

Seasonal variation of Air mycoflora over Som plantation at Goalpara district of Assam during various Muga crop seasons

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ABSTRACT

Fungal spores are widely distributed over the world which constitute the major component of the air borne microflora. They are affected by various environmental factors such as temperature, humidity, moisture, wind and geographical location. Seasonal variation affect the distribution of fungi of particular area. Occurrence and types of fungal species change with season and geographical locations. A study was conducted on air mycoflora over Som (*Persea bombycina*) growing areas of Goalpara district of Assam during various seasons of the year 2014. The site for the study represents a rural & semi urban area. A total of 11 species of fungi were isolated and identified on the basis of colony morphology, mycelia, sporangiophore and spore structure from different groups. Among all the species the dominant fungal genera prevailing on the air of Som plantation area are *Aspergillus niger* and *Rhizopus stolonifer*. The other species includes *Aerobasidium pullulans*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus candidus*, *Alternaria alternate*, *Cladosporium cladosporioides*, *Curvularia lunata*, *Fusarium oxysporum* and *Penicillium chrysogenum*. The mycoflora were isolated by using Culture method or Gravitational setting method on Potato Dextrose Agar, Martins Rose Bengal Agar and Czapek's Dox Agar medium supplemented by suitable antibiotics. It has been observed that over the last few years, study on airborne fungi gaining significant progress because of medical and phytopathological consequences associated with fungal spores. The seasonal & monthly variation of these airborne fungi were studied qualitatively and quantitatively. The present study was conducted to elucidate the distribution and occurrence of airborne fungi throughout the year 2014.

Keywords: air mycoflora, Som, seasonal variation, Goalpara district

INTRODUCTION

The widely distributed air borne fungal spores are affected by seasonal variation and various environmental factors. *Persea bombycina* (King ex Hook.f.) Kosterm., locally known as Som is the primary food plant of golden silk producing Muga silk worm (*Antheraea assamensis* Helfer.). They are based solely on morphological and physiological characteristics, which are easily influenced by the environment. Different types of microorganisms are responsible for causing different diseases to mugasilkworms as well as to the food plants. It is gradually become evident that a good numbers of fungi do not exist in nature individually, but a number of microorganisms (viz. fungi, bacteria and algae) are present in the air, rhizosphere, phylloplane and in other habitats in the host or in close proximity of that host. So the presence of a pathogen doesnot always signify the possibility of initiation of a disease.

Sometimes different organisms occurring together may be individually involved in disease syndrome, while in some cases some may not be non-pathogenic. Variations in altitude and climatic conditions such as temperature, relative humidity, rainfall etc. prevailing in Northeastern region are responsible for development of different diseases and insect pest as well. The diversity microorganisms in air, phylloplane and soil have been studied by different workers. Some aerobiological studies conducted in India have been made by Rajan *et al.*¹¹; Sreeramulu & Ramalingam¹⁵; Mehrotra & Claudius¹⁰, Agarwal *et al.*¹; Ramalingam¹², Bhati & Gaur³. Aerobiological studies have received much attention recently because of applications in the field of allergy, dispersal of pathogens & in allied aspects of microbiology.

Goalpara district is situated at a distance of 146 km from Guwahati, the capital city of Assam. The district covers an area of 1,824 sq. km and is bounded by West and East Garo hill districts of the state of Meghalaya on the south Kamrup district on the east, Dhubri district on the west and the Brahmaputra all along the north. It is located between latitudes 25.53 degree and 26.30 degree North and longitudes 90.07 degree and 91.05 degree east. Sericulture in Goalpara district existed almost as a practice amongst the people since a long time. Goalpara district has been given the geographical identification mark because its climate is suitable for silkworm rearing⁸. In accordance with Assamese calendar the Six different generations of Muga silkworm in a year are known as i) Jarua-winter ii) Chatua-early spring iii) Jethua-spring iv) Aherua-early summer v) Bhodia- Summer vi) Kotia –late summer or early winter. As the air, phylloplane and soil microflora maintains a cyclic pattern, it may ultimately affect the muga silk worm. Hence, the present study is conducted to study the air mycoflora over Som plantation area during all these 6 generations of the muga silkworm rearing on the year 2014.

