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Seasonal variation of Aeromycoflora of *Hibiscus sabdariffa* Linn. (Roselle)

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Abstract

The present investigation deals with the study of aeromycoflora of *Hibiscus sabdariffa.* The aeromycological study of *Hibiscus sabdariffa* was done for a year, from June to May 2013. At around 870 fungal colonies were identified during the investigation period. The isolates consist of 23 genera with 57 species. In the present study the most dominating fungal species were varied with respect to season. Cladosporium *cladosporioides, fusarium pallidoroseum, Aspergillus niger, Cladosporium oxysporum, Curvularia lunata, Alternaria alternata, Aspergillus flavus, Aspergillus fumigates* were found to be dominant species. Further, the present study revealed that the percentage contribution recorded during winter season was higher (54.69%) followed by rainy season (28.59%) and summer season (16.65%) respectively.

Airborne fungi generate as single unit spores and sometimes as hyphal fragments, conidiophores, connected with inorganic particles as "Bioaerosol". These fungi are allergens as well as profoundly produce diseases in crop plant. Members of all the fungal groups in terrestrial habitats, regardless of their origin, may be found in the bioaerosols during their dispersal phase. Once the spores become airborne, they may colonize new suitable substrates exposed to the air[10]. Airborne fungal spores are originally created from plant, animal, and soil sources; however, some authors believed that airborne spores are mainly a contribution from vegetation[7]. These airborne fungal spores when settle on leaf surface and cellular structure (endophytes) for their growth and reproduction, cause diseases in host. Many scientists made contribution in study of airborne organisms in the different fields, on *Ocimum sanctum*[17], *Catharanthus roseus*[20] and on *Mentha arvensis*[19] plant. Some researchers worked on *Curcuma longa*[18], on cauliflower[13], on *Hibiscus sabdariffa* (Roselle) [15].

Hibiscus sabdariffa Linn. (Roselle) is a vegetable plant of West African origin. Roselle is a shrub belonging to the Family-

Malvaceae[1]. It is being widely cultivated in West Africa, Asia, Austria and many tropical countries. Its flowers, calyx, young shoot and leaves are consumable and are widely used by Chhattisgarhi tribes as well as among rural and urban dwellers. It is locally well known as 'Amari or jerra bhaji'. Its calyx has nutritional value. Chhattisgarh tribes used to preserve dry calyx and make drink during summers. It is coolant as well as has antioxidant property.

Fungus is the chief pathogen for *Hibiscus sabdariffa* in subtropical areas of india. *F. oxysporum* was isolated from the Roselle roots, rotten stems and seeds in Malasiya[11]. Fungal pathogen *F. oxysporum* is a ubiquitous pathogen, infecting several vegetable crops causing diseases such as, vascular wilt [2]. No previous documentation was reported on aeromycoflora in the field of *Hibiscus sabdariffa* culture. As the plant is very important with rest to its nutrient contents, medicinal properties and agriculture, the present study aimed to ascertain the aeromycoflora in the field of *Hibiscus sabdariffa*[9].

Futher, number and kinds of fungi are very much affected by the environmental conditions[12]. Composition of air mycoflora disappears with adverse change in humidity, temperature sunlight and suspension of organic as well as inorganic material. Thus, the local seasonal variations significantly affect the distribution of aeromycoflora of particular area. Seasonal variation of fungal spores in the air also depends both on internal biological factors and on external factors such as temperature, relative humidity and rain fall. The present study aimed to ascertain the effect of seasonal variation in aeromycoflora in the field of *Hibiscus sabdariffa*.

