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Aerobiological approach to leaf spot and rust disease of groundnut (*Arachis hypogaea* L.)

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ABSTRACT

Ground nut (*Arachis hypogea* L.) occupies first place among the all oil seed crops in India. It is also subjected to various types of fungal diseases, which causes extensive damage to crop in the quality as well as quantity of the yield. The Tikka leaf spot (*Cercospora arachidicola* and *C. personata*) and rust (*Puccinia arachidis*) has been occurring in a serious form in every groundnut growing area of the country. Aerobiological experiments were carried out to find out the concentration of pathogenic fungal form, their relation with the meteorological parameters and growth stages of crop. Air sampling was done during from July to October in both years of 2004 and 2005. Air monitoring revealing that maximum concentration of Leaf spot pathogen and rust pathogen were observed in air during October of both the seasons. Maintained meteorological data throughout the period of investigation to correlate with the incidence of pathogen and severity of infection. The role of the meteorological factors for survival of the pathogen, growth stages of the crops and disease incidence have been discussed.

Key words : Tikka disease, Rust, Cercospora, Puccinia, Groundnut**.**

Groundnut (*Arachis hypogea* L.) occupies first place in order of importance, out of the all oil seed crops growing in India. About 75 million hectors of land is under groundnut cultivation and the production is about 6 million tonnes.

Groundnut is also subjected to various types of fungal diseases, which causes extensive damage in the quality as well as quantity of the yield. The Tikka leaf spot (*Cercospora arachidicola* and *Cercospora personata*), the caller rot (*Aspergillus niger* and *A. pulverulentum*) and Rust (*Puccinia arachidis*) have been occurring in a serious form in recent years in most of the groundnut growing areas and has limited the cultivation of groundnut. It is proposed to carryout the aerobiological investigation over the groundnut to find out the time and date of the onset of the pathogen and subsequent inset of the disease, severe epiphytic, if any and the role of the environmental factors for the survival of the pathogen. The ultimate aim behind this investigation is to provide a better and an efficient forecasting system for Groundnut.

MATERIALS AND METHODS

The aerobiological investigations have been carried out with the help of Tilak continuous air sampler (Tilak and Kulkarni, 1970). Tilak continuous air sampler continuously runs with 230 V. current and the drum present inside the sampler completes on a rotation in eight days. The air sampler was installed at a constant height of 1.5 m above the ground level in the groundnut field in the botanical garden of college. The air sampling was started on 20/07/2004 to 30/10/2004 during Ist season and 01/07/2005 to 30/10/2005 during IInd season. Air sampling was continued till the harvest of the crop.

The meteorological data was maintained throughout the period of the investigation. Scanning and detailed calculations were obtained by using same method described earlier (Tilak and Srinivasulu, 1967). Identification of fungal spore was accomplished with the help of visual identification and literature after Ellis (1971), Burnett and Hunter (1972) and Tilak (1980) and Nair *et al*. (1986).

RESULTS AND DISCUSSION

Leaf spot pathogen (Cercospora spp.*):*

During present investigation the first sign of infection of *Cercospora arachidicola* was noticed on the leaf blade after 32 days and 28 days of sowing during I season and II season, respectively. It was followed by the spot caused by *Cercopora personata* some what late on the leaf lets with small and differ from earlier. These were recorded after 44 days and 49 days of sowing during the 2004 and 2005, respectively. In both seasons two species of *Cercospora i.e.Cercospora arachidicola and Cercospora personata* firstly recorded at different intervals before the onset of their infection. They were recorded sporadically and less in number. However, occasional high catches were recorded on few days. The spores were recorded frequently after rainfall.

Concentration of *Cercospora arachidicola* was maximum and continuously trapped from 10th September

(I season) and 16th September (II season) where as the *Cercospora personata* was recorded maximum from 23rd September (I season) and 27th September (II Season) to till the harvesting during 2004 and 2005, respectively. The spots caused by *Cercospora personata* were formed late on leaflets, however, they spread faster and covered maximum area.

The spore concentration of *Cercospora personata* (1498/m^3 of air) and *C. personata* (1162/m^3 of air) was recorded maximum in the month of October during 2004. When there was a total rainfall of 3.56 mm the average mean temperature was 26.53^0 C and 81.16 % of average relative humidity in that month.

