 (1913)  
= *Torula monilis* Pers., Ann. Bot. (Usteri) 15: 25 (1794)

Colonies on natural substratum very variable in size, sometimes only a few mm diameter, at others completely encircling stem and extending along them for several centimeters, black, velvety. Setae absent. Conidiogenous cells  $6.1-7.5 \mu\text{m}$  in diameter. Conidia catenate, straight or slightly curved, more or less cylindrical, rounded at the ends, dark brown, smoother, 1-3- (mostly 2) septate and  $9.4-21.2 \times 5.4-7.2 \mu\text{m}$ .

**Remarks:** The above collection resembles the type species in morphological details (Ellis 1971). The species have been earlier reported from the Solan (Bilgrami et al. 1991 and Jamaluddin et al. 2004) but the species has been first time reported from the

Bilaspur, Chamba, Kangra, Kullu, Mandi and Shimla districts of Himachal Pradesh, which indicates it is widely distributed in Himachal Pradesh (Bilgrami et al. 1991 and Jamaluddin et al. 2004).

**Collection examined:** Rajnish Kumar Verma PAN 30357, on dead and decaying leaves of *Pterospermum* sp. Bilaspur 19 Nov. 2012, PAN 32601 on fallen twigs Dharamshala, PAN 32558 on fallen twigs Swarghat 17 Nov. 2012, PAN 32605 on fallen twigs Narkanda, 2 Oct. 2013, PAN 32604 on *Urtica dioica*, Manali, 3 Oct. 2012, PAN 32640 on fallen dead twigs Jolplakhin, 22 July 2012, PAN 32650 on fallen twigs Sunder Nagar, PAN 32651 on fallen twigs Dalhausi 18 June 2014, PAN 32652 on fallen twigs Kasauli 10 Nov. 2011.

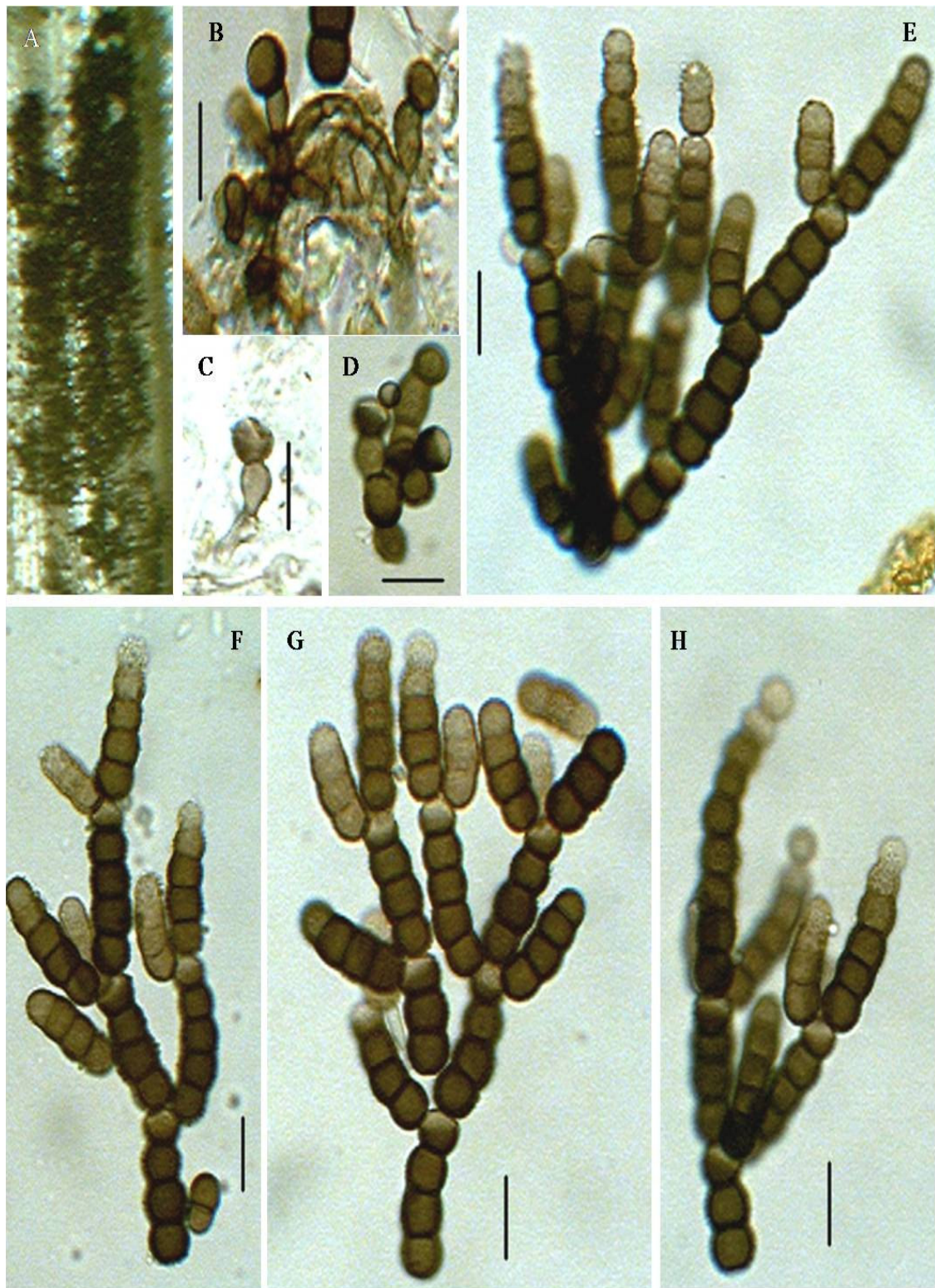
*Ceratosporium fuscescens* Schw., 1832, *Trans. Ann. Phil. Soc., N.S.*, 4: 300. **Fig.5**

