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OBSERVATIONS ON THE CHANGES IN THE ATMOSPHERIC SPORE CONTENT OF *Piricularia oryzae* Cav. AND ON THE INTENSITY OF BLAST INCIDENCE ON RICE

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Most pathogenic as well as nonpathogenic fungi liberate their spores under favourable conditions. A knowledge of the occurrence of the spores of pathogenic fungi in the air and the factors which favour their production and liberation is essential for evolving criteria for forecasting crop diseases.

Rice crop in kerala is subject to a number of diseases, the most important one being blast caused by *Piricularia oryzae* Cav. Since the disease spreads with the help of conidia and since various factors are known to influence sporulation an attempt was made to assess the content of *Piricularia* spores over two successive rice crops during 1966-67 using Hirst's automatic volumetric spore trap. An attempt was also made to correlate the severity of infection with the concentration of spores in the atmosphere.

Materials and Methods

Three varieties of rice, namely, Tainan-3, ADT. 27 and Kaoshiung-18 were raised in the irrigated garden land attached to the College of Agriculture at Vellayani. Each variety was grown in two plots, each plots having an area of 9.45 sq. metres. Two crops were raised, the first crop during October to January and the second crop during January to May. All the plots were uniformly manured. A Hirst's automatic volumetric spore trap was set up in the middle of the crop.

The trap slides were scanned to determine the hourly spore load of each day. The hourly spore loac's for individual days of a month were added up to arrive at the total monthly spore load for the different hours of the day. Temperature and humidity records were also maintained from December onwards using a thermohygrograph which was located near the spore trap.

An assessment of the incidence and progress of the blast disease was made only fcr the second crop. This observation was taken at weekly intervals from plants selected at random using a rectangular frame of size 30 x 30 cm. In each plant the second leaf of all the tillers were taken for recording the number of spots. The extent of leaf infection was converted into numerical scores as follows.

1 to 3 spots	= score 1;	4 to 15 spots	= score 2
16 to 30 spots	= score 3;	31 to 50 spots	= score 4
51 to 80 spots	= score 5;	above 80 spots	= score 6.

Results

ADT. 27 was severely affected by blast in both the seasons. Kaoshiung-18 and Tainan-3 were also affected but not so severely. ADT. 27 and Kaoshiung-18 showed symptoms of blast earlier than Tainan-3. Incidence of blast was observed on the leaves during the seedling stage itself.

Spores of *Piricularia* occurred in comparatively large numbers during December. The spore load was very low during the subsequent months and no spores were present during May.

A definite periodicity in the liberation of spores was exhibited by *Piricularia oryzae*. The highest spore load in December always occurred during night hours. The peak spore load during the month was noted around 02.00 hrs. Spores were present in comparatively smaller numbers during day time also (Fig 1 a), In March the night maxima shifted to a day maxima. The highest spore load was noted in the forenoon (Fig. 1 b).

Effect of temperature and humidity on the spore load

Maximum concentration of spores of *p. oryzae* in the air was noted during periods of high humidity and low temperature. Generally the spores began to appear in small numbers in the evening when the temperature fell and humidity rose. The peak concentration of *Piricularia* spores occurred at a temperature range of 23° – 26°C and relative humidity of 89-99%. In December the humidity generally began to rise and temperature began to fall around 19.00 hrs and this condition was usually maintained throughout the night till 07.00 hrs. The peak spore load occurred 7 to 8 hours after the temperature began to fall and humidity began to rise, namely, at 02.00 hrs (Fig 1 a). In March, on the other hand, the temperature began to fall and humidity began to rise around 23.00 hrs and the peak spore load occurred in the forenoon (Fig 1 b).

Correlation between spore content in the air and blast infection

A definite correlation was noted between the concentration of spores of *Piricularia* in the atmosphere and severity of blast incidence. It was found that an increase in the spore load in the atmosphere was followed by increased leaf infection (Fig. 2).

