

## MYCOFLORA ASSOCIATED WITH MELIOLACEOUS AND CAPNODIACEOUS FUNGI

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Thirty nine fungal species growing in association with Meliolaceous and Capnodiaceous forms are reported. Out of the thirty nine species reported here, four belong to Zygomycetes, one to Ascomycetes, three to Coelomycetes and the rest are Hyphomycetes. Most of the Hyphomycetes are dematiaceous forms. Many of them are common to the two types of habitats investigated, inspite of the fact that they were collected from two different ecologically diverse habitats and also provided varying ecological niches for their growth. The ecological significance of the microbial associations in the present study has been discussed.

**Keywords :** Capnodiaceous fungi; Ecological significance; Meliolaceous fungi; Mycoflora.

### Introduction

In tropical countries the Meliolaceous and Capnodiaceous fungi form a conspicuous part of mycological landscape. These include all dark or brown fungi growing superficially on the aerial parts, especially the leaves. Both the Meliolaceous (Meliolales) and Capnodiaceous (Sphaeriales) fungi belong to Pyrenomycetes. The phylloplane microflora has been investigated by Dickinson<sup>1-3</sup>, Lamb and Brown<sup>4</sup>, Preece and Dickinson<sup>5</sup>, Apinis *et al.*<sup>6</sup>, Norse<sup>7,8</sup>, Godfrey<sup>9</sup>, Stover<sup>10</sup>, Dickinson and Preece<sup>11</sup> and several others. Fraser<sup>12-14</sup> reported the constant association of *Cladosporium herbarum*, *Penicillium*, *Alternaria*, *Epicoccum*, *Asbolisia* with sooty moulds. Friend<sup>15</sup> also reported the occurrence of form like *Cladosporium herbarum*, *Epicoccum*, *Alternaria*, and *Fusarium* in association with the sooty moulds.

However, till date, no systematic effort has been made to study the various saprophytic micro-organisms associated with the two types of sooty moulds. The Meliolaceous and Capnodiaceous fungi found in different climatic and geographic conditions awakened the interest to explore the phylloplane mycoflora associated with two types of sooty moulds so that their ecological significance could also be understood.

### Materials and Method

The materials for the present study were collected from Mahabaleshwar, a hill station near Pune (altitude 1200-1500m above sea level, annual rainfall 620 cm) and also from the plains of Pune, Maharashtra (altitude 350m, annual rainfall 110 cm). The following species of *Meliola* were collected on various hosts from Mahabaleshwar during the winter months of December, January and February.

#### HOST

- 1 *Canthium diococcum* (Gaerth.) Merr.
- 2 *Gymnosporia rothiana* Laws
- 3 *Jasminum malabaricum* Wight.
- 4 *Pavetta indica* L.
- 5 *Litsea wightiana* Benth
- 6 *Memecylon umbellatum* Burm.

#### FUNGUS

- Meliola coilicosa*  
Nair and Kaul  
*Meliola casaericola* Hansf.  
*Meliola jasminicola* P. Henn.  
*Meliola psychotriae* Earle  
var. PAVETTAE Hansf. & Deight  
*Meliola litseae* Syd.  
var. *rotundipoda* Hansf.  
*Meliola memecyli* Syd.

The following Capnodiaceous forms were collected from Pune during winter months on three hosts as given below:

HOST	FUNGUS
1 <i>Alstonia scholaris</i> (Linn.) R. Br.	<i>Polychaeton</i> (Pers.) Lev
2 <i>Cassia fistula</i> Linn.	<i>Scorias spongiosa</i> (Schw.) Fries <i>Polychaeton</i> (Pers.) Lev.
3 <i>Gardenia gummifera</i> Linn.	<i>Polychaeton</i> (Pers.) Lev. <i>Scorias spongiosa</i> (Schw.) Fries

In both cases, the materials were collected in polythene bags and used for isolation on Potatò dextrose agar, Kauffman's modified malt extract (Wright), Mycological agar, Sabouraud's agar and Bandonis MYP agar using dilute plating suspension method and leaf impression technique. For examining fungal forms, the leaves were bleached with chlorine, dehydrated and mounted in canada balsam. Another method used was to lift the colonies from the leaves using collodion and collodion was then dissolved using acetone.