Field study of *Hibiscus sabdariffa*:

Study area for the present study was Abhanpur, in Raipur district, Chhattisgarh, India. It is a part of the Naya Raipur Township. It is located at 21°32 103 N 81°442 443 E, situated at Paloud. The studied crop, *Hibiscus sabdariffa* Linn., (Roselle) was 2.5 to 3.5m tall and has deep penetrating taproot. It consists of smooth, cylindrical, typically dark green colored and red colored stem. Leaves were alternate, colored, dark green to red, flower large red to yellow with dark centre (Photoplate 1). Following is the epoch of various stages of *Hibiscus sabdariffa* plant (Table-1). The aeromycoflora was observed in these stages with the help of Gravity Petri plate Methods.

Table-1. Observed stage and period of *Hibiscus sabdariffa*

S.No	Stage	Period
I.	Seedling	June-July
II.	Preflowering	Aug- September
III.	Flowering	Oct - Nov
IV.	Fruiting	Dec- Jan
V.	Senescent	Feb- March

Survey of Aeromycoflora: Gravity petriplate method :

For the study of aeromycoflora over the plants, 5 petriplates containing PDA (potato, dextrose, agar) media were used. The petriplate were exposed over cultivated *Hibiscus sabdariffa* field (Photoplate1) for 5-10 mts, then this petriplates were brought in to the laboratory and incubated at 25 ± 10 °C for 5 to

7 days (Photoplate 2). After incubation period, number of colonies was counted, identification with the help of available literature and finally identified from authentic authority: National centre of fungal taxonomy Delhi. Percentage contribution calculated from following formula[4].

$$\text{Percentage contribution} = \frac{\text{Total no. of colonies of individual species in all Observation taken together}}{\text{Total no. of colonies in all species}} \times 100$$

Overall 870 colonies were identified under 57 fungal types belonging to 23 genera from aeromycoflora of *Hibiscus sabdariffa* during 2013-2014. Out of the 57 fungal species, 04 fungal species (39 fungal colonies) belonging to 03 genera from Zygomycotina, 04 fungal species (43 fungal colonies) of 04 genera of Ascomycotina, 46 fungal species (756 fungal colonies) of 15 genera from Anamorphic fungi (some anamorphic fungi are showed on photoplate 3 and 4), 03 fungal species (32 fungal colonies) of 01 genera from Mycelia sterilia were observed. Out of total 57 fungal species maximum number of fungi 55 were recorded during winter season, moderate 37 during rainy season and minimum 16 were observed during summer season (Table-2).

Class wise percent contribution of fungal colonies with respect to seasons:

The seasonal percentage contribution of aeromycoflora was observed during the investigation period. In rainy season, the percentage contribution of Zygomycotina, Ascomycotina, Anamorphic fungi and Mycilia sterilia were 8.03, 3.61, 85.14 and 3.21 respectively. During winter season, percentage contribution of Zygomycotina, Ascomycotina, Anamorphic fungi and Mycilia sterilia were 2.94, 3.15, 92.01 and 1.89 respectively. Further for summer season, the percentage contribution of Zygomycotina, Ascomycotina, Anamorphic fungi and Mycilia sterilia were 3.44, 13.10, 73.10 and 10.34 respectively (Table 3) . The maximum percentage contribution (54.69) was recorded during winter season, followed by rainy season (28.59) and summer season (16.65) respectively. Also study the maximum percentage contribution of *Cladosporium* fungal species throughout the total fungal species.

Monthly variation:

Month wise percentage contribution of each class with respect to different month was also observed. Class wise (various fungal groups) percentage contribution were found to be vary from month to month. All the species were not found throughout the months. It is found that Anamorphic Fungi was most dominant throughout the year as compared to other fungal species. In the month of summers such as March, April and May, the percent contribution of fungal colonies was reduced or was absent (Table-4).

The Anamorphic fungal species were the largest contributors of the total airborne fungal species. *Cladosporium* were the most dominant type and maximum percentage contribution throughout the study period[16].

