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Preliminary survey of rust spore over soybean field

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Abstract

Aerobiology is the study of air spora like airborne fungal spores, pollen grains and other airborne microorganism and their release into atmosphere, dispersion, deposition and effect on living organism like plants, animals and human beings.

The aerobiological study is useful to understand the general components of air spora in the region and also useful to develop disease forecasting method for saving crop diseases. Plant pathogens cause diseases to crop plants, of these mostly air borne. Air sampling over Soybean field was carried out by using continuous Tilak air sampler from 17th June 2017 to 3rd October 2017 for a kharif season. The main aim of this experiment is to find out the concentration of airborne, rust spores and their relation with the disease incidence. In the investigation rust spore concentration was 11900 spores/m³ of air recorded during the season from aerobiological sampling. The fluctuation in the concentration of rust spore were observed indifferent growth stages of the crop. Maximum concentration of rust spores were recorded 4130 spores/m³ of air in the month of August 2017 and minimum in the month of June and October 2017.

Keywords: Tilak air sampler, kharif season, Rust spore.

Introduction

According to Edmonds and Benninghoof¹ (1973) aerobiology is a scientific and multi-disciplinary approach focused on the transport of organisms and biologically significant material. These studies are of great importance to the mycologist, microbiologist, allergologist etc. According to Jacobs²(1951) aerobiology includes

the dispersion of insect population, fungal spores, bacteria, viruses and pollen grains. Tilak and Kulkarni³(1978) studies the occurrence, seasonal distribution and diurnal periodicity of rust and smut spore content of air over Sugarcane field. Mane⁴(1981) made a systematic aerobiological approach to rust disease of Bajra caused by *Puccinia penniseti*.

The present investigation deals with the air spora over Soybean (*Glycine max* L.) field. Soybean is a member of family-Leguminaceae and Subfamily-Papilionaceae. Soybean is rich in protein, carbohydrate, oils, major and minor minerals.

Fungal pathogens play a significant role in causing the disease and decreasing the yield. The Major fungal diseases which cause extensive damage to Soybean crop in India are rust, leaf spot, downy mildew, blight etc. In order to control and manage diseases. Aerobiological investigations over this crop is essential and air monitoring experiments over this crop was conducted to trap the pathogenic fungal spores, their source, dispersion and impact of meteorological parameters of such pathogens.

Materials and Methods

This aerobiological investigation over Soybean crop fields includes qualitative and quantitative analysis of airspora at Udgir. The main aim of this study is to find out airspora components over Soybean in relation to different growth stages and meteorological parameters.

The air sampling over Soybean field was carried out by using volumetric continuous Tilak air sampler⁵(1967). Sampler is an electrically operated device. It provides continuous sampling of air for 8 days. The sampler is a tinbox with 10.4 × 8 size. It has an elevated round cap on its lid. The cap contrits on exhaust fan inside. The cap is provided with netted window for expelling out the internal sucked air. At the bottom of box clockwise mechanism is fitted. The drum rotates in anticlockwise manner when electricity on. Backside of this box is provided with a small orifice projecting tube through which sucked air enters in the air sampler. The air rushes in it Impinges on transparent cello tape of the rotating drum coated with a thin layer of petroleum jelly or transparent vaseline and thus entraps the bioparticles from the air. It gives continuous

8 days data of various components of air and bio particles are trapped on the cello tape. The present work of air sampling was carried out for kharif season from 17th June 2017 to 3rd October 2017. The sampler is stopped by putting the electric button off after 8 days. The rotating drum is removed without touching and the cello tape is carefully removed and cut out into 16 equal parts. It is mounted on a clean glass slide using glycerine jelly. Scanning of slides containing airborne catches was done. The identification of spore types and other biological materials was done by microscopic observation of spore with reference to size, colour, shape and septation. The confirmation of identity was made by reference standard literature and relevant books of Tilak⁶ (1989), Barnett and Hunter⁷(1972), Mukadam⁸ (1997), Alexopolus⁹(1980), Dube¹⁰(1978), and Ainsworth¹¹et.al. (1973).

Results and Discussion

The aerobiological investigations over Soybean (*Glycine max* L.) field was undertaken for kharif season from 17th June 2017 to 3rd October 2017. In this investigation 57 types have been reported of which 51 were fungal spore types and remaining were other biological groups which include fungal hyphae, insect parts, pollens, protozoan cyst and unclassified group.

