

THE NATURAL OCCURRENCE OF ERGOT IN SOUTH INDIA—III

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SINCE the publication of the earlier communications on the natural occurrence of ergot in South India (Thomas *et al.* I, II, 1945) more hosts affected by *Claviceps* have been discovered. Descriptions of the fungi on these hosts and the results of some inoculation experiments are recorded in this communication.

1. *Cynodon plectostachyum* Pilger.—This is a new grass recently introduced into Coimbatore by the Government Lecturing and Systematic Botanist for trial as a fodder. It was found to be severely infested by *Claviceps* during November 1945 to January 1946, and again in December 1946. The sphaelial form is conspicuous as white drops of sticky honey dew. A number of such drops are visible in a spike. The conidia are of two types. One kind of conidium is hyaline, oblong or reniform, measuring 15.9×6.9 ($11 - 8.5 \times 3.5 - 7.4$) μ (Fig. 1). The second type is smaller more or less elliptical or sometimes subspherical, hyaline and measuring 9.4×7.3 ($7 - 11 \times 5.6 - 9.3$) μ . The smaller type seems to be the secondary conidia formed by the germinating bigger conidia. The sclerotia usually develop in January. They are black, slightly bent, protruding beyond the glumes and measuring $3 - 5.5 \times 1.5$ mm.

This fungus closely resembles the one on *C. dactylon*. The conidial measurements and the shape and size of the sclerotia are almost identical on both the hosts and it is considered that both of them belong to the same species. A further comparison of the ergots occurring on different hosts brings out the close resemblance of the conidial stages on *Digitaria chinensis*, *D. wallichiana*, *Panicum maximum*, *Cynodon dactylon* and *C. plectostachyum*. Spore suspensions of conidia from *P. maximum* were sprayed on open flowers of *C. dactylon*. Even after 15 days there was no sign of infection. But this does not necessarily mean the fungi on these two hosts are not the same species. In the genus *Claviceps* specialisation of parasitism exists and in the same species some strains do not pass on from one host to another (Atanasoff, 1920). However without the knowledge of the stromatal and perithecial characters it is unsafe to determine this species of *Claviceps*,

2. *Vetiveria Lawsoni* Blatt and MacC.—This is another grass under experimental cultivation in the botanic Garden at Coimbatore which exhibits severe infection by *Claviceps* in December. The conidial stage appears as sticky translucent drops which finally dry up into creamy white hard round masses outside the spikelets. Sometimes the fluid spreads over the glumes and



Fig. 1.	Conidia of <i>Claviceps</i> on	<i>Cynodon pheetostachyum</i> .
" 2.	" "	<i>Paspalidium flavidum</i> .
" 3.	Sclerotia on	<i>Paspalidium flavidum</i> .
" 4.	Conidia on	<i>Cenchrus setigerus</i> .
" 5.	" "	<i>Vetiveria lawsoni</i> .
" 6.	" "	<i>Heteropogon contortus</i> .
" 7.	" "	<i>Ischaemum pilosum</i> .
" 8.	" "	<i>Urochloa panicoides</i> .

(All drawings of conidia $\times 500$).

forms, on drying, white deposits over the surface of the affected and adjoining spikelets. From this white colouration the disease can be easily spotted. The conidia are hyaline, oblong with straight sides or constricted slightly in the middle. They measure 10.2×4.2 ($7.4-11 \times 3.7-5.5$) μ (Fig. 5). The diseased spikelets are soon overgrown by *Cerebella* which arrests the

formation of sclerotia though it enables one to easily locate the affected spikelets. On dissecting open some of the spikelets, not overgrown by *Cerebella*, small black sclerotia $2-3.5 \times 0.75-1$ mm. in size can be seen between the glumes replacing the ovary. The base of the sclerotium is sometimes purple in colour.

3. *Ischaemum pilosum* Hack.—The honey dew is noticed as clear or white drops later turning brown outside the glumes. The conidia are hyaline and oblong with rounded ends. The contents are granular with the granules often grouped at the two ends. The conidia measure 11.4×5.0 ($8.4-14.4 \times 4.8-5.6$) μ (Fig. 7). Here also *Cerebella* easily overgrows the fungal tissue and sclerotial formation is thus prevented. In some of the affected spikelets with no *Cerebella* infection, small dark sclerotia measuring 3×0.5 mm. were noticed inside the spikelets in the place of the ovary and completely enveloped by the glumes. The ergot on *Vetiveria lawsoni* and *Ischaemum pilosum* are identical and must be considered as belonging to the same species. They fall into the same group as those on *Themeda triandra*, *Ischaemum aristatum*, *Andropogon lividus* and *Cymbopogon flexuosus* (Thomas *et al* 1945). Ajrekar (1920) has recorded a *Sphacelia* on *Ischaemum pilosum* but the spores are stated to be curved. Hence the fungus recorded now is quite different.