### Results and Discussion

Table 1 depicts the various saprophytic fungi isolated on species of *Meliola* and Capnodiaceae on their respective hosts in the two, quite distinct, habitats (hereafter referred to as Meliolaceous and Capnodiaceous habitats for easy reference for fungi collected from Mahabaleshwar and Pune respectively). The table clearly indicates the variation that exists in the number of fungi in the two types of habitats.

In all 34 forms were found in association with the meliolaceous fungi. These include *Mucor*, *Rhizopus* and *Cunninghamiella* of the Zygomycetes, and *Chaetomium* of the Ascomycetes. The great majority of them belonged to the Hyphomycetes, which included species of *Alternaria*, *Curvularia*, *Cladosporium*, *Cordana*, *Acroconidiella*, *Beltrania*,

*Drechslera*, *Nigrospora*, *Torula*, *Paecilomyces*, *Pithomyces*, *Trichoderma*, *Trichothecium* and *Verticillium*. Besides these, forms like *Fusarium*, *Penicillium* and *Aspergillus* also occur. Coelomycetes like *Pestalotiopsis* and *Phyllosticta* were also found in association with species of *Meliola*.

Saprophytes on Capnodiaceous fungi showed less diversity in comparison to those on species of *Meliola*, as only 21 species were found in association with Capnodiaceous with fungi. Zygomycetous and ascomycetous forms were the same as those on *Meliola* species. Hyphomycetous forms included species of *Alternaria*, *Curvularia*, *Cladosporium*, *Trichoderma*, *Fusarium*, *Gliomastix*, *Aspergillus*, *Paecilomyces*, *Setodochium*, *Scytalidium*, *Torula*, *Acromoniella*, *Diplodia*, *Phyllosticta* and *Pestalotiopsis*, represented the Coelomycetes.

Occurrence of a large number of saprophytes on *Meliola* species is possibly due to the fact that these sooty moulds restrict themselves to either circular spots or scatter sparsely on the host leaf, providing a lot of space for the saprophytic fungi to grow on the leaf surface. Also, at the start of colonization, there are likely to be excess nutrients in the ecosystem leading to a diversity of species.

The two groups of fungi were collected from two different habitats. Despite the different ecological conditions which prevail in the two different habitats, a number

Table 1. Different Fungi found in association with Meliolaceae and Capnodiaceae fungi.

