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Aeromycological investigations of some fungal diseases over *Zea mays* (maize) field from Niphad tehsil of Nashik district, Maharashtra

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Abstract
The present paper deals with the investigations carried out to study the prevalence of fungal spores over Maize (*Zea mays* L.) fields during Kharif season in Niphad tehsil of Nashik district, Maharashtra, India and the coincidence of the disease development along with certain environmental parameters. The investigations carried out with the help of Tilak air sampler revealed the presence of certain airborne pathogenic fungi were responsible for causing diseases in certain crops some of them are, Anthracnose leaf blight (*Colletotrichum*), *Curvularia* leaf spot (*Curvularia*), Southern corn leaf blight (*Bipolaris maydis* or *Drechslera*), Gray leaf spot (*Cercospora*), and Common corn rust (Rust spore). The present investigation is beneficial for local grower to efficient control of diseases of crop plant at different developmental stages and improvement of yield and quality of crop.

Keywords: tilak air sampler, kharif season, fungal spores, environmental parameters

Introduction
Maize is one of the most important cereal crops globally. It was first found in Mexico and Central America. About 160 countries cultivate it on approximately 150m ha having broad diversity of soil, climate, management practices and biodiversity. It contributes to the global grain production by 36%. In India it is next only to wheat and rice in terms of production and cultivate mainly during *Kharif* season which covers 80% area. It is not only used as human food but also as animal and poultry feed and for production of various industrial products which include starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetic, film, textile, gum, packaging material and paper etc. It is highly adaptive and can be cultivated under diverse agro-climatic conditions and has the highest genetic yield capacity among the cereals. All this makes Maize an important element of agricultural economy and industries allied to it. Any change in maize production would not only hamper the economy of the farmers but also of the array of industries dependent on it. One of the major hindrances in maize production is the infection by the pest and diseases. Of these two, diseases particularly airborne fungal diseases are the one which can give a severe blow to maize production.
Maize is a staple cereal affected by over 32 major diseases that can cause substantial yield losses (Mueller *et al*. 2016; Munkvoldand White 2016) [14] and diseases cause particularly in conducive environment. Proper management and control of fungal disease can help in eliminating or reducing the damage caused by the fungal disease. This requires proper knowledge regarding the conditions under which the fungal spores are concentrated the most and infect the crop. 'Aeromycology', one of the sub-branches of aerobiology deals with study of airborne fungal spores. Aero mycology proves useful is estimating the concentration of fungal spores and when coupled with the environmental factors helps in better understanding the infection, development and spread of disease which in turn is of immense importance in management and control of disease. Niphad tehsil has a substantial area under maize cultivation besides grapes, sugarcane and onion. In this context the present study was under taken to investigate the type of aeromycoflora over maize fields and the environmental conditions present therein. The Aeromycological studies was done by trapping, scanning and identification of airborne fungal spores, and this data is use to predict probable fungal diseases which can be used to determine the dissemination and deposition of phytopathogenic spores within crops, and to predict their transport from one crop to another (Frenguelli G; 1998).

Material Method
Sampling site
The present Aeromycological investigation was conducted during the year 2020 -2021 in Kharif season over Maize (*Zea mays* L.) crop. In the present investigation, the airborne fungal spore trapping was done by using Tilak Air Sampler (Tilak and Kulkarni; 1970) [17] located in the middle of two acre field of Maize. Monitoring of

airborne fungal spore from sampling sites selected for study were carried out in kharif seasons from June to October in Maize field for five months.

The apparatus and its working

Samples were collected by operating volumetric Tilak air sampler (Tilak and Kulkarni; 1970) [17]. Sampling was carried out by operating the air sampler continuously with its orifice projection tube kept at a constant height of 1 meter above ground level. The apparatus was protected from rain by a polyethene cover, which does not impair the sampling efficiency. It consist cubical tin box, runs on electric power supply and it will provide continuous sampling of air for 8 days. Air will be sucked in (5liters/minute) and impinges on the transparent cello tape of the rotating drum coated with thin layer of petroleum jelly; thus the bioparticles from the air will be entrapped. The exposed cello tape was changed every 8 days and cut into 16 equal parts; each representing 12 hours trace area, of a day & night accordingly. The pieces of cello tape were mounted on microscopic slides using glycerin jelly as a mount.