Colonies on natural substratum effuse, dark brown, mycelium superficial and immersed, composed of septate, pale brown to brown, smooth-walled hyphae. Conidia solitary, basal cell single,  $8-12 \mu\text{m}$  thick at its broadest part, with 2-3 divergent arms arising from the apex, Arms divergent from the base, distal ends of the arms straight or flexuous, smooth, brown, pale brown toward the apex, arms 12-18 septate, not constricted at septa, up to  $192 \mu\text{m}$  long (most of unequal length),  $11-19 \mu\text{m}$  thick below, tapering to  $5-8 \mu\text{m}$ .

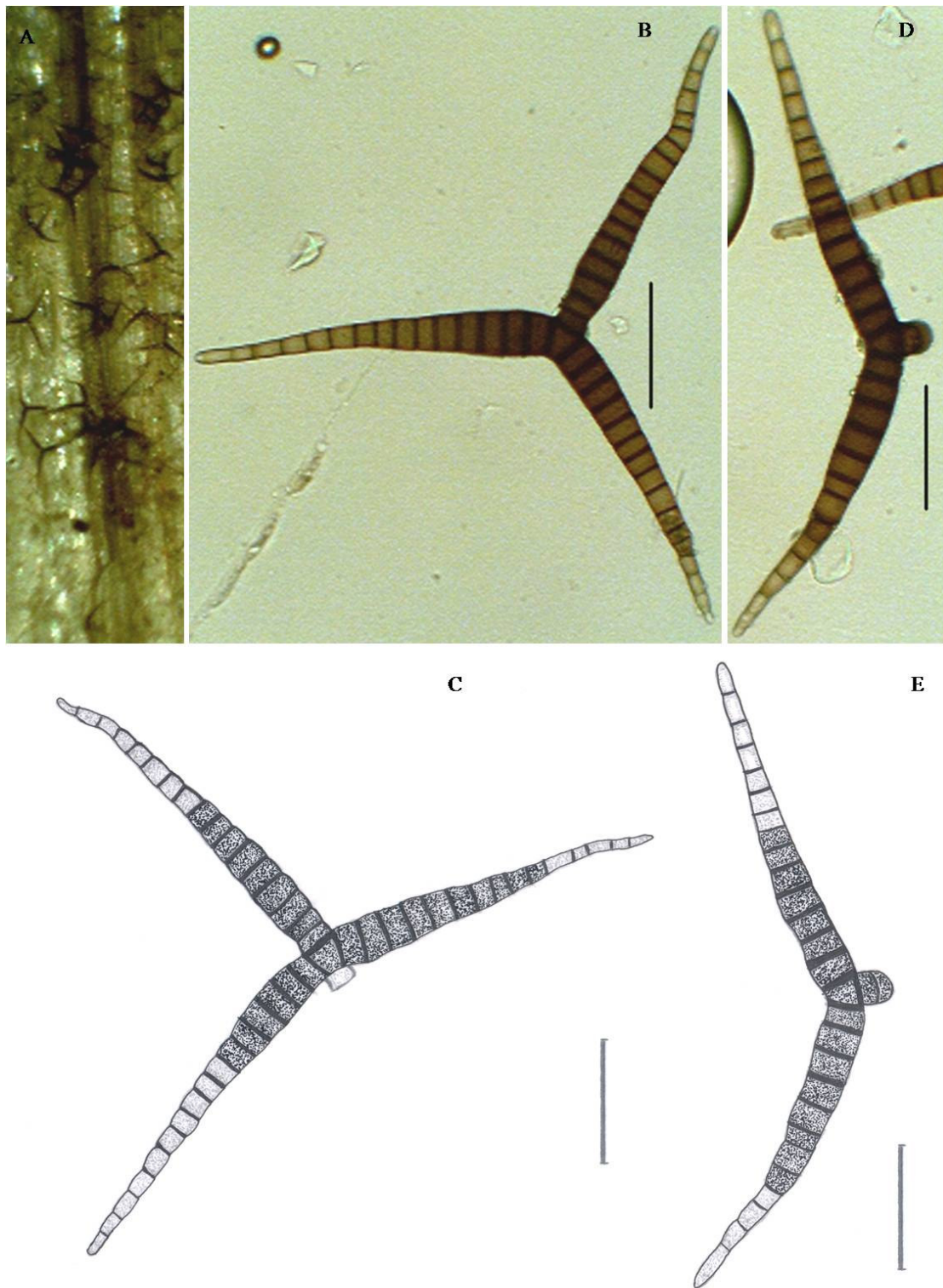
**Remarks:** The genus *Ceratosporium* was established by Schweinitz (1832) with type species *C. fuscescens*. The detailed account of taxonomy and conidial development was given by Hughes (1951). Hughes (1964) drew attention to the occurrence of secondary conidial fructification. The genus is characterized by inconspicuous flexuous brown conidiophores and integrated intercalary monoblastic determinate denticulate conidiogenous cells which produce solitary conidia with pyriform central cell and divergent pleuriseptate branches (Ellis 1971). There