

## Circadian periodicity study of some important fungal spores over Jowar crop field at Jamkhed, Dist. Ahmednagar.

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**ABSTRACT:** Circadian periodicity study of some important fungal spores over jowar crop such as *Aletrnaria*, *Cercopsora* and *Cladosporium* were recorded from data with the help of continuous volumetric “Tilak air sampler” during two Kharif seasons from 15<sup>th</sup> June 2009 to 20<sup>th</sup> October 2009 and 15<sup>th</sup> June 2011 to 24<sup>th</sup> October 2011. The aerobiological investigation was carried out over Jowar (*Sorghum vulgare*.Pers) crop field at Jamkhed Dist. Ahmednagar. The Circadian periodicity of *Aletrnaria*, *Cercopsora* and *Cladosporium* were coincided with respect to the meteorological parameters and it clearly pointed out that these spore types shows “Day spora” pattern. Highest count number of *Cercopsora* spores was recorded in the month of September where as *Aletrnaria* and *Cladosporium* spore types were reported in month of August respectively.

**KEYWORDS:** Circadian periodicity, Day spora pattern, Jowar, Tilak air sampler, *Aletrnaria*, *Cercopsora*, *Cladosporium*.

### Introduction

The dominant members like *Aletrnaria*, *Cercopsora* and *Cladosporium* spore concentration was maximum in rainy seasons in month of August and September were noticed. Their peak period of spores was recorded during the day time, hence known as “Day spora” pattern. Bhati and Gaur (1979) pointed out the structural aspect in atmospheric spores were useful for circadian periodicity. The occurrence of ascospores has a close relationship between the meteorological factors such as temperature, rainfall and relative humidity (Tilak, 1980). Spore production and discharge being correlated with low temperature and high humidity (Pady *et al.*, 1962). There is a close relationship between temperature, relative humidity and the rainfall to the release of spores. Gregory (1967) was pointed out that interpretations of the circadian periodicity studies are not always clear. A circadian periodicity is correlated to the some spore types for liberation mechanism and there is daily change in environmental factors. The dispersal of spore and occurrence of spores in air are always controlled by environmental conditions, hence the circadian periodicity patterns changes from place to place. Various workers such as, Patil (1985), Sreeramulu and Ramlingam (1966), Harvey (1970), Jogdand (1987), Subbareddy (1974), Tilak *et al.*, (1983), have studied circadian periodicity of some fungal spores from air. Trejo *et al.*, (2011) have reported airborne ascospores in Merida (SW Spain), He correlated the effect of rainfall and environmental parameters to the concentrations. Abu-Dieyeh and Barham (2014) studied concentration and dynamics of fungal spore populations in the air of Zarqa, Jordan. Thakur and

Jite (2015) studied the circadian periodicity of *Leptosphaeria* and *Didymosphaeria* spores.

To study the circadian periodicity, some important fungal spores such as *Aletrnaria*, *Cercopsora* and *Cladosporium* over jowar crop field, the present aerobiological investigation were used.

### Materials and Methods

In the aerobiological investigation over jowar crop field these fungal spores were recorded while studying airspora at Jamkhed Dist. Ahmednagar. Jamkhed is well known Tahasil of Ahmednagar district having an area of 772.3 sq. km area. It is located at 75<sup>o</sup> 45' in east longitude and 18<sup>o</sup> 25' north latitude. The air sampling was done with the help of volumetric continuous Tilak air sampler (Tilak and Kulkarni, 1970) for two Kharif seasons from 15<sup>th</sup> June 2009 to 20<sup>th</sup> October 2009 and 15<sup>th</sup> June 2011 to 24<sup>th</sup> October 2011. The daily environmental parameter such as temperature, relative humidity and rainfall was recorded continuously throughout period of investigation. The slide preparation, scanning, mounting and calculations were recorded with the help of method suggested by (Tilak and Srinivasulu, 1967). Identification was made by using authentic literature, reference slides, photographs etc.

