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AN AEROBIOLOGICAL APPROACH TO GROUNDNUT RUST

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ABSTRACT
An aerobiological survey was conducted over the groundnut (*Arachis hypogea* L. Var.JL-24) fields at Newasa (Ahmednagar) for two consecutive kharif seasons of 2007 and 2008 by employing volumetric Tilak air sampler kept at a constant height of 0.75m in the centre of the groundnut field to find out the concentration of uredospores, pathogenic to the crop, their correlation with the meteorological parameters and the growth stages of the crop. The aerobiological monitoring revealed that the maximum concentration of rust pathogen was observed in air during September in both the kharif seasons. Meteorological data was maintained in both the kharif seasons. The role of the meteorological factors for survival of the pathogen, growth stages of the crop and disease incidence has been discussed in the paper.

INTRODUCTION

Groundnut (*Arachis hypogea* L.) is by far the most important oil seed crop of India, covering nearly half of the area under oil seeds. Being a legume, it is valued for its nitrogen fixing capacity through the root nodule bacteria and forms an important member in many crop rotations followed all over the country. Lukose *et al.* (2008) reported, groundnut as the world's fourth most important source of vegetable protein. In India, it is grown in 11 states in an area of 7.6 million hectares producing about 7.8 million ton of pods. The average annual productivity of this crop in India is about 1000kg/ha.

Groundnut is subjected to various fungal, bacterial and viral diseases which are airborne or soil borne. The rust of groundnut caused by *Puccinia arachidis* Speg. was reported from Punjab in 1969 (Chahal and Chohan, 1971) and now it is common in occurrence in most groundnut growing states in India (Mayee *et al.,* 1977, Subrahmanyam *et al.,* 1979). Groundnut rust caused by *Puccinia arachidis* Speg. is a destructive disease of groundnut on a world scale (Bromfield, 1971; Hammons, 1977; Subrahmanyam *et al.,* 1979). Rust of groundnut due to *Puccinia arachidis* Speg. has been occurring in a serious form in recent years in most of the groundnut growing areas and limited the cultivation of groundnut. Uredospores are the main agent of rust disease of groundnut of which the dispersal is brought about on large scale. In view of the above fact, the present paper deals with the concentration of airborne uredospores of *Puccinia arachidis*, in relation to meteorological parameters.

MATERIALS AND METHODS

Aerobiological surveys over groundnut (*Arachis hypogea* L. Var.JL-24) fields at Newasa (Ahmednagar) were carried out by installing the volumetric Tilak air sampler (Tilak and Kulkarni, 1970) at a constant height of 0.75 meter above the ground. Air sampling experiments were carried out for two consecutive kharif seasons *i.e.* 1st kharif season from 15th July to 8th November 2007 and 2nd kharif season from 10th July to 7th November 2008 respectively. Air sampling was continued 7 days more after the crop harvesting in both the Kharif seasons.

Throughout the investigation period, meteorological data was maintained. Once in a week, the diseased material from the field was collected for assessing the disease incidence. Scanning and further calculations were done by using the method described by Tilak and Srinivasulu (1967). Identification of trapped fungal spores was done on the basis of spore morphology and authentic slides prepared from the known fungi (Ellis, 1976; Barnett and Hunter, 1972; Tilak, 1989).

RESULTS AND DISCUSSION

Rust pathogen-*Puccinia arachidis* Speg. an autoecious rust, causes severe loss to the crop of groundnut in both quality and quantity, if it is in epidemic form in occurrence. The highest concentration of uredospores (280/m^3 of air) was recorded on 30th September 2007 when there was a record of mean temperature 25.7ºC, mean relative humidity 75.5% and mean wind velocity 5.0km/h with absence of rainfall. In second Kharif season the highest concentration of uredospores (238/m^3 of air) was recorded on 21st September 2008, when there was a record of mean temperature 24.7ºC, mean relative humidity 74.00% and mean wind velocity 5.8 km/h with no incidence of rainfall (Table 1, Fig. 1:1a to 1e and 2:2a to 2e).

In the 1st kharif season of 2007, maximum monthly concentration of uredospores (4032/m³ of air) was recorded in the month of September 2007, when there was a record of mean temperature 25.8ºC, mean relative humidity 81.8%, mean wind velocity 5.9km/hr and rainfall 212.7mm, whereas in the second kharif season of 2008, the maximum monthly concentration of uredospores (4172/m³ of air) was recorded in the month of September 2008, when there was a record of mean temperature 25.3ºC, mean relative humidity 79.2%, mean wind velocity 6.7km/h and rainfall 323.4mm.

The total uredospore concentration 8918/m³ of air, with 2.10% contribution, and 8946/m³ of air, with 2.40% contribution was recorded in first and second Kharif seasons respectively. Although the incidence of uredospores was noticed throughout the sampling period in both the kharif seasons, nevertheless, incidentally in both the kharif seasons of 2007 and 2008 during the harvesting period the concentration was found to be reduced.