Fungus	Meliola caesari-cola on Gymnosporia rothiana	Meliola coili-cosa on Canthum diococcum	Meliola jasminicola on Jasmi-num Mala bar icum	Meliola litreae on Litsea wight iana	Meliola memecyli on Meme-cylon umbellatum	Meliola psychotrial Earle on Pavetta indica	Capnodi-aceae on Atstonia scholaris	Capnodi-aceae on Cassia fistula	Capnodi-aceae on Gardenia Gumm-ifera
	1	2	3	4	5	6	7	8	9
<i>Acremoniella atra</i> (Corda) Sacc.	-	-	-	-	-	-	-	-	+
<i>Acroconidiella tropaeoli</i> (Bond) Lindquist & Alippi	-	-	-	-	+	-	-	-	-
<i>Alternaria phargospora</i> van Emden	-	-	-	-	+	+	-	+	-
<i>Alternaria raphani</i> Meier, Drechs & Eddy	-	+	-	-	+	-	-	+	-
<i>Alternaria radicina</i> Gover & Skolko	-	-	-	-	+	-	-	+	-
<i>Aspergillus flavus</i> Link ex Fries	+	-	-	-	-	+	+	+	+
<i>Aspergillus phoenicis</i> (Corda) Thom.	+	-	-	+	-	-	-	-	-
<i>Beltrania rhombica</i> O. Penzig	-	-	-	+	-	-	-	-	-
<i>Chaetomium seminudum</i> Ames	-	+	-	-	+	-	-	-	+
<i>Cladosporium chlorocephalum</i> (Fresen) Mason & Ellis	-	-	-	+	+	-	-	-	-
<i>Cladosporium cladosporioides</i> (Fresen) de Vries	-	-	-	-	+	+	-	-	-
<i>Cladosporium oxysporum</i> Berk & Curt.	-	-	+	+	-	+	-	+	+
<i>Cunninghamella ehinulata</i> Thaxter	-	-	-	-	+	-	-	-	+
<i>Curvularia brachyspora</i> Boedijn	-	-	+	+	-	-	-	-	-
<i>Curvularia pallescens</i> Boedijn	+	-	+	+	+	+	+	-	+
<i>Curvularia leonensis</i> Ellis	-	-	-	+	-	-	-	-	-
<i>Cordana musae</i> (Zimm.) Hohnel	+	+	-	-	-	-	-	-	-
<i>Diplodia</i> sp. Fr.	-	-	-	-	-	-	-	-	+
<i>Drechslera australiensis</i> (Bugnicourt) Subram & Jain	+	+	-	-	-	-	-	-	-
<i>Drechslera</i> State of <i>Coahiliobolus spicifer</i> Nelson	+	-	-	-	-	-	-	-	-
<i>Drechslera erythrospila</i> (Drechs) Showmaker	-	+	-	-	+	-	-	-	-
<i>Fusarium oxysporum</i> Schl. ex Fries	-	+	+	+	-	-	+	+	+
<i>Gilimastix novaezelandiae</i> Hughes & Dickinson	-	-	-	-	-	-	+	-	-
<i>Mucor hiemalis</i> Wehmer	-	+	-	+	+	+	-	-	-
<i>Nigrospora sphaeria</i> (Sacc.) Mason	-	-	+	-	-	-	-	-	-
<i>Paecilomyces varioti</i> Bainier	-	-	-	-	-	+	+	-	-
<i>Penicillium citrinum</i> Thom.	+	-	-	-	-	-	-	-	-
<i>Pestalotiopsis sydowiana</i> (Bresadola) Sutton	+	+	+	-	+	+	-	+	-
<i>Phyllactica</i> Sp. (Pers.)	-	+	-	-	+	-	-	+	-
<i>Pithomyces chartarum</i> (Burk & Curt) Ellis	-	-	-	-	-	+	-	-	-
<i>Rhizopus nigricans</i> Ehrenberg	-	-	-	-	-	-	+	+	-
<i>Rhizopus oryzae</i> Went, cf. Gerlings	+	-	-	-	-	+	-	+	-
<i>Scytalidium lignicola</i> Pesante	-	-	-	-	-	-	-	-	+
<i>Setodochium</i> sp. Bat. & Cif.	-	-	-	-	-	-	-	+	-
<i>Torula ellisi</i> Vadav & Lal	-	-	-	+	-	-	-	-	-
<i>Torula herbarum</i> (Pers.) Link ex Gray	+	-	-	-	+	+	-	-	+
<i>Trichothecium roseum</i> (Pres.) Link ex Fries	-	-	+	+	-	+	-	-	-
<i>Trichoderma vivide</i> (Pers.) Fries	+	-	-	+	+	-	-	+	-
<i>Verticillium luteo album</i> (Link ex Fries) Subran	+	-	-	+	+	-	-	-	-

of fungi like *Torula herbarum*, *Phyllosticta* sp., *Pestalotiopsis sydowiana*, *Fusarium oxysporum*, *Curvularia variota*, *Alternaria phragmospora*, *A. radicina*, *Cladosporium oxysporum*, *Cunninghamiella echinulata*, *Rhizopus oryzae* and *Chaetomium seminudum*, were found to be common. At the same time, however, some of the forms were found only in the Meliolaceous habitat, and others only in the Capnodiaceous habitat.