### Result and Discussion

The mean of circadian periodicity curve for *Aletrnaria*, *Cercopsora* and *Cladosporium* were recorded on the basis of percentage obtained from the bihourly catches for 24 hour periods for each spore type from the data of the spores present in the

air (Figure 1, 2 and 3). *Aletrnaria*, *Cercopsora* and *Cladosporium* were taking vital role to airspora, present throughout the investigation period over Jowar crop field. Maximum spore catch of *Aletrnaria* spore has been reported in the month of August (24388/m<sup>3</sup> of air) whereas the highest daily count has been mentioned on 25<sup>th</sup> August 2011 (1708/m<sup>3</sup> of air) during Kharif second season.

Circadian periodicity curve study showed that during the day time spore concentration was high, recorded maximum in number during day time and during night time it decreases in number, so it was a "Day Spora" group. The number of this spore type increases from 10.00 to 12.00 hrs. and showing peak at 14.00 hrs. It again decreases during 14.00 to 16.00 hrs. and again increases at peak 18.00 hrs. Thus it shows double maxima pattern at 14.00 and 18.00 hrs., which showed that concentration was highest during day time and declined after evening and night hours.

Occurrences of *Aletrnaria* were noted maximum in the atmosphere in the month of August on 25<sup>th</sup> 2011 and total rainfall 104.6 mm, the average relative humidity 76.64%, and temperature 19.28°C were recorded. These environmental factors were responsible for favorable for the discharge of spores and increased concentrations of spores in atmosphere at high humid conditions, while on the dry days the spores were less in the air. Thus the spore type belongs to "Wet spora" group, which were released from pseudothecia was triggered by rainfall (Grinn- Gofron and Mika, 2008, Dawidziuk *et al.*, 2012).

The diurnal periodicity indicates that the highest peak concentration was during day time and low during night time. This spore was found throughout the day time during the period of investigation. Jogdand (1987) recorded peak between 14.00 hrs. and 16.00 hrs. during day time. Pady (1959) reported afternoon peak with occasional night peak, Meredith (1962), Pathak and Pady (1965) reported lower concentration slightly in the afternoon but increased to a second peak at 18.00 hrs. Derrick (1966) recorded conidia in large numbers to January, Sheehy and Huguelate (1967) encountered the spores between 09.00 hrs. and 16.00 hrs. with the highest peak usually occurring between 13.00 hrs and 16.00 hrs. Yousef-Al-Doory (1967) recorded their highest concentration in August. Schanck (1968) in Florida reported high concentration in June. The concentration suddenly increases after the rains.

Highest spore catch of *Cladosporium* spore has been reported in the month of August (33796/m<sup>3</sup> of air) while the highest daily count has been noted on 26<sup>th</sup> August 2009 (2100 /m<sup>3</sup> of air) during kharif first season 2009. The circadian periodicity studies of *Cladosporium* showed that the maximum number of spores were present during day time so it belongs to "Day spora" group. The *Cladosporium* spore type increases gradually

after morning hours and the highest peak was observed after afternoon at 16.00 to 18.00 hrs and showed that concentration dropped gradually during night hours. The incidence of *Cladosporium* spores was recorded maximum in the atmosphere in the month of August 2009 in relevance to total rainfall 88.14 mm, the average relative humidity 73.88%, and average temperature 19.66°C. Thus occurrence of this spore type could be correlated with the prevailing weather parameters like rainfall and humid conditions at optimum temperature.

The diurnal periodicity studies have carried out by many workers such as, Adams (1964) recorded 39% spores from the total caches and seasonal incidence was from June to September. K. Reddy (1987) reported their higher concentration having daily maxima between 10.00 hrs and 20.00 hrs and peak at about 18.00 hrs. Tilak and Srinivasulu (1967) at Aurangabad did not encounter *Cladosporium* from August to November which is an unusual record. Mishra and Shivastava (1969) found that the population of *Cladosporium* spores varied at different sampling periods in the different months and was governed by atmospheric conditions. Mishra and Kamal (1971) reported *Cladosporium* was dominant in winter whereas absent in summer and rainy seasons. Nasiruddin (1996) showed double maxima between 10.00 hrs and 20.00 hrs and peak at about 18.00 hrs. The Diurnal periodicity studies at present investigation agree with these of Gregoray and Sreeramulu (1999), Sreeramulu and Ramlingam (1963 and 1966).