Table -2. Showing fungal groups distribution of aeromycoflora of *Hibiscus sabdariffa* (Roselle) throughout the year (2013 – 2014)

S. No.	Fungal groups	Fungal genera	fungal species	Fungal colonies
I.	Zygomycotina	3	4	39
II.	Ascomycotina	4	4	43
III.	Anamorphic Fungi	15	46	756
IV.	Mycelia sterilia	1	3	32
	Total	23	57	870

Table-3. Showing class and season wise percentage contribution of aeromycoflora of *Hibiscus sabdariffa* (Roselle)

S.No.	Name of fungal group	Rainy season	Winter season	Summer season
I.	Zygomycotina	8.03	2.94	3.44
II.	Ascomycotina	3.61	3.15	13.10
III.	Anamorphic Fungi	85.14	92.01	73.10
IV.	Mycelia sterilia	3.21	1.89	10.34

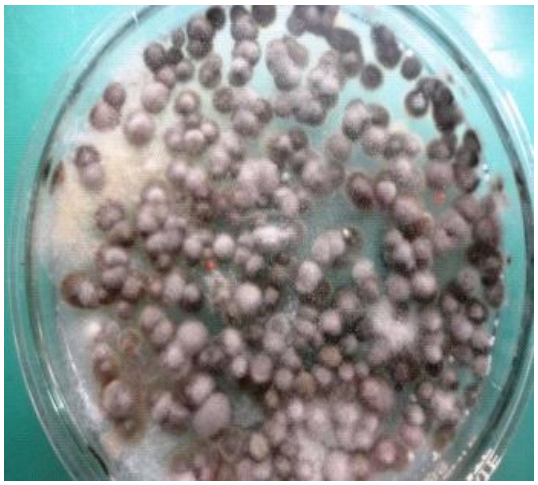
Table-4. Showing month wise, season wise and class wise percentage contribution of each fungal group to the total aeromycoflora of *Hibiscus sabdariffa* (Roselle)

S. no.	Name of fungal group	Rainy season				Rainy Season	Winter season				Winter season	Summer season				Summer season
		Jul	Aug	Sep	Oct		Nov	Dec	Jan	Feb		Mar	Apr	May	Jun	
I.	Zygomycotina	2.04	7.93	11.59	8.82	8.03	5.81	2.60	2.05	2.32	2.94	8.92	-	-	-	3.44
II.	Ascomycotina	-	3.17	1.44	8.82	3.61	5.81	1.73	1.36	4.65	3.15	7.14	-	36.36	19.44	13.10
III.	Anamorphic Fungi	97.95	85.71	81.15	79.41	85.14	84.88	92.17	95.20	93.02	92.01	67.85	87.09	63.63	75	73.10
IV.	Mycelia sterilia	-	3.17	5.79	2.94	3.21	3.48	3.47	1.36	-	1.89	16.07	12.09	-	5.55	10.34

Table-3 Total aeromycoflora of *Hibiscus sabdariffa* (Roselle)