In the first kharif season of 2007, the disease incidence on foliage was recorded for the first time on 20th September 2007 *i.e.* after 61 days of sowing, whereas in the second kharif season of 2008 on set of leaf disease was seen on 13th September 2008, *i.e.* 59 days after sowing. Thus during both the kharif seasons, it was observed that if the meteorological conditions are favorable, then rust incidence to foliar part of groundnut can occur even after 60-80 days of sowing. Similar observations also have been recorded by Quazi (1985), Tilak (1988), Murdhankar and Pande (1991), Lukose *et al*. (2008), Kadam *et al*. (2008), Rajalakshmi and Shakila (2008), Mali and Gaikwad (2011).

In the first kharif season 2007, the spore concentration and subsequently increase in disease incidence was recorded as maximum right from 10th to 30th September 2007 when the crop was 71 days old, when there was a record of mean temperature 25.8ºC, mean relative humidity 81.8%, mean wind velocity 5.9km/hr and total rainfall 212.7mm.

In the second kharif season of 2008, the spore concentration and disease incidence was maximum right from 5th to 21st September 2008, when there was a record of mean temperature 25.3ºC, mean relative humidity 79.2%, mean wind velocity 6.7km/h and rainfall 323.4mm. However, incidentally that time the crop was 67 days old.

High incidence of uredospores in the ambient air over the groundnut field was recorded after 71 days in first Kharif season

Table 1: Kharif season 1 (2007–2008) reveals day to day variation in the concentration of uredospores/m³

Crop season	Date of first incidence of spore in air	Date of first onset of disease on crop	Date of highest concentration of uredospores	Weather parameters				Maximum monthly concentration in air spores in air	Susceptible age incidence of of the crop
				Temp(ºC)	R.H.(%)	Wind Velo. (km/h)	Rainfall (mm)		
Kharif 1st 2007	15th July 2007	20th Sep. 2007	30th Sep. 2007	25.7ºC	75.5 %	5.0km/hr	No rainfall	September 2007	71 days
Kharif 2nd 2008	10th July 2008	13th Sep.2008	21st Sep. 2008	24.7ºC	74.00 %	5.8km/hr	No rainfall	September 2008	67 days

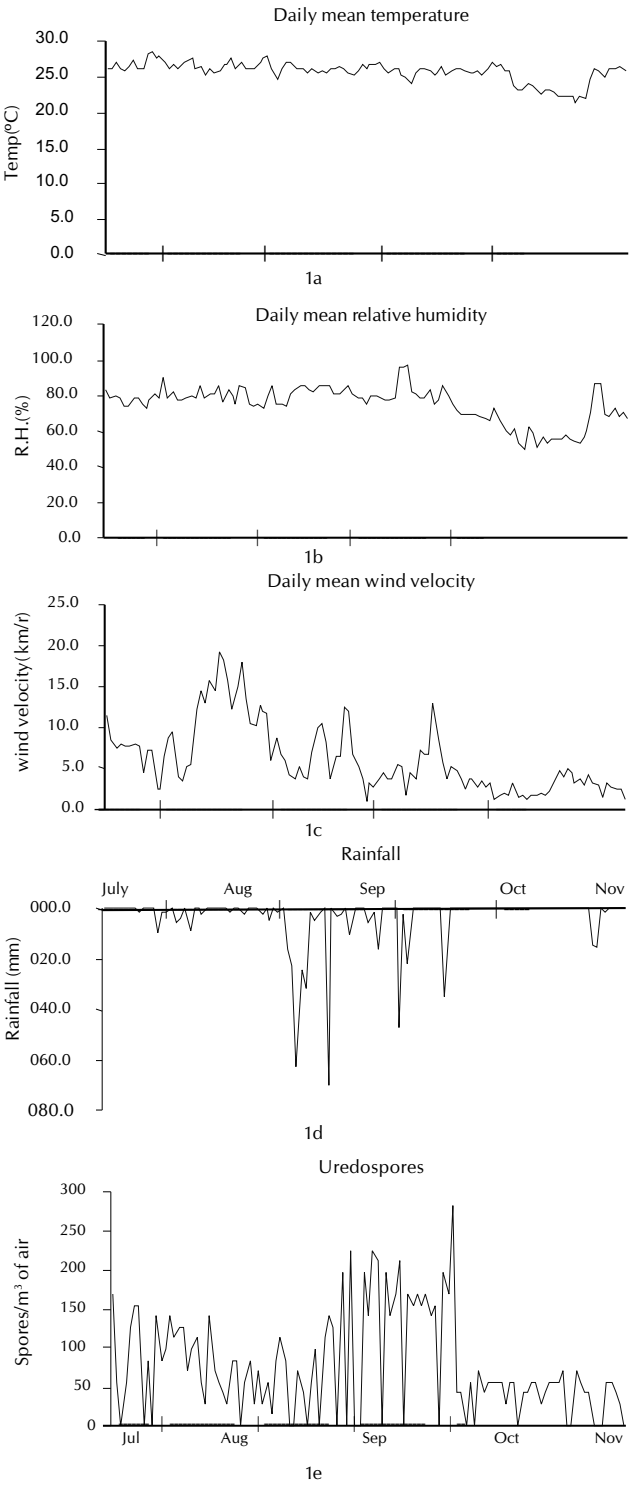

Figure 1: (1a to 1e): Kharif season 1 (2007) reveals day to day variation in the concentration of uredospores/m³ of air in relation to meteorological conditions