Maximum concentration of *Cercopsora* spore has been reported in the month of September (21560/m<sup>3</sup> of air) whereas the highest daily count has been recorded on 13<sup>th</sup> September 2011 (1540 spores/m<sup>3</sup> of air) during kharif 2011. The circadian periodicity studies of *Cercopsora* pointed out that the maximum number of spore were present during day time hence it was a "Day spora" pattern. The number of this spore type increases gradually after early morning hours and the highest peak was obtained in morning at 10.00 to 12.00 hrs and observed that concentration of spores was maximum before afternoon and gradually decreases after afternoon and lowest during night time. The occurrence of *Cercopsora* was recorded maximum in the month of September 2011 which was correlated to the total rainfall i.e. 41.78 mm, the average relative humidity 75.09%, and average temperature 19.79°C.

Thus incidence of this spore type could be correlated with the prevailing weather parameters like rainfall and humid conditions at optimum temperature. Sreeramulu and Seshvataram (1962) reported a diurnal periodicity with a narrow peak at 09.00 hrs. Burger (1969) observed that conidial rapid drop was found with that of relative humidity which generally occurred from 08.00 to 11.00 hrs. Spore trap data showed a striking periodicity with

60% of total spore catches between 11.00 to 15.00 hrs. and only 5% between 12.00 to 20.00 hrs. Sreeramulu (1967) observed highest peak at 10.00 hrs in the forenoon with a gradual fall upto 16.00 hrs over groundnut field. Mane (1978) reported the total airspora over bajra field at Vaijapur having peak concentration at about 10.00 hrs.

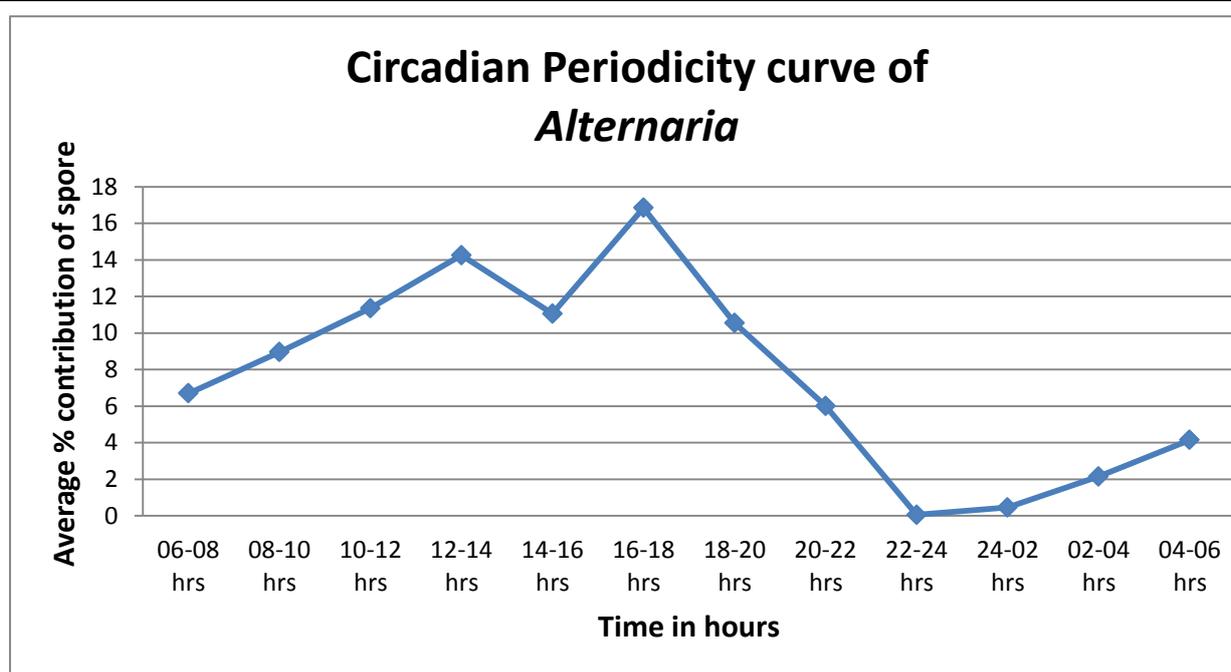
Sreeramulu and Ramlingam (1965) reported their daily peak between 08.00 hrs and 10.00 hrs., Ingold (1965), Mane and Tilak (1980) reported the peak between 06.00 to 08.00 hrs in the morning. Tilak and Babu (1983) make an aerobiological survey over Bajra field for the incidence of certain ascospores in the air. The