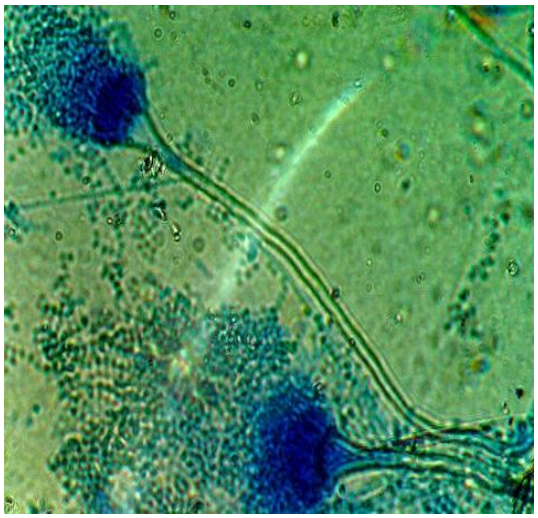
S. No	NAME OF FUNGI
ZYGOMYCOTINA	
•	*Mucor hemalis*
•	*Rhizopus oryzae*
•	*Rizopus stolonifer*
•	*Syncephalastrum racemosum*
ASCOMYCOTINA	
•	*Ascotrica chartarum*
•	*Emericella nidulans*
•	*Lewia infectaria*
•	*Thielavia terricola*
ANAMORPHIC FUNGI	
•	*Acremonium killiense*
•	*Acremonium strictum*
•	*Alternaria alternata*
•	*Alternaria humicola*
•	*Alternaria racticina*
•	*Aspergillus flavus*
•	*Aspergillus fumigates*
•	*Aspergillus japonicas*
•	*Aspergillus luchensis*
•	*Aspergillus niger*
•	*Aspergillus nidulans*
•	*Aspergillus ochracens*
•	*Aspergillus speluneus*
•	*Aspergillus sydowii*
•	*Aspergillus tamarii*
•	*Aspergillus terreus*
•	*Aspergillus versicolor*
•	*Cladosporium cladosporioides*
•	*Cladosporium oxysporum*
•	*Cladosporium sphaerospermum*
•	*Curvularia lunata*
•	*Curvularia oryzae*
•	*Curvularia ovoidea*
•	*Curvularia clavata*
•	*Drechslera indica*
•	*Fusarium chlamydosporum*
•	*Fusarium equiseti*
•	*Fusarium oxisporum*
•	*Fusarium pallidoroseum*
•	*Fusarium solani*
•	*Gilmaniella humicola*
•	*Myrothecium cinctum*
•	*Nigrospora oryzae*
•	*Oidiodedron griseum*
•	*Penicillium chrysogenum*
•	*Penicillium citrinum*
•	*Penicillium funiculosum*
•	*Penicillium frequentans*
•	*Penicilium versicolor*
•	*Penicillium notatum*
•	*Phoma glomerata*
•	*Phoma fimeti*
•	*Phoma herbarum*
•	*Sporidensmim cookei*
•	*Trichoderma hurzianum*
•	*Trichoderma spiralis*
MYCELIA STERILIA	
•	Mycelia sterilia (black)
•	Mycelia sterila (gray)
•	Mycelia sterila (white)

Photoplate 1: *Hibiscus sabdariffa*



Photoplate 2: Fungal culture in PDA plate

Photoplate 3: *A. fumigatus*



Photoplate 4: *A.oryzae*

The present study recorded altogether 57 fungi from all the places. *Aspergillus* and *Penicillium* contributed the maximum, *Cladosporium* is the fungal genus most correlated with meteorological parameters. This may be attributed to the size and nature of conidia. *Cladosporium* produces dry conidia in chains easily carried through the air. Therefore dispersion of *Cladosporium* spores is more influenced by meteorological parameters than *Alternaria* spores[3].

Environmental factor was the important physical factor, which effect the fungal

population and contribution. Maximum aeromycoflora isolated in winter season due to favorable condition. Similar result was also observed by reported over sugarcane[24]; scientist reported maximum fungal types during winter over rice field[5,22,23]. Similar results also observed over *Mentha arvensis*[19] and from leaf surface of *Ocimum sanctum*[17], from *Catharanthus roseus*[21] and from groundnut[14] researchers have also reported Maximum contribution in winter season, minimum % contribution in summer season and moderate recorded in rainy season. Meteorological factor included minimum and maximum temperature, relative humidity and rainfall[8]. These variables correlated with spore concentration.

The Anamorphic fungal species were the largest contributors of the total airborne fungal species. The distinction between dry-air spores and wet- air spores is well known. During January the air is dry. Dry-air spores include *Cladosporium, Alternaria, Drechslera* and *Curvularia*[6]. Monitoring of airborne fungi can be helpful in prevention of fungal allergic diseases. The predominance of fungal species, the dominance of Anamorphic followed by other fungal groups, concentration of individual fungal species, dominant fungal species, allergic and pathogenic specie show close correlation in occurrence and concentration in the aerospora.