Species richness, a measure of diversity, gives insight into the ecological functioning of a community. Unfortunately studies on the ecological aspects on fungi are meagre. The present study has, nonetheless, very clearly brought out the role of environment of the development of microbial communities, and the interactions operating between the host and the fungal populations. Favourable conditions for the growth of *Meliolia* sp. and various saprophytes seem to exist in Mahabaleshwar, while Pune, favoured the growth of Capnodiaceous members, and comparatively a lesser number of saprophytes.

As to why these sooty mould fungi, in general allow a number of saprophytic fungi to grow on them, is perhaps due to their ability to provide a suitable medium for the growth of these saprophytes. A physiological factor of great importance which is shared by all sooty mould forming fungi is that they are able to make use of the intermittent moist conditions of the atmosphere. The sooty mould fungi form thick mycelial mat. The mycelia have a gelatinous matrix which is a source of nutrients for the transient fungi as also pointed out by Reynolds<sup>16</sup>. In addition, success of a new species invading a colonized substrate would depend on the competitive ability, the amount of inoculum, and the competitive abilities of the established microflora. Also, antagonism may be existing. Antagonism between *Alternaria* and *Fusarium* and also

between *Cladosporium* and *Spirococcum* and *Chaetomium* and *Curvularia*, *Chaetomium*, and *Cladosporium* has been reported<sup>17,18</sup>. The present study also confirms the antagonistic relationship between *Alternaria* and *Fusarium*. However, this antagonism is existing on species of *Meliolia* only and it is not found on Capnodiaceae members. Studies have shown that infection of wheat leaves by *Septoria nodorum* or *Cochiliobolus sativus* was stimulated when aphid honey dew was added to the inoculum. Simultaneous inoculation with three yeast like fungi and *Cladosporium herbarum* decreased this stimulation. These saprophytes thus acted as biocontrol agents<sup>19</sup>.

#### References

1. Dickinson C H 1967, *Can. J. Bot.* **45** 915
2. Dickinson C H 1973a, *Pesticide Science* **4** 563
3. Dickinson C H 1973b, *Trans. Brit. Mycol. Soc.* **60** 423
4. Lamb R J and Brown, J F 1970, *Trans. Brit. Mycol. Soc.* **60** 383
5. Preece T I and Dickinson C H (eds.) 1971, *Ecology of Leaf Surface Microorganism*. Academic Press, London.
6. Apinis A E, Chester C G C and Taligoola H K 1972, *Nova Hedwigia* **23** 113
7. Norse D 1972a, *Trans. Brit. Mycol. Soc.* **59** 261
8. Norse D 1972b, *Ibid.* **58** 515
9. Godfrey B E S 1974, *Trans. Brit. Mycol. Soc.* **62** 305
10. Stover R.H. 1975, *Trans. Brit. Mycol. Soc.* **65** 328
11. Dickinson C H and Preece T I 1976, *Microbiology of Aerial Plant Surface* Academic Press, New York.
12. Fraser L 1933, *Proc. Linn. Soc. N.S.W.* **58** 375
13. Fraser L 1934, *Ibid.* **59** 123
14. Fraser L 1937, *Ibid.* **62** 35
15. Preece T I and Dickinson C H (eds.) 1971, *Ecology of Leaf Surface Micro-organisms* Academic Press, London.
16. Reynolds D R 1975; *Nova Hedwigia*. **26** 179
17. Magan N and Lacey J 1984, *Trans. Br. Mycol. Soc.* **82** 305
18. Wicklow D T and Carroli G C 1981, *The fungal community : Its Organisation and Role in the Ecosystem* Marcel Dekker, New York.
19. Fokkema N J, Riphagen I, Poot R J and de Jong C 1983, *Trans. Br. Mycol. Soc.* **81** 355