OBSERVATIONS ON ERGOTS ON *PENNISETUM* AND OTHER GRASSES

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Ergot has been recorded on over thirty different grasses in South India. On some hosts the sphacelial state alone has been observed. On others sclerotia also have been noticed. More than four species of *Claviceps* are definitely to be found among these, *viz.*, *Claviceps purpurea* Tul., *C. viridis* Pad. and Azm., *C. paspali* Stev. and Hall., and *C. pusilla* Ces. The germination of the sclerotia has been followed in a few but not in all. Therefore the identity of the species could not be determined in the latter. The conidia are small or big, oblong, lunulate or triangular. Based on the characters of the conidia the ergots (whose perithecial state has not been observed) recorded in South India can be grouped into five or six well defined classes. The cold months from October to February with intermittent showers and heavy dew appears to be the most suitable period for large-scale infection of grasses in the plains of South India.

In November 1950 all the plants in a group of allotetraploid hybrids of *Pennisetum typhoides* × *P. purpureum* grown by Dr. N. Krishnaswamy, Cytogenecist, at the Millets Breeding Station, Coimbatore, were heavily infected by an ergot which prevented seed setting. Examination of the ears showed the presence of honeydew and sclerotia in most of the spikelets. The sclerotia were small and dark brown, just projecting from between the lemma and palea. The honey dew was light honey coloured. The conidia were however hyaline and lunulate and measured 18 × 5 μ (13–25 × 3–6). The shape of the conidia suggested affinity to the ergots recorded on *P. hohenackeri*, *Brachiaria ramosa*, *Cenchrus ciliaris*, etc. (Ramakrishnan, 1947). Further studies were carried out with the new fungus and other strains infecting *B. ramosa* and *Urochloa setigera* and the observations are recorded in this communication.

Materials and Methods

The infected ears of the hybrid above mentioned were dried in shade and stored in corked tubes for obtaining the inoculum. Spore suspensions were made in distilled water using two or three infected spikelets for 20 c.c.

of water. The suspension was of a thin milky colour. It was atomised on young ears just when stigmas were protruding. After spray inoculation, the ears were enclosed in glass tubes plugged at the ends with damp cotton-wool. The tubes were removed after three days under humid conditions or kept on for two more days if bright weather prevailed. The analyses of sclerotia were made by the method described by Mukerji and De (1944).

EXPERIMENTAL RESULTS

The spray inoculations were carried out in the months of April to November. In susceptible hosts positive infection took place irrespective of the month, provided the humidity round the ear was maintained as near saturation level as possible.

The results of infection experiments are given below:

TABLE

Statement showing the results of inoculation

Host	Results
Pennisetum typhoides ..	Positive infection with honey dew in 8 days
P. purpureum	" " " " 7–8 "
P. reupellii	" " " " 8 "
P. hohenackeri	" " " " 8 "
P. alopecuros	" " " " 8 "
P. polystachyon	" " " " 8 "
Cenchrus ciliaris	" " " " 7 "
C. setigerus	" " " " 7 "

This ergot infects all the species of *Pennisetum* included in the trials and the species of *Cenchrus*. The inoculations were repeated on different hybrids of *P. purpureum* × *P. typhoides* exhibiting differences in chromosome numbers. Sterile F_1 ($2n = 21$), fertile F_2 ($2n = 22$), allotetraploids ($2n = 28$) and other F_2 ($2n = 42$) populations were included in the trials to note whether any differences in their reaction are noticeable. All of them were readily infected in six to seven days producing copious honey dew.

Both the fertile and the sterile progenies were equally infected showing thereby that the fertility of the grasses is not essential for successful infection.

The course of infection was closely followed in one of the hybrid hosts (*P. typhoides* × *P. purpureum*). The suspension was sprayed on the ear when the stigmas were coming out. Random spikelets were taken out at 24-hour intervals to watch the progress of infection. After 48 hours, germinating spores were found on the surfaces of stigma, style and ovary. After a lapse of 72 hours mycelial growth was evident at the base of the ovary with penetration into the outer layers of cells. The spores on the style and stigma had germinated but there were no signs of further growth or infection of these parts. Ninety-six hours after inoculation the ovary was found to be completely invaded and conidial formation had commenced in some portions near the surface. In five days honeydew was formed. The stamens, style and stigma were not involved. On the sixth and seventh days more profuse mycelial growth took place and the mass thus formed developed conidia from all over the surface borne on closely arranged conidiophores. In ten days sclerotia had developed in the infected spikelets.