timing of peak concentration of both types varied slightly at Aurangabad.

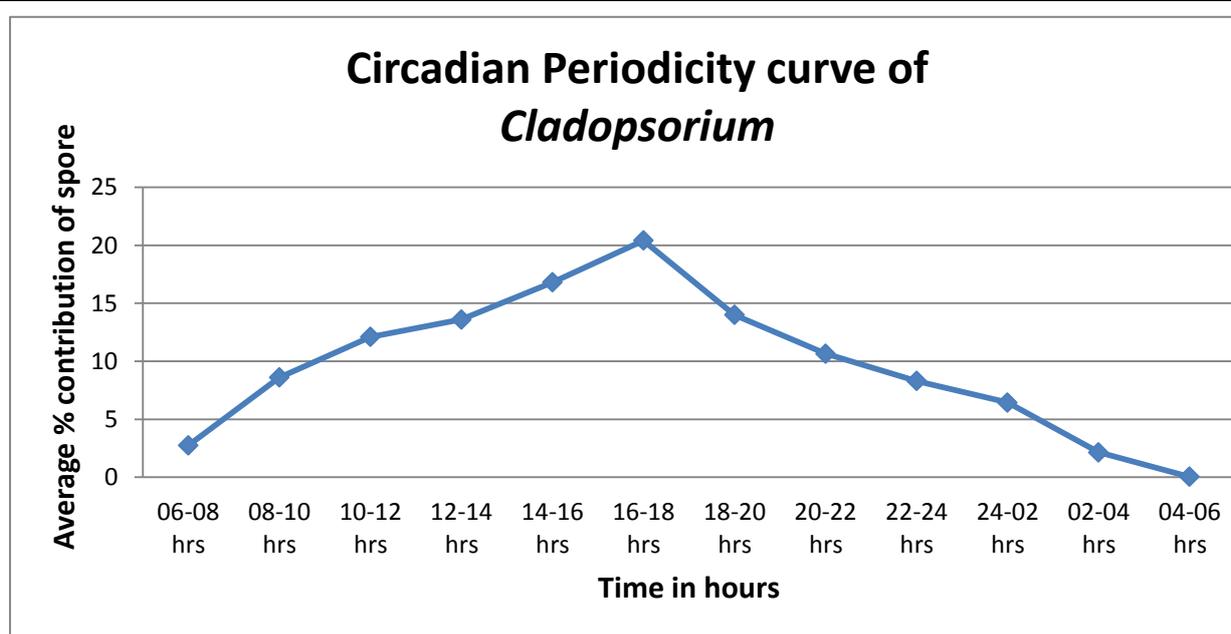
**Conclusions**

In the present investigation of airborne, *Aletrnaria*, *Cercopsora* and *Cladosporium* spores in the atmosphere of Jowar field were generally affected by weather, especially rain fall, moderate temperature and high relative humidity seems to increase the spore concentration. The spores concentration were highest during the day time and lowest during the night time. As these spores were occurred during day time, so these types of spores belong to “Day spora” pattern.