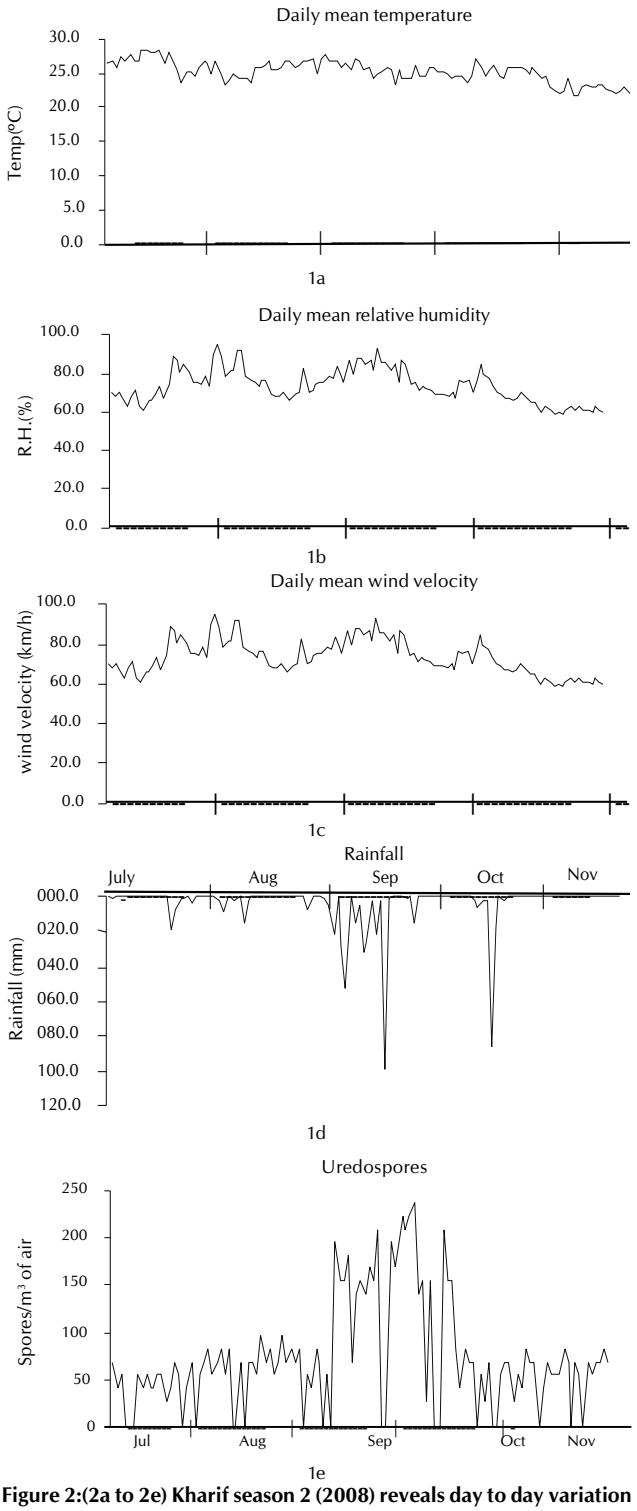

Figure 2:(2a to 2e) Kharif season 2 (2008) reveals day to day variation in the concentration of uredospores/m³ of air in relation to meteorological conditions

2007 and in second Kharif season, after 67 days (Table 1). However, Mallaiah and Rao (1982) recorded uredospores from the air after 80-90 days of the crop sowing, Sharma and Mukherji (1972) also recorded the appearance of the sori on the leaflets when the crop was 45 days old. Quazi (1985) recorded maximum incidence 55-80 days after the crop sowing. Murdhankar and Pande (1991) recorded high incidence of uredospores in the air 60-80 days after the crop sowing.

However, during first and second Kharif seasons of 2007 and 2008, it was found that particularly in the month of September in both kharif seasons, an average range of temperature (25.8ºC and 25.3ºC), average relative humidity (81.8% and 79.2%), average wind velocity (5.9km/h and 6.7km/h) and (212.7mm and 323.4mm) rainfall were found to be congenial for rust disease prevalence in groundnut fields. Similar results were also recorded by Mallaiah and Rao (1982), Murdhankar and Pande (1991). However, the growth stages of the crop might have played an important role in disease development.

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