The spores belonging to Deuteromycetes contributed highest percentage 72.65% to the total air spora followed by Ascomycetes 13.83%, other types 10.82%, Basidiomycetes 2.69% and Phycomycetes 0.01%. The spore belonging to Basidiomycetes contributed fourth dominant group to the total air spora. In this investigation rust spore was found second dominant spore type from Basidiomycetes group (Table I) & (Graph I). Maximum concentration of Rust spores were recorded 4.30 spores/m³ of air in the month of August 2017 and minimum in the month of October 2017 (Table II).

Table I: Air spora concentration, percentage contribution of Basidiomycetes group for Kharif season

Spore type	Total concentration of spores/M ³ air	% contribution to the total air spore
Ganoderma	7866	0.45
Rust spore	11960	0.69
Smut spore	18016	1.02

Graph - I

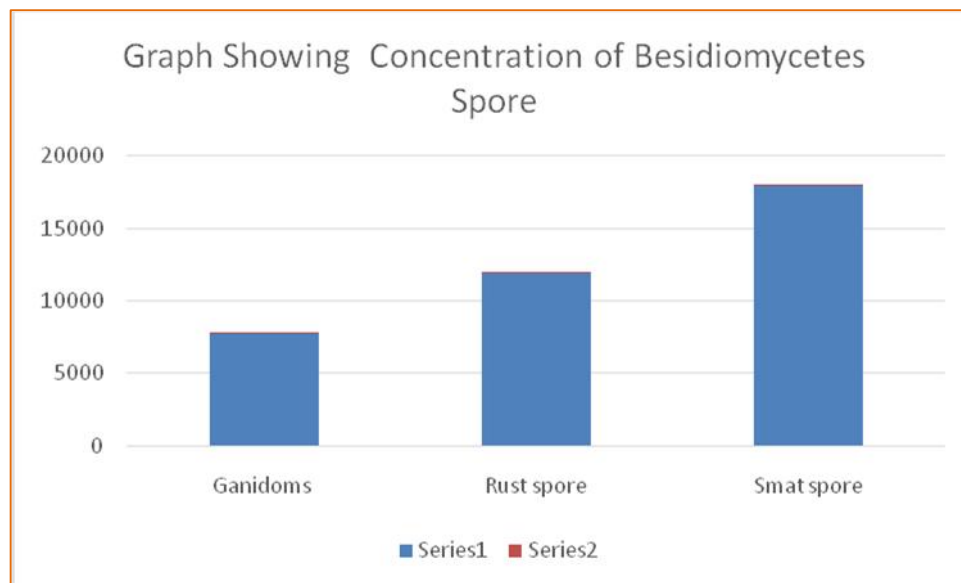


Table II: The concentration and percentage contribution of Rust spore over Soybean field during 17th June 2017 To 3rd October 2017.

Spore type	June	July	August	September	October
Rust spore	700	2688	4130	3682	700

The spore types of Basidiomycetes were grouped into Ganoderma, rust spore, smut spore. There was a clear correlation among the incidence of disease growth stages and the spore population in air. During these investigations Soybean crop showed incidence of leaf rust disease caused by *Phakopsora pachvrihizi*. The disease incidence was observed in kharif season in the first week of October. Rust spore contained 0.69% to the total air spora. Comparatively low temperature and high relative humidity was found to be favorable for causing disease incidence and development. Patil¹²(1985) reported the disease spread and intensity was higher in the flowering stage and onwards as compared to Seedling stage and onwards as compared to seeding and flowering stage. It indicates that positive inoculum and environmental factors cause the disease but plant

age is also important which determines disease incidence and intensity of various ways infection before flowering and at the flowering stage of the crop cause considerable damage and less in the yield. Bhalke¹³(1981), wankhede¹⁴(1983), and also recorded similar findings smut spore were more abundant throughout the period of investigation. Smut disease in Sorghum and Sugarcane were common in this area.

Ganoderma basidiospores contribute 0.45% to the total air spora. In this investigations it was observed that there is a temporary increase of spore in heavy rain. According to Ingold¹⁵ (1965) the hygroscopic movement of the conidiophores release spore from organic contact. This is significant particularly in rust.

Gregory¹⁶(1961) pointed out that blowing away occurs commonly with dry spored fungi including moulds smut and rust spore because the spores are after present on an elevated sporophore in any stem or leaf pathogen being raised on its host tissue. More spore carried away in higher wind speed. In conclusion it can be said that Basidiomycetes (rust and smut) discharge was more when the substratum is wet. Air humidity and wind speed affect less spore shedding in higher Basidiomycetes.

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