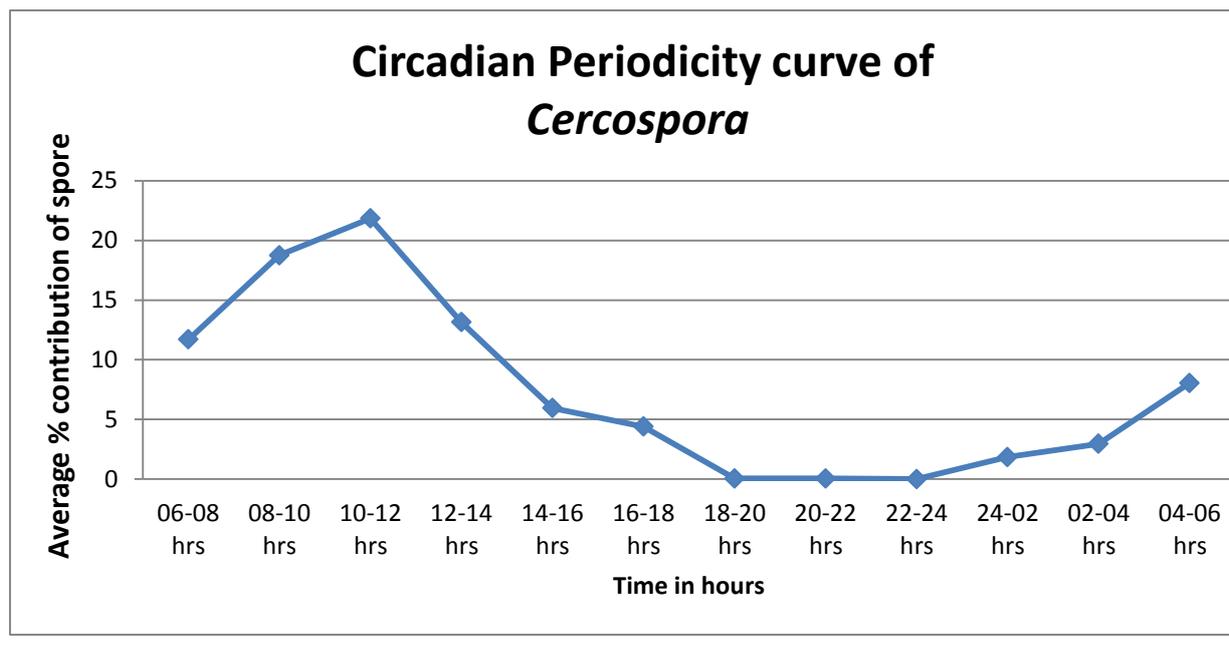
**Figure.1** Circadian periodicity curve of average percentage contribution of *Alternaria*