The sclerotia were small, dark and grey coloured but white inside. The alkaloid content of the sclerotia was chemically assayed. There were only slight traces of the alkaloid. This would suggest that the possibility of ergot poisoning through the presence of the disease in the grain crop is remote. There are indications however that physiologically different strains of this ergot exist and that there might be differences in host range, alkaloid content and other characters between these.

The ergot under study closely resembles the ones recorded on *P. hohenakeri* and *Cenchrus* spp. (Thomas, *et al.*, 1945). But the sclerotia formed on the former are bigger, while on the latter hosts sclerotia are not formed at all either by the isolates naturally found on them or by those found on *Pennisetum*. Thus the host influences the size and development of the sclerotia. Similar behaviour has been observed in *C. purpurea* by Atanasoff (1926). *C. purpurea* which forms sclerotia on rye and many other hosts infects *Anthoxanthum odoratum* but forms only conidia and not sclerotia. The fungus under study has numerous hosts and differences in the size and formation of the sclerotia, host range, etc., are exhibited by the strains on different hosts. The ergot on *Brachiaria ramosa* has been collected from different places in the State. The conidia are identical in shape and size to those found on *Pennisetum*. The strain from the *Pennisetum* hybrid failed to infect *B. ramosa*. But the strain on *Cenchrus ciliaris* was however able to infect *B. ramosa*.

Thus it seems that there is evidence of differences in host range existing between the forms found on different hosts. It has been stated above that analyses of the small sclerotia formed on *Pennisetum* revealed only traces of the alkaloid. Some samples of the sclerotia formed on *B. ramosa* collected from South Kanara however contained a high percentage of the alkaloid (0·8% calculated as ergotoxine). A sample of this ergot was sent to the Veterinary Investigation Officer, Ranipet, for feeding trials. He has reported that guinea pigs fed with crushed sclerotia mixed with the food died in a couple of days. Another strain with conidia closely resembling those found on *Pennisetum* hybrid was observed to infect the spikelets of *Urochloa setigera* at Kallar (Coimbatore). This strain readily passed on to *Pennisetum* hybrids and developed honeydew and sclerotia in 10 days. The sclerotia obtained from *Urocholoa* contained over 0·5% of alkaloid. But the sclerotia formed on *Pennisetum* hybrids by the same strain had only traces of the alkaloid. It therefore becomes evident that the strain of the fungus on one host has little alkaloid while on another host it develops a high alkaloid content. There is a possibility of cattle poisoning from the strains having a high alkaloid content when cattle are grazed on infected grasses.

The ergot sclerotia did not germinate even after stratification and exposure to low temperature. The question arises as to how the fungus survives from year to year. No specimen or ergot showing germination of sclerotia under natural conditions was observed. Nor did they germinate in the laboratory after various treatments. It was therefore surmised that the survival might be through the viability of the conidia. In order to test this, germination of the conidia from specimens air-dried and stored in closed glass tubes in the laboratory was determined at monthly intervals. At the same time ears of *Pennisetum* hybrids were also inoculated with suspensions of the spores. In hanging drop cultures the spores were found to germinate readily for a period of seven months after collection. In the eighth month germination was poor and there was no germination in the ninth month. But even in the tenth month germination became evident when the spores were floated on drops containing crushed young ovaries of the host. Successful infections were obtained in the ears of the hybrids sprayed with a suspension of spores 13 months old. The above results definitely show that the fungus can survive from year to year through the agency of the conidia. The large number of hosts with different flowering seasons will be of additional advantage in the perpetuation of the ergot. These ergots are common in several districts. Some of them contain high percentages of the alkaloid, ergotoxine. There is thus a danger of stock

poisoning by feeding on infected grasses. The infection is however confined to the ears. There is no danger from grazing on grasses which have not flowered. After flowering it is better to examine the ears for freedom from ergot before letting in the cattle to graze. Otherwise the ears should be cut off so that cattle have no chance of eating ergotized grains.

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