The recognition of spore type is established by its (i) Morphological characters (ii) Visual identification by correlation with reference slide prepared (iii) By uncovering culture plate method. Attempts are made to recognize fungal spore type up to generic level and as an when possible up to species level.

Scanning: The scanning of collected sample was done regularly for the two year period. Total 9600 sq. micron of the area was obtained during daily scan by using 10x and 45x eye piece of the compound microscope as well as binocular microscope. Scanning of prepared glass slides was done regularly and identification of pathogenic fungal spore and other bio-particles was based on microscopic diagnostic features, reference slides and available literature.

Spore Photoplates

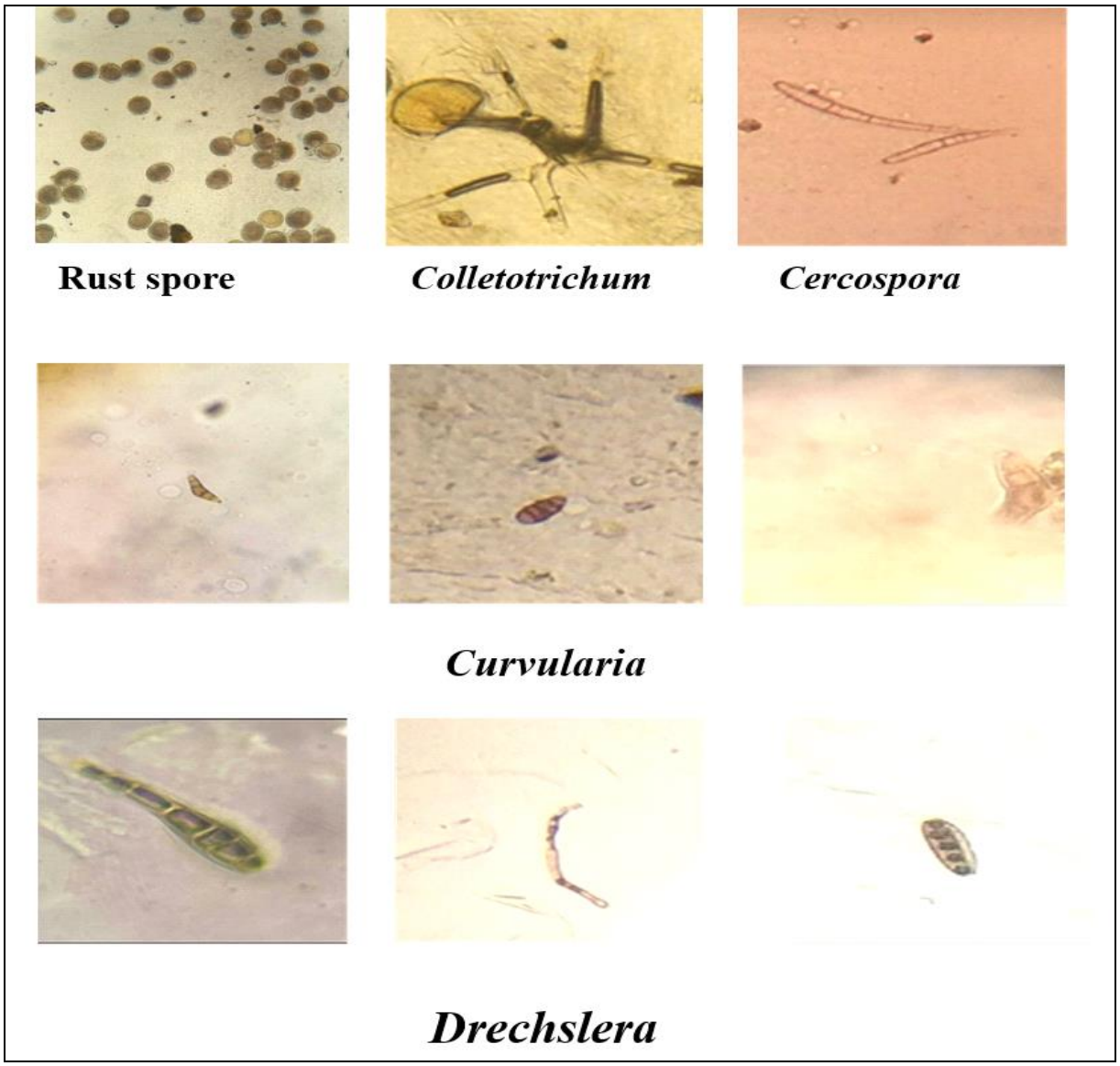

Fig 1

Graphs

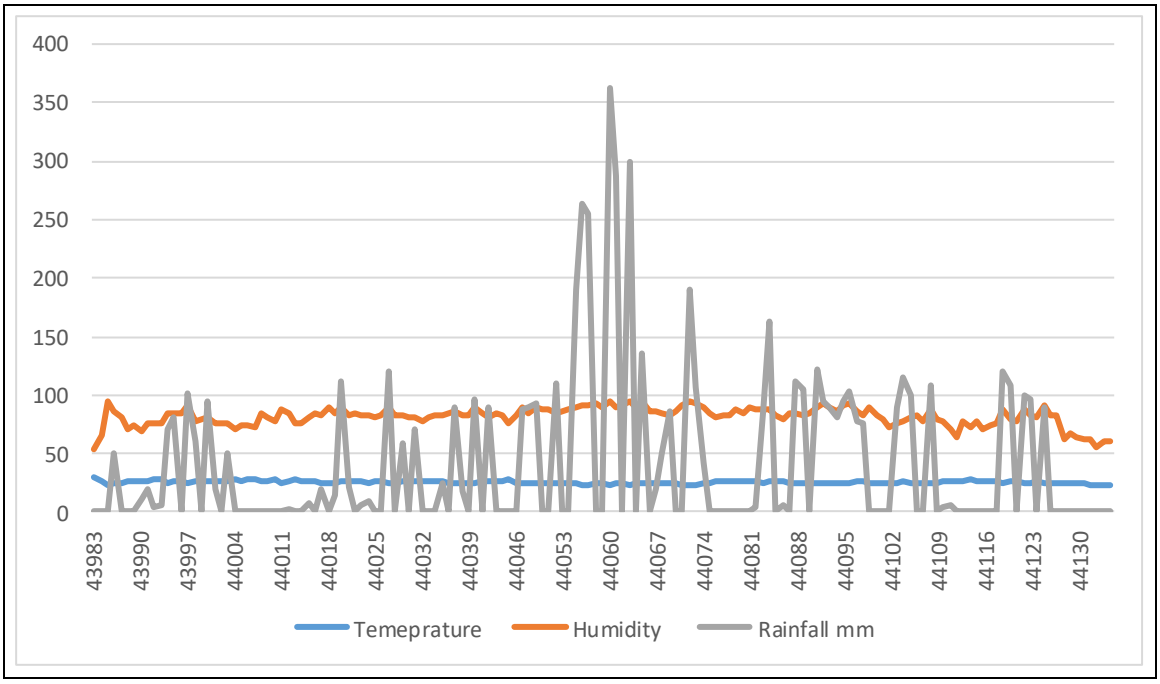

Fig 2: Graph showing correlation between meteorological parameters

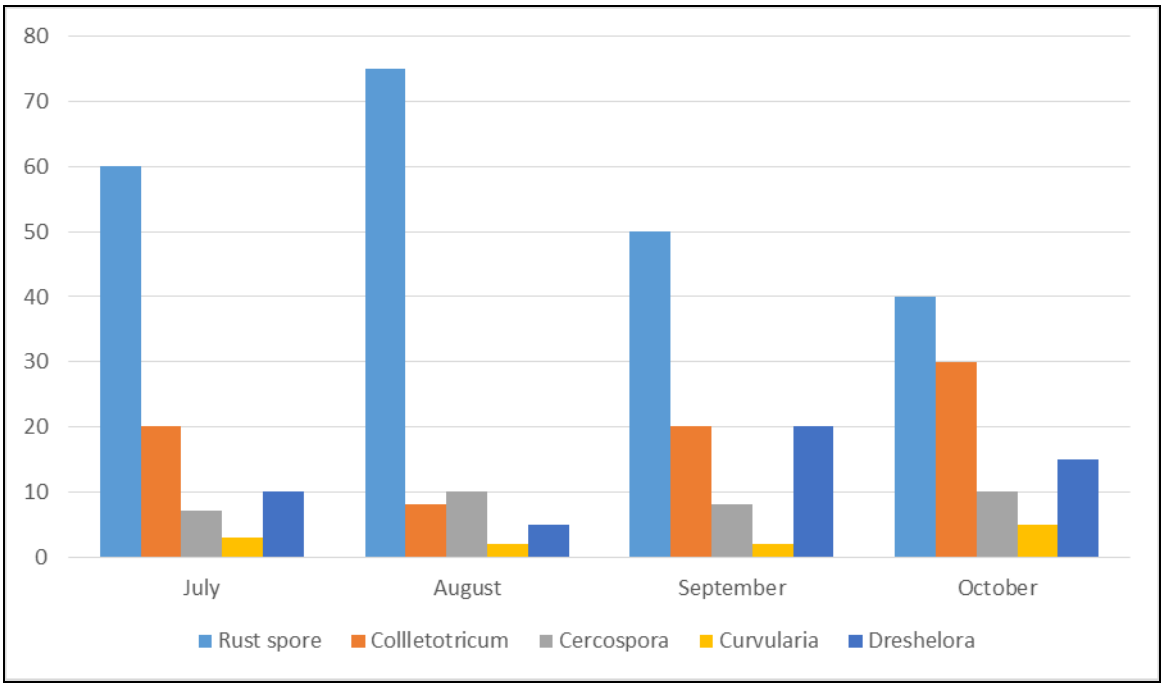

Fig 3: Graph showing monthly concentration of spores

Results and Discussion

In the present investigation most of fungal diseases of maize are distributed in all over the field of maize. Many of them are mostly favored by humid and warm environmental condition. The present study reveals the high concentration of airborne pathogenic fungal spores were responsible for diseases in Maize crop. Some of them are Anthracnose leaf blight (*Colletotrichum*), the disease causing pathogen or the causal organism is *Colletotrichum graminicola*. This disease seen generally in warm and humid environments in month July and October 2020-21 and temperature ranging from 21-37°C high temperature and high humidity 80-90%. The disease symptoms occur early during the growing season on lower leaves of corn. It has two phases with foliar disease phase and a stalk rotting phase. Later the symptoms occur mostly in the upper leaves where they already have stalk rot symptoms. *Curvularia* leaf spot (*Curvularia*), is caused by the fungus *Curvularia geniculata* and start as very small (1/16 to 1/8 inch) round tan lesions on leaves. Lesions often have a brown border and can be surrounded by a yellow halo. Symptoms can be observed at different growth stages, range from a lesions densely covering large section of leaves to few lesions scattered across leaves. The fungus that causes *Curvularia* leaf

spot has a broad host range, and other grass species can play a role in disease development. Warm and wet weather favorable for disease development. Southern corn leaf blight (*Drechslera*) is caused by the fungus *Bipolaris maydis* or *Drechslera* spore. It is mostly seen in leaves, blades & sheaths of the crop. It is mostly seen in areas having 64-90°F temperature with high humidity. It appears on the lower leaves; first it is oval but later becomes rectangular. Even later purple brown border may appear on the lesions a severe infections can lead to stalk rots. The disease develops under favorable moist and warm condition transported to the healthy plants through wind or rain. Gray leaf spot (*Cercospora*), Gray leaf spot is caused by fungus *Cercospora zeae-maydis*. It is mostly seen under relatively high humidity, abundant moisture and temperature range from 21-32°C. The lesions due to these fungus are long, pale brown or grey to tan. They are a bit rectangular in shape. The older ones are pale brown to reddish in color. Symptoms start on lower leaves progressing upwards. Common corn rust (Rust spore), this disease caused by the fungus *Puccinia sorghi*. These can easily recognized and distinguished by the development of dark, reddish-brown pustules scattered over both the upper and lower surface of the leaves, oval to elongate in shape, are generally small, less than ¼ inch long. Spores must be blown during growing season from mid-June to mid-July at 23°C average temperature. Disease is spread by wind-born spores.

This aero mycological investigation was undertaken to understand the incidence of fungal spore infect the plant and some diseases were recorded on Maize crop to control these diseases by to use resistant hybrids, where resistance is lacking, spraying with foliar fungicides may be necessary. Clean ploughing with crop rotation will reduce disease severity in field and correlation with environmental parameters are the most important basis of devising the disease forecasting system, for the efficient control of diseases of Maize crop.

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