During II *kharif* season, maximum spore load of *C. arachidicola* (1968/m^3 of air) and *Cercospora personata* (1840/$m^3$of air) were recorded in the month of October. When there was total rainfall of 205.5mm, mean temperature 26.61^o C and 75.45% average relative humidity.

It indicated that high relative humidity, moderate mean temperature and shower of rains are congenial factors for the dispersal of conidia of *Cercospora* species.

Maximum spore catches and disease incidence coincided with the pod development stage of the crop. It clearly indicated that growth stages of the crop have got some importance for the incidence of Tikka disease.

The circadian periodicity of two species of *Cercospora* reveals that higher concentration between 10.00 am to 12.00 noon and low concentration was recorded during night hours. A similar finding was observed by Kadam *et al.* (2008a) at Ahmedpur.

Rust pathogen (Puccinia arachidis):

Another pathogenic form *i.e. Puccinia arachidis* was observed and it initiated the infection with brown pustules on the leaflets, when the crop was 49 days old.

The rust spores were sporadically recorded since beginning of Air Sampling. The incidence of rust disease on foliage of the crop was noticed on 16th September and 22nd September of 2004 and 2005, respectively. The spores were trapped less in numbers in August. During this period there was a record of intermittently rainfall, moderate daily temperature and the relative humidity were 75- 80%.

The rust spore concentration was maximum in the month of October continuously till the harvesting. Occasionally the spores were trapped less in numbers. Analysis of weather conditions in this period shows that there was a record of 26.53 and 26.61^{o}C of average mean temperature, 3.56 and 205.8 mm of total rainfall and 81.10 and 75.45 % of average relative humidity in that month during 2004 and 2005, respectively. The maximum disease incidence and the spore concentration was recorded from October to the harvest which coincided with susceptible stage of the crop.

From the results, it was clearly evident that there is a clear co relationship between the high concentration of rust spores in the atmosphere with rainfall and high relative humidity and moderate temperature (20-26^{o}C). Maximum spores were trapped during day time than night. On rainy days there was a low concentration of uredospores. It may be washed down due to prolonged rains.

Circadian periodicity of rust spores indicated that the peak concentration was observed at (9.00 Hrs) and steep fall during night hours.

During present survey the maximum spores catches were observed in October (1064/m^3 of air and 2814/$m^3$of air) followed by September (532/m^3 and 2100/$m^3$of air) in both the seasons of 2004 and 2005, respectively.

In the month of September maximum (38.1 mm and 95.4 mm) of rains were recorded in both the seasons. The spore catches were also high, because of this at the beginning the rust pustules were recorded on few plants, their continuous cycle rust spores were occurred producing the bulk of inoculum and subsequently spread of disease. The rust spore concentration in the air in relation to disease incidence and growth stages of the crop was observed. Pady (1954) with his slide exposure technique caught numerous rust spores in the month of September. Nagrajan *et al.* (1976), Mane (1978), Babu (1983), Mali (2002), Kadam *et al.* (2008b) also recorded more or less similar findings

The investigations have clearly brought out the close relationship between the spore concentration, disease incidence, meteorological factors and growth stages of

Table 1 : Monthly contribution of *Cercospora* spp./m^3 of air to the total airspora over groundnut field during I & II season.

Month	Pathogen Concentration / m^3 of air						Meteorological Factors					
	Puccinia arachidis		*Cercospora archidicola*		*Cercospora personata*		Average relative humidity (%)		Average Rainfall (mm)		Average Temperatures (^{o}C)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
July	196	280	350	854	200	420	81.67	75.30	3.29	10.50	26.10	28.38
August	280	466	378	1442	336	826	84.48	75.51	4.11	4.10	24.78	28.05
September	532	2100	952	1540	490	1306	73.13	76.13	1.27	3.20	26.75	27.07
October	1064	2814	1498	1968	1162	1140	81.16	75.45	0.42	6.90	26.53	26.61

the crop.

Present studies would provide a basic for obtaining efficient forecasting systems in future. Further studies on the spore production, spore liberation, the effect of meteorological conditions on their dispersal in air, their variation in air in different groundnut growing regions of the country should be carried out for developing an efficient and definite method for forecasting and controlling of Tikka and rust diseases of groundnut which becoming a menace for groundnut cultivation.

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