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The Concentration of Pathogenic Fungal Form, their Relation with the Meteorological Parameters and Growth Stages of Groundnut Crop (Arachis hypogea L.)

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Abstract: Ground nut (Arachis hypogea L.) occupies first place among the all oil seed crops in India. It 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 2018 and 2019. Air monitoring revealing that maximum concentration of Leaf spot pathogen and rust pathogen 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.

Keywords: Rust, Cercospora, Puccinia,Tikka disease Groundnut

I. INTRODUCTION

Groundnut (Arachis hypogea L.) occupies first place in order to 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) has 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, severs epiphytic, if any and the role of the environmental factors for the survival of the pathogen. The ultimate aim behind this investigation to provide a better and an efficient forecasting system over Groundnut.

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II. MATERIAL 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 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 our college. The air sampling was started on 20/07/2018 to 30/10/2018 during Ist season and 01/07/2019 to 30/10/2019 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 (1986).

III. RESULTS AND DISCUSSION

3.1 Leaf Spot Pathogen (Cercospora sps.)

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 was observed 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 2018 and 2019 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 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 2018 and 2019 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 2018. 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.

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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.

3.2 Rust pathogen (Puccinia archidis sps.)

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 2018 and 2019 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 2018 and 2019 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 daytime 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 2018 and 2019 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 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

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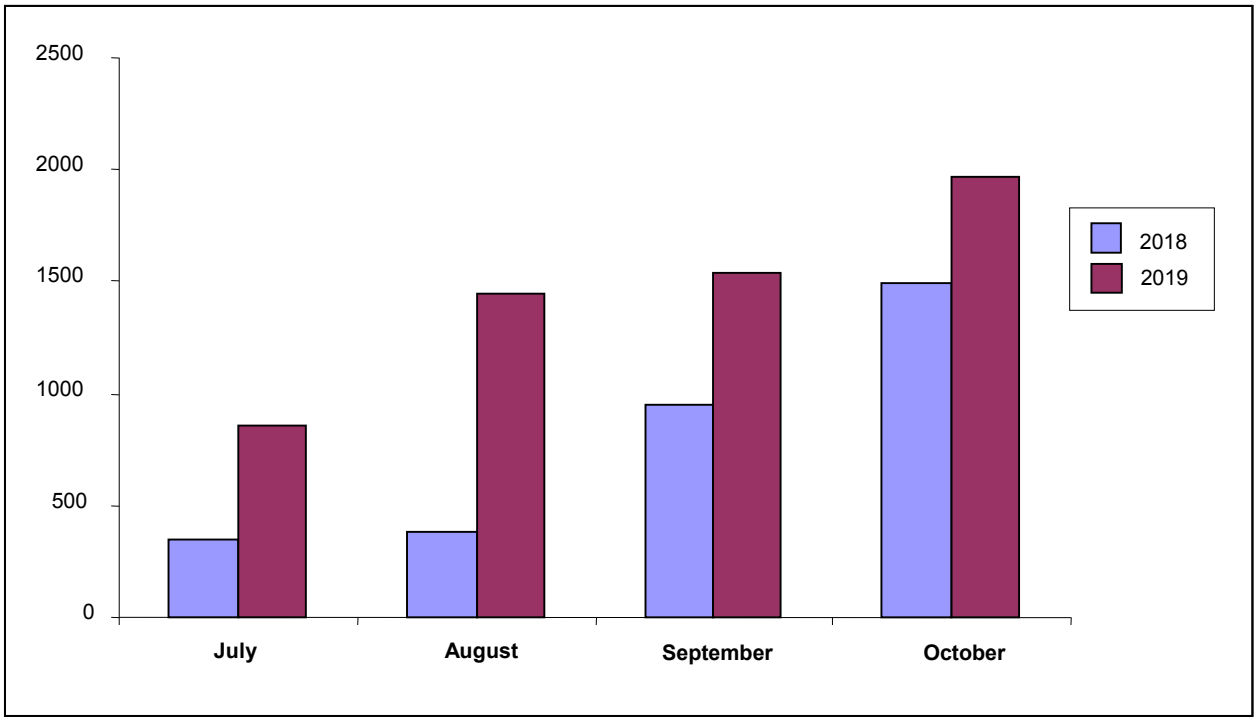
be carried out for developing an efficient and definite method for forecasting and controlling of Tikka and rust disease of groundnut which becoming a menace for groundnut cultivation.