**Figure.2** Circadian periodicity curve of average percentage contribution of *Cladosporium*



**Figure.3** Circadian periodicity curve of average percentage contribution of *Cercospora*



#### References

1. Abu-Dieyeh, M.H., Barham, R. 2014. Concentration and dynamics of fungal spore populations in the air of Zarqa, Jordan using the volumetric method. *Grana* Vol. 53, No. 2, 117-132 .
2. Dawidziuk, A., Kaczmarek, J., Podlesna, A., Kasprzyk, I., Jedryczka, M. 2012. Influence of meteorological parameters on *Leptosphaerium maculans* and *L. biglobosum* spore release in central and eastern Poland *Grana*, 51: 240–248.
3. Gregory, P.H. 1967. Atmospheric microbial cloud systems. *Sci. Prog.*, 55: 613–628.
4. Grinn-Gofroń, A., Mika, A. 2008. Selected airborne allergenic fungal spores and meteorological factors in Szczecin, Poland, 2004–2006. *Aerobiologia*, 24: 89–97.
5. Ingold, C.T. 1965. Spore liberation. Clarendon press, Oxford. 1: 210–221.
6. Jogdand, S.B. (1987), Airspora at Aurangabad. Ph.D. Thesis, Marathwada University. Maharashtra, India.
7. Mane, D.A. (1978), Studied in Airspora over some fields. Ph.D. Thesis, Marathwada University. Maharashtra, India.
8. Meredith D.S. (1962), Some components of air spora in Jamaican banana plantations. *Ann. Appl. Biol.* 50: 577-594.
9. Mishra R.R. and Kamal 1971. Aeromycology and Gorakhpur III-Seasonal variation in Air fungal spora. *Mycopath. et. Mycol. Appl.* 45: 301-310.
10. Mishra R.R. and Srivastava V.S. 1969. Aeromycology of Gorakhpur. V. Air spora over Wheat and Barley fields. *Proc. 5. Ind. Sci. Cong. Bot. Sect.* Abstract no.99.
11. Nasiruddin, N. (1996). Studies in Aerobmicrobiota at Aurangabad. Ph.D. Thesis, Marathwada University, Aurangabad, Maharashtra, India.
12. Patil, B.Y. (1985) Aerobiological studies at Aurangabad. Ph.D. Thesis, Marathwada University, Aurangabad, Maharashtra, India.
13. Pady, S.M., Kramer, C.L., Wiley, B.J. 1962. Kanas Aerobiology XII materials, methods and general results of diurnal studies 1959-60. *Mycology*, LIV: 168–180.
14. Reddy R.K. (1987) Airspora at Aurangabad. Ph.D. Thesis, Marathwada University, Aurangabad, Maharashtra, India.

15. Sreeramulu, T. (1970) Conidial dispersal in two species of *Cercopsora* causing Tikka Leaf spots on groundnut (*Arachis hypogea*) J. Agri. Sci. 40:173-178.
16. Sreeramulu, T., Ramlingam, A. 1964. Some short period changes in the atmospheric spore contents associated with changes in the weather and other conditions. *Proc. Ind. Acad. Sci.*, 59: 154–172.
17. Sreeramulu, T., Sehavataram, V. 1962. Spore content of air over paddy fields I. Changes in a field near Pentapadu from 21 Sept. to 31 December 1957. *Ind. Phytopath.*, XV: 61–74.
18. Subbareddy, C. 1974. Circadian periodicity in the incidence of airborne spores of *Sporormia*, *Pithomyces* and *Spegazzinia*. *Curr. Sci.*, 43(3): 85–86.
19. Subbareddy, C., Janakibai, 1977. Circadian periodicity in airborne spores of *Dedryphiella*, *Pestalotia* and *Periconia*. *Ind. Phytopath.*, 30(4): 570–572.
20. Tilak, S.T., Babu, M. 1983. Diurnal periodicity in the incidence of airborne ascospores of *Didymosphaeria* and *Leptosphaeria* *Acta Botanica Indica*, 11: 246–247.
21. Tilak, S.T. and Jogdand, S.B. (1987), Aerobiological study of Rust and Smut over Jowar field at Aurangabad, Biome. 2 (2): 83-87.
22. Tilak, S.T., Pillai, S.G., Saibaba, M. 1983. Circadian periodicity studies in the incidence of airborne spores of *Pringsheimia*, *Sordaria* and *Chaetomium*. *Pol. Res.*, 2(1): 16–18.
23. Tilak, S.T., Srinivasulu, B.V. 1967. Airspora at Aurangabad. *Indian J. Microbiol.*, 7: 167–170.
24. Tilak, S.T., Srinivasulu, B.V. 1971. Airspora of Aurangabad II Ascospores. *Ind. phytopath.*, 24: 740–742.
25. Trejo, F.H., Rodriguez, A.F.M., Molina, R.T., Palacios, I.S. 2011. Airborne ascospores in Merida (SW Spain) and the effect of rain and other meteorological parameters on their concentration. *Aerobiologia*, DOI 10.1007/s10453-011-9207-1.