MATERIALS AND METHODS

The study was conducted at Goalpara district of Assam, represents a rural & semi urban area during January to December, 2014. Three sites were selected namely Agia Sericulture firm, CMG dorapara and Dudhnoi sericulture firm for collecting the samples of airborne fungi over the year during the 6 muga crop seasons. Samples were collected using the culture (gravitational setting) method with petridishes containing Potato Dextrose Agar (PDA), Martins Rose Bengal Agar (MRBA) and Czapek's Dox Agar medium supplemented with Chloramphenicol (250mg/ml) to prevent bacterial growth. After exposing the plate for 10-15 minutes at 2-3 meter height above the ground level they were transferred to the laboratory and kept for incubation at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for a period of 7 days and then the plates are examined for the development of fungal colonies. The isolated fungi were identified. The mycelia and spore characters of fungi were studied under microscope (Labomed, Germany) using Lactophenol cotton blue staining and with the help of "A manual of soil fungi by Gilman⁷ and illustrated genera of imperfect fungi by H.L. Baranatt².

Fig.1: Images of collection of air sample from Som plantation area and their growth after 7 days of incubation period



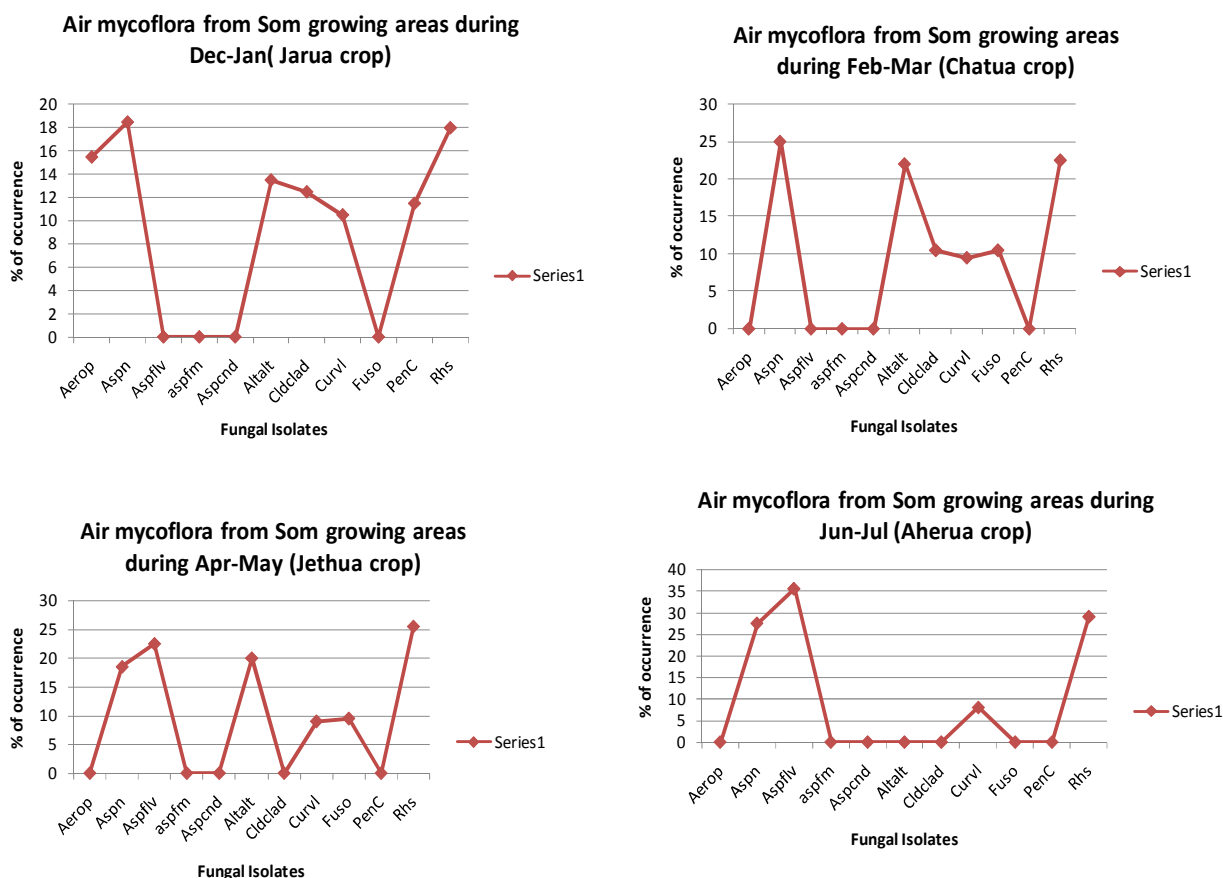
RESULTS AND DISCUSSION

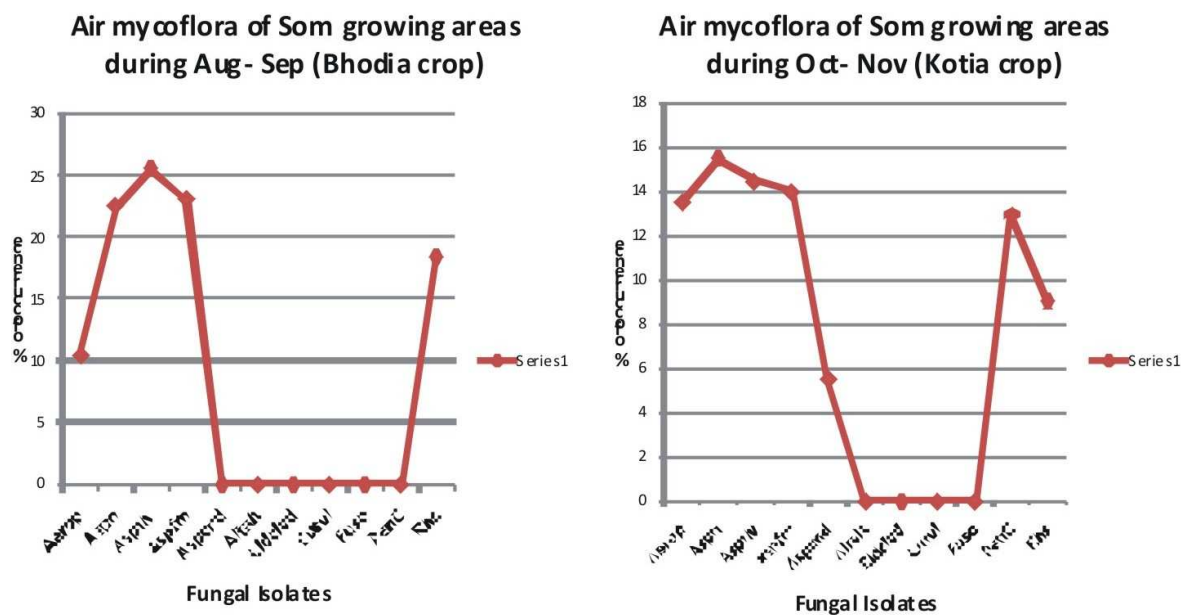
During the study period, a total of 11 species of fungi were isolated and identified on the basis of colony morphology, mycelia, sporangiophore and spore structure from different groups. Among all the species the dominant fungal genera prevailing the whole year on the air of Som plantation area are *Aspergillus niger* and *Rhizopus stolonifer*. The other species includes *Aerobasidium pullulans*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus candidus*, *Alternaria alternate*, *Cladosporium cladosporioides*, *Curvularia lunata*, *Fusarium oxysporum* and *Penicillium chrysogenum*.