are eleven accepted species of *Ceratosporium* (Ma et al. 2014). Only three species viz. *C. fuscescens* Schwein., *C. productum* Petch and *C. indicum* V.G. Rao & D. Rao reported from India (Bilgrami et al. 1991 and Jamaluddin et al. 2004).

Conidia in our collection are shorter (up to  $192 \mu\text{m}$  vs.  $230 \mu\text{m}$ ), narrower at the base ( $11-19 \mu\text{m}$  vs.  $14-22 \mu\text{m}$ ). Despite these minor differences, we believe they are basically the same species. *Ceratosporium fuscescens* have been already reported from the Solan but first time reported from Shimla district of Himachal Pradesh (Bilgrami et al. 1991 and Jamaluddin et al. 2004)





**Fig. 4** *Torula herbarum* A. Colonies on natural substratum B-D. Conidiophores and Conidiogenous cells E-H. Conidia in chains. Scale Bar B-H= 10  $\mu$ m.



**Fig: 5** *Ceratosporium fuscescens* A. Colonies on natural substratum B,C Conidia with three appendages D,E Conidia with two appendages Scale Bar B-E= 50  $\mu$ m



**Collection examined:** Rajnish Kumar Verma, PAN 30110, on fallen twigs, Shogi (Shimla), Nov. 10, 2011.

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