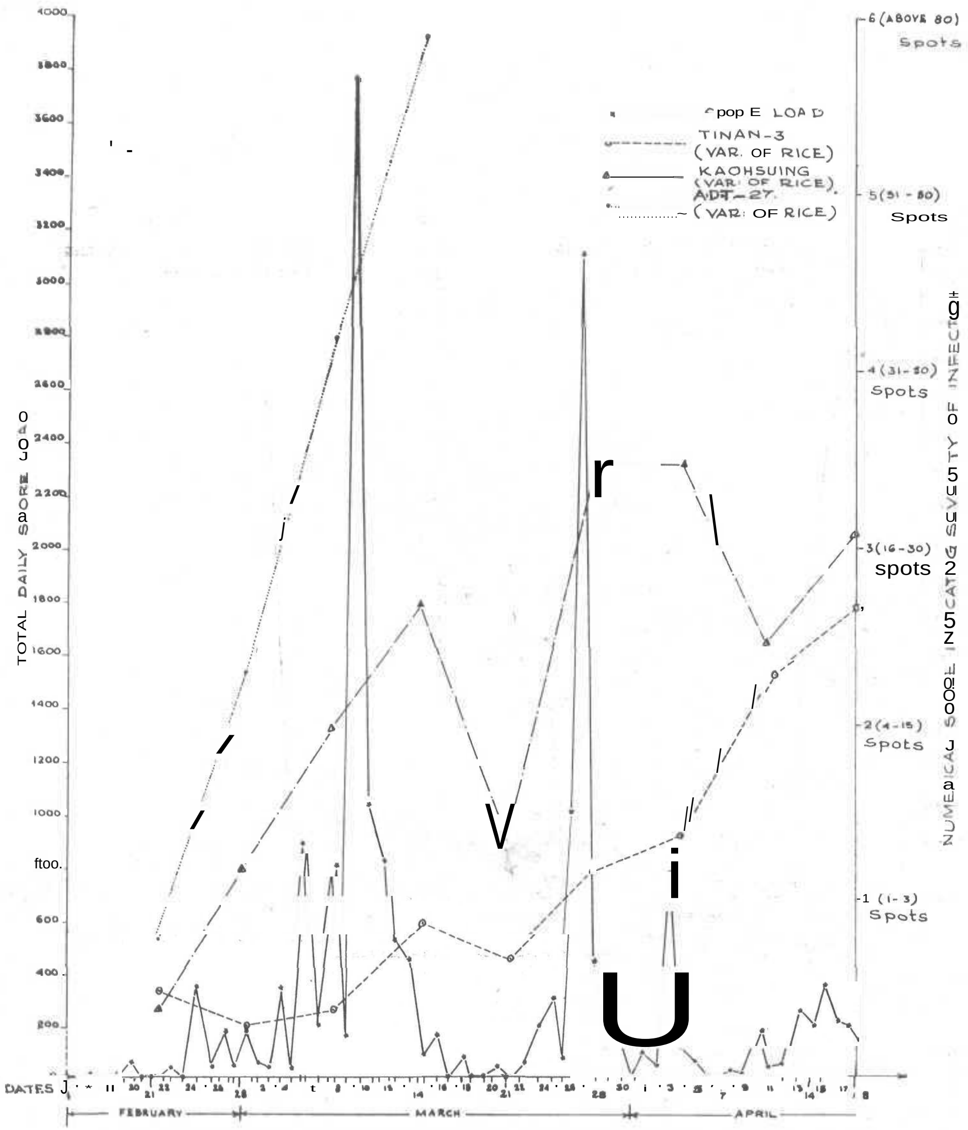

FIG: 2. PIRICULARIA ORYZAE INFLUENCE OF SPORE LOAD ON THE INTENSITY OF BLAST INFECTION IN THREE VARIETIES OF RICE

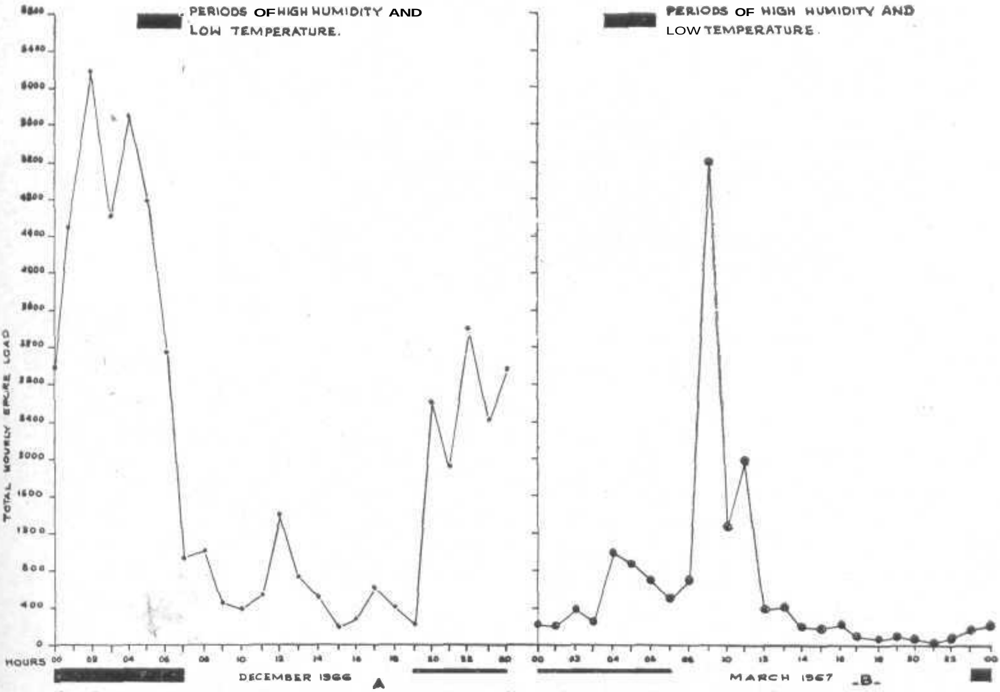

FIG: 1. *PIRICULARIA ORYZAE* SPORE LOAD IN THE ATMOSPHERE IN RELATION TO PERIODS OF HIGH HUMIDITY AND LOW TEMPERATURE

There was a slight increase in the spore* load during the week ending 28-2-1967 and this Was accompanied by an increase in the severity of infection. From then on, the spore load showed a tendency to increase. During the wtek ending 14-3-1967 there was a marked increase in the spore load and this was followed by a very sharp rise in infection. ADT. 27 was so severely affected by the disease that the crop was almost Completely damaged at this stage. Only the other two varieties survived. A fall in the spore load was noted during the week ending 21-3-1967 and this was accompanied by a fall in infection. The spore load during the week ending 28-3-1967 showed a sharp increase and this was accompanied by an increase in infection (Fig. 2.)

Discussion

It is possible that a few spores of *Piricularia spp.* from grasses might also have been trapped along with those of P. *oryzae.* However, it is considered that this error might not have vitiated the results since the spore trap was located in the middle of an infected rice crop.

The spore load in December was found to be much higher than those during January to April. This may be attributable to the differences in the weather conditions which prevailed during these periods. The weather data for December indicate that high humidity and low temperature prevailed over longer periods on most of the nights during the month. This might have favourably influenced the production of spores. In March on the other hand the above favourable conditions were obtained only for shorter periods and the spore load was also low.

Spores of P. *oryzae* exhibited a night maxima during December, the highest spore load occurring around 02.00 hours. This changed to a day maxima in March, the highest spore load occuring between 08.00 and 11.00 hours. Ramalingam (1966) found that under the conditions obtained at Visakhapatnam, peak spore load in the first crop season during September to October occurred at 04.00 hours while in the second crop season during February to April it occurred at 06.00 hours. The shift in the period of spore liberation rioted in the present study was, however, much more marked.