Table.1. Percentage of occurrence of aeromycoflora from Som growing areas during the year 2014, at Goalparadistrict, Assam during various Muga crop seasons

Fungal isolates	Dec-Jan (Jarua)	Feb-Mar (Chatua)	Apr-May (Jethua)	Jun-Jul (Aherua)	Aug-Sep (Bhodia)	Oct-Nov (Kotia)
<i>Aerobasidium pullulans</i>	15.5	0.0	0.0	0.0	10.5	13.5
<i>Aspergillus niger</i>	18.5	25.0	18.5	27.5	22.5	15.5
<i>Aspergillus flavus</i>	0.0	0.0	22.5	35.5	25.5	14.5
<i>Aspergillus fumigates</i>	0.0	0.0	0.0	0.0	23.0	14.0
<i>Aspergillus candidus</i>	0.0	0.0	0.0	0.0	0.0	5.5
<i>Alternaria alternata</i>	13.5	22.0	20.0	0.0	0.0	0.0
<i>Cladosporium cladosporioides</i>	12.5	10.5	0.0	0.0	0.0	15.0
<i>Curvularia lunata</i>	10.5	9.5	9.0	8.0	0.0	0.0
<i>Fusarium oxysporum</i>	0.0	10.5	9.5	0.0	0.0	0.0
<i>Penicillium chrysogenum</i>	11.5	0.0	0.0	0.0	0.0	13.0
<i>Rhizopus stolonifer</i>	18.0	22.5	25.5	29.0	18.5	9.0

Fig.2: Occurrence of aeromycoflora over Som during various crop seasons of muga silkworm





Abbreviations: Aerop- *Aerobasidium pullulans*, Aspflv- *Aspergillus flavus*, Aspfm- *Aspergillus fumigatus*, Aspcnd- *Aspergillus candidus*, Altalt- *Alternaria alternate*, Cldclad- *Cladosporium cladosporioides*, Curvl- *Curvularia lunata*, Fuso- *Fusarium oxysporum*, PenC- *Penicillium chrysogenum*, Rhs- *Rhizopus stolonifer*

The cultural, morphological and microscopic study revealed the characteristics of vegetative and reproductive structure of the fungal isolates. It is seen that during Jarua, Chatua and Kotia muga crop seasons the dominant aeromycoflora of Som plantation area were *Aspergillus niger* and on Jethua generation the dominant fungal genera were *Rhizopus stolonifer*, whereas during Aherua & Bhodia muga crop generation of muga crop season the dominant air mycoflora on som vegetation were *Aspergillus flavus*. The results clearly indicates that seasonal as well as monthly variation of climatic factors such as temperature, humidity, rainfall etc of the particular area affect the distribution of airborne fungal flora.

A very few works have been carried forward on the field of aeromicrobiology at the Northeast part of India, including Assam. No systematic studies have been made on aeromycoflora under agroclimatic condition of Goalpara district, Assam. Hence an attempt has been made to investigate the same. However, few works have been done on aeromicrobiology over tea plantation area. Debnath and Baruah⁵, Dutta *et al.*⁶ made a study over aeromicroflora of tea plantation area. Bhattacharjee *et al.*⁴ conducted a study on aeromycology at a bus terminus in Guwahati, Assam. Similarly Ray & Mishra¹³ conducted a study on aeromicroflora both at indoor and outdoor environment of a B.N College campus of Dhubri district of Assam. In all the studies there is a little difference on the occurrence and distribution of mycoflora. Sharma¹⁴ on her study on aeromycoflora in relation to soil mycoflora of Darjeeling tea garden recorded 16 fungal species. During her study she observed *Aspergillus fumigatus* showed maximum percentage followed by *Aspergillus flavus*. While in the present study *Aspergillus niger* showed the maximum occurrence followed by *Rhizopus* species. On the other hand Kulkarni⁹ on her study over public park recorded *Alternaria alternata* as a dominant fungus followed by *Aspergillus niger*. She also mentioned that however *Aspergillus* was found most predominated genus in the various studies conducted by different researcher at Raipur. Muhshin and Adlan¹⁶ on their study on Southern Iraq on seasonal distribution pattern of outdoor fungi recorded, *Cladosporium cladosporioides* as the dominant fungal genera over *Penicillium notatum*, *Alternaria alternata*, *Aspergillus niger* respectively. Dutta *et al.*,⁶ made a comparative study on the air, phyllosphere & soil mycoflora of tea plantation area of Cachar district, Assam where they reported *Aspergillus niger* showed highest occurrence in the month of June, July & September where as in the present investigation occurrence of *Rhizopus* species is gradually increased and highest in June- July. Hence from the above discussions it is seen that the seasonal variation as well as geographical location affects the fungal flora of the environment both in quantitatively and qualitatively.