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References :

1. Al-Hashmi, A.G. (2012). *African Journal of food Science, 6:* 506-511.
2. Amusa,N.A., A.A. Adegbite and M.O. Oladapo (2005). *Plant Pathology Journal, 4:* 122-125.
3. Awad, A.H. (2005). Aerobiologia, *21:* 53-61.
4. Jadhav, S. K. and K. L. Tiwari (1994). *Indian Botanical. Reporter. 1 :* 33-36.
5. Jadhav, S. K. (1996). Studies of aeromycoflora over rice field at Balodabazar, Raipur (M.P.). Ph.D. thesis Pt. Ravishankar Shukla University, Raipur (M.P.)
6. Katial R.K., Y.M. Zhang, R.H. Jones and P.D. Dyer (1997). *International Journal of Biometeorology.; 41:*17–22.
7. Lacey J., G.T. Cole and B. Kendrick (1981). Aerobiology of conidial fungi Biology of conidial fungi New York: Academic, 273.
8. Lall, B. M. (2008). Studies of indoor and outdoor aeromycoflora of Dr. Bhim Rao Ambedkar hospital Raipur (C. G.). Ph.D. Thsis, Pt. Ravishankar Shukla University, Raipur.
9. Mohamed, B.B., A.A. Sulaiman, A.A. Dahab (2012). Roselle (Hibiscus sabdariffa L.) in sudan, cultivation and their uses. *Bulletin of Pharmacology and Life Science 1:* 48-54.
10. Mohammed H., A. Raghda, B. Khaled, A. Radhi, I. Shaheen, (2010). *Jordan. Aerobiologia, 26:* 263.
11. Ooi, K.H. and B. Salleh (1999). *Biotropia, 12:* 31-41.
12. Pepeljnjak, S. and M. Segvic Klaric (2003). *Aerobiologia., 19:* 11-19.
13. Sahu, S.K. and K.L. Tiwari (1994). *Advance Plant Science, 7:* 203-211.
14. Sahu, S.K. and U. Gupta (1995). *Geobios*

New Reports, 14: 235-239.

15. Sahu, S., K. Sharma, S. Patra (2014A). Aeromycological study of *Hibiscus sabdariffa* (Roselle) in winter season. *International Journal of Scientific Reaserch, 3:* 467-468.
16. Sahu, S., K. Sharma, S. Patra (2014B). *Scholars Academic Journal of Biosciences, 2:* 529-531.
17. Sharma, K. (2001). Studies of aeromycoflora in relation to leaf surface mycoflora of *Ocimum sanctum* Linn plant. Ph.D. Thsis, Pt. Ravishankar Shukla University, Raipur.
18. Sharma, R. (2006). Studies on the leaf surface mycoflora and aeromycoflora of *Curcuma longa*, Ph.D. Thsis, Pt. Ravishankar Shukla University, Raipur.
19. Singh, N.B. (2006). Studies of aeromycoflora in relation to leaf surface mycoflora of *Mentha arvensis* Linn. Ph.D. Thsis, Pt. Ravishankar Shukla University, Raipur.
20. Saluja, P. K. (2005). Studies of aeromycoflora in relation to leaf surface mycoflora of *Catharanthus roseus* Linn. Ph.D. Thsis, Pt. Ravishankar Shukla University, Raipur.
21. Tiwari, K.L. and P. Saluja (2012). *Indian Journal Applied & Pure Biology, 27:* 59-64.
22. Tiwari, K.L. and S.K. Sahu (1995). *Advance Plant Science, 8:* 391-396.
23. Tiwari, P. (1999). Aerobiological studies of Raipur with special reference to fungal spores. Ph.D. Thesis Pt. Ravishankar Shukla University, Raipur.
24. Tilak, S.T. and R.L. Kulkarni (1970). Airospore over sugarcane fields. *International Symposium Pathology,* New Delhi.