TABLE - I: MONTHLY CONTRIBUTION OF CERCOSPORA SP/M^3 OF AIR TO THE TOTAL AIRSPORA OVER GROUNDNUT FIEID DURING I & II SEASON I KHARIF SEASON (20/07/2018 TO 30/10/2018) II KHARIF SEASON (01/07/2019 TO 30/10/2019)

Month	Pathogen Concentration / m^3 of air						Meteorological Factors					
	Puccinia arachidis		*Cercospora archidicola*		*Cercospora personata*		Average relative humidity (%)		Average Rainfall (mm)		Average Temperatures (°C)	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
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

GRAPH SHOWING MONTHLY CONTRIBUTION OF **PUCCINNIA ARACHIDIS**/M^3 OF AIR TO THE TOTAL AIROSPORA DURING Ist AND IInd SEASON

GRAPH SHOWING MONTHLY CONTRIBUTION OF **CERCOSPORA ARACHIDICOLA**/M^3 OF AIR TO THE TOTAL AIROSPORA DURING Ist AND IInd SEASON



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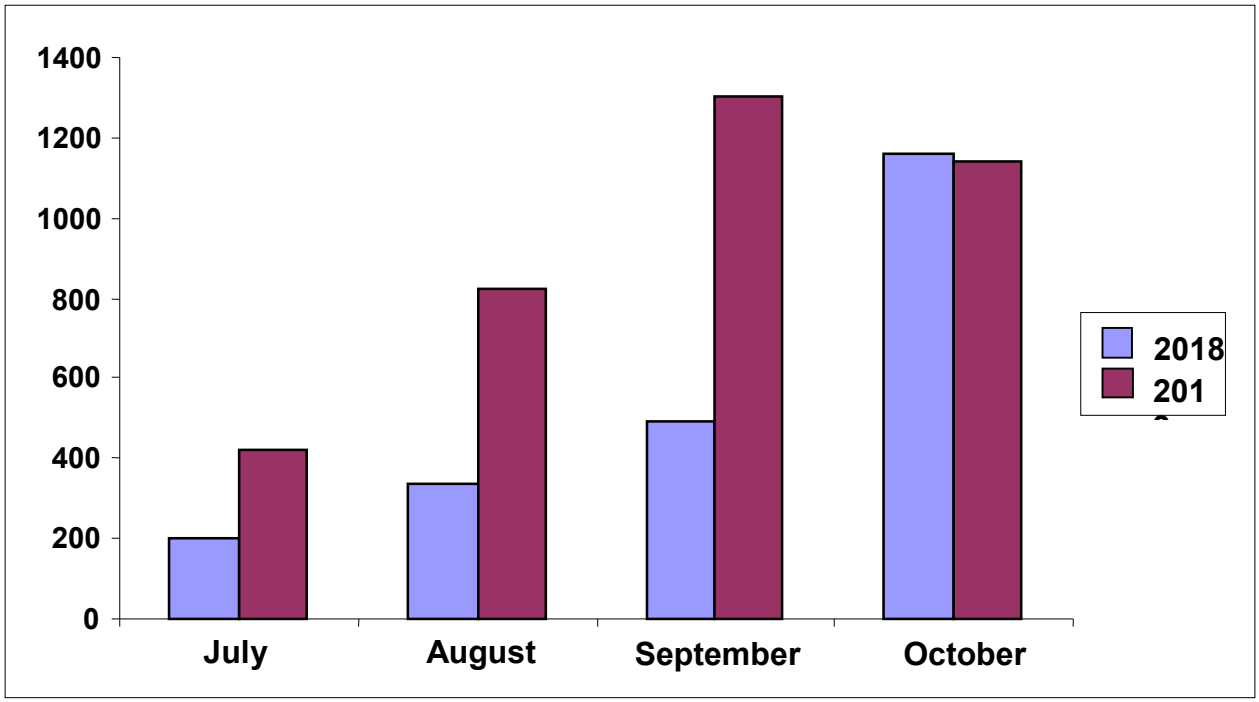
GRAPH SHOWING MONTHLY CONTRIBUTION OF **CERCOSPORA PERSONATA**/M^3 OF AIR TO THE TOTAL AIROSPORA DURING I^{st} AND II^{nd} SEASON



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