The systematic studies will lead to the illustration of identification characters of pathogenic and non-pathogenic fungus occurring in Som ecosystem. The systematic characters will help to develop diagnostic keys supplemented with information on symptoms of diseases, its extent of damage, life cycle, and distribution and management strategies. The initial studies gave the qualitative and quantitative data on the aeromycoflora of som plantation area during all the generations of Muga silk worm rearing seasons of Goalpara district, Assam, India. More works will be carried and will be communicated due course of time.

CONCLUSION

The initial study over the year gives qualitative & quantitative data on the air mycoflora over the som plantation area . A total of 11 species of fungi were isolated and identified during the year and their occurrence with seasonal variation has been studied. The dominant fungal species found during the study period were the *Aspergillus niger* & *Rhizopus stolonifer*. More studies will be conducted and communicated due course of time.

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REFERENCES

1. Agarwal, M.K., Shivpuri, D.N. and Mukerji, K.G. Studies on the allergic fungal spores of the Delhi, India, metropolitan area. *Journal of Allergy.*, **44**: 193 (1969)
2. Baranatt H.L. Illustrated Genera of Imperfect Fungi . 2nd Ed, Published by Burgess Publishing Co. (1960)
3. Bhati, H.S. & R.D. Gaur. Studies on Aerobiology-Atmospheric fungal spores. *New Phytol.*, **82**: 519-527 (1979)
4. Bhattacharjee, Kathakalee; G.C. Sharma; S. Kalita. Aeromycological study in a bus terminus in guwahati city, Assam. *AJEBS*. **3(2)**: 311-319 (2012)
5. Debnath, S. and Baruah, P.K. Seasonal variation of air mycoflora over tea plantation in Jorhat district, Assam. *Ind. J. Aerobiol.* **21(2)**: 79-85 (2008)
6. Dutta, S; B.K. Dutta, P.K. Nath. Comparative study of air, phyllosphere and soil mycoflora of the tea plantation area of Cachar district, Assam. *Assam University Journal of Science & Technology: Biological and Environmental Sciences*, **5(1)**: 89-94 (2010)
7. Gilman Joseph Charles .A manual of soil fungi. Published by Printwell.(1995)
8. Goswami Chandrama and Manisha Bhattacharya. Contribution of Sericulture to Women's Income in Assam -A Case Study in Goalpara District of Assam, India. *International Journal of Scientific and Research Publications*, **3 (3)**: (2013)
9. Kulkarni, Pragma. Aeromycological profile of the public parks of Bhilai Township, Chhattisgarh, India. *Indian Journal of Science and Technology*; **4(5)**: 558-560 (2011)
10. Mehrotra, R.S. & Claudius R.S. Aerospora of Saugar University campus, *Bulletin of the Botanical Society of the University of Saugar.*, **15**:18 (1968)
11. Rajan , B.S.V., Nigam, A. & Shukla, B.K. A study of atmospheric fungal flora at Kanpur. *Proceedings of the Indian Academy of Sciences.*, **35**: 33 (1952)
12. Ramalingam, A. Aerospora of Mysore. *Proceedings of the Indian Academy of Sciences.*, **74**: 22 (1971)
13. Ray, Manjit Kumar and P.K Mishra, A preliminary Screening and identification of microflora in the outdoor and indoor environment of B.N.College, Dhubri, Assam. *Ann Plant Physiol.* **26(1)**: 35-39 (2012)
14. Sharma, Kavita,. Comparative study of Aeromycoflora in relation to soil mycoflora of Darjeeling tea garden, India. *Recent Research in Science and Technology*, **3(5)**: 84- 86 (2011)
15. Sreeramulu, T. & Ramalingam, A. A two year study of air spora of paddy field near Vishkhapatnam, *Indian journal of Agricultural Sciences.*, **36**: 111 (1966)
16. Muhsin Tawfik M. And Munirah M. Adlan. Seasonal distribution pattern of outdoor airborne fungi in Basrah city, southern Iraq. *Journal of Basrah Researches (Sciences)* **38(1)A**: 90-98 (2012)