P. *oryzae* is known to exhibit a nocturnal pattern of spore liberation at periods of high atmospheric humidity and low temperature. Ingold (1965) has observed that the spores of this fungus can be set free only if the air is saturated or nearly so.

The alternation of the nocturnal pattern of spore liberation noted in the present work under natural conditions can be attributed to seasonal influence. Normally the spore load was seen to increase *gradually* when the temperature began to fall and the humidity began to rise. The maximum spore liberation occured 7 to 8 hours afterwards. This seems to be the period required for the production and maturation of the spores. While in December, the fall in temperatare and rise in humidity occurred around 19 hours, in March the above condition was obtained only around 23 hours (Fig. 1 a & b). This may perhaps be the reason why the peak spore load occurred only in the forenoon in March. It may be noted that in December also a few spores were liberated during day time eventhough the peak spores load occurred during night. While the dispersal during night can be considered due to some active discharge mechanism as suggested by Ingold (1965), that during day time may be due to the drying up of the substratum and wind erosion.

A definite correlation was noted between the spore load of P. *oryzae* and severity of blast infection. The three varieties of rice used in the present studies were found to behave differently with regard to severity of infection under identical conditions.

Summary

An attempt was made to assess the atmospheric spore content of *Piricularia oryzae* over two successive rice crops during 1966-67 using Hirst's automatic volumetric spore trap.

Spores were present in the atmosphere in larger numbers during December and in smaller numbers during the other months, being absent in May. The highest spore load usually occurred 7 to 8 hours after the temperature began to fall and the humidity began to rise.

Spores of the organism exhibited a night maxima in December drying which month the highest spore load usually occurred around 02.00 hrs. A shift in the nocturnal pattern of spore liberation to a forenoon pattern was noted in March. While the dispersal during night is considered to be brought about by some active discharge mechanism, that during day time may be due to the drying up of the substratum and wind erosion.

A correlation was noted between the spore load of P. *oryzae* and the severity of blast infection.

The intensity of infection was found to differ in the three varieties of rice used under identical conditions.

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