4. *Paspalidium flavidum* A Camus.—This is a common fodder grass found in many parts of the province. At Coimbatore it is affected by ergot in the months of November and December. The honey-dew protrudes as a sticky pearly drop from the spikelet. Later it may spread over the glumes and pedicels forming white crusts. The conidia are hyaline, lunulate and measure 16×5 ($12.8-20.8 \times 4.8-6.4$) μ (Fig. 2). Sclerotia are formed. These are dark brown to black, curved, $4-5 \times 1$ mm. and projecting out from between the lemma and palea (Fig. 3).

5. *Urochloa panicoides* Beauv.—This is a good fodder grass common in all districts of the province. It is also affected by ergot at Coimbatore. The sphacelial stage develops in individual spikelets forming translucent to white drops exuding from the spikelets. Later, these harden into brown masses running over the glumes. Sometimes the whole spikelet is covered by a white deposit by means of which the affected spikelets can be easily recognised. The conidia are hyaline, fusoid to lunulate, measuring $15.4-5.1$ ($12.8-19 \times 3.2-6.4$) μ (Fig. 8). The sclerotia are small, brown, globose to oblong $1.5 \times 0.5-0.75$ mm. and occupying the position of the ovary between the lemma and palea. There is a close resemblance between the ergots on *Paspalidium flavidum*, *Urochloa panicoides*, *Urochloa reptans* and

Brachiaria distachya. The last named host was severely infested during December 1946 at Coimbatore. Thirumalachar (1945) has recorded a similar ergot on *B. distachya* from Mysore.

6. *Heteropogon contortus* Beauv.—Thomas *et al.* (1945) have recorded an ergot on this host having mainly triangular conidia. During December 1946 another type of sphacelial infection was noticed on this host besides the one recorded before. The honey-dew formation was more or less similar to the one noticed earlier but the conidia were different. They were hyaline oblong, with rounded ends, very rarely tending towards reniform and measured 15.0×5.1 ($11-19 \times 4.8-6.4$) μ (Fig. 6). The honey-dew soon dried into white or cream coloured masses projecting out of the spikelets.

Thirumalachar (1945) has also recorded from Mysore oblong conidia of the same size in sphacelial infection of this host. Thus this host appears to be susceptible to infection by two different types of *Sphacelia*.

7. *Cenchrus setigerus* Vahl.—This grass is common in all open places in this district. A widespread epiphytotic of *Sphacelia* was noticed on this grass from the month of November, 1946. The infection involved either some of the spikelets of the panicle or all the spikelets. A creamy white drop of fluid collected at the apex of the spikelet and flowed down the sides where it dried into white deposits clearly visible against the dark purple colour of the spikelet. The conidia were mainly lunulate sometimes fusoid, hyaline and measured 17.9×4.8 ($12.8-26 \times 3.2-6.4$) μ (Fig. 4). The ovary and rarely the stamens also were enveloped in a compact hyphal mass. From the surface of this mass large members of conidiophores were developed in a closely packed folded hymenial layer. The formation of distinct sclerotia was not observed.

This resembles the *Sphacelia* recorded on *Cenchrus ciliaris* (Adyantayya, 1946) and *Pennisetum hohenackeri* (Thomas *et al.*, 1945). Conidial suspensions of the *Sphacelia* on *C. setigerus* were sprayed on healthy blooming panicles of *C. ciliaris*, *C. setigerus*, *Brachiaria ramosa*, *Panicum maximum* and *Apluda aristata*. The inoculations were carried out during a spell of rainy weather and the experimental plants were kept inside glass cages or under bell jars for three days to provide favourable conditions for infection. On the ninth day a number of spikelets of *C. ciliaris*, *C. setigerus*, and *B. ramosa* were showing honey-dew formation. The controls and the other hosts were free. Thus the ergot passes from one host to another. The conidial characters also indicate that the same species is present on *C. ciliaris*, *C. setigerus*, *B. ramosa* and *P. hohenackeri* (though inoculation experiments were not made on the last named host). The infection of the spikelets of

C. ciliaris is possible when inoculations are made when the anthers protrude or earlier. Six spikes were completely immersed in spore suspension for 2 minutes, three days after emergence and long before the flowers opened. In the course of ten days all the spikelets in the inoculated spikes were found infected with the honey-dew formation while the controls bloomed normally. Anthesis did not occur in the inoculated spikes.

Thirumalachar (1945) is of opinion that the ergot on *P. hohenackeri* "comes nearest to or is identical with *Claviceps microcephala*," judging from the colour of the stroma, size of ascospores and perithecia. But the conidia of this species are small and oval and measure $7-8 \times 3-5 \mu$, while the conidia of the fungus on *P. hohenackeri* are bigger, lunulate, and measure $20.4 \times 5.8 \mu$ (Thomas *et al.*, 1945). Consequently it is evident that the ergot on *P. hohenackeri* is different from *C. microcephala*. Judging from the conidial characters the tentative grouping of the ergots suggested by Thomas *et al.* (1945-1) has to be slightly modified. In the first group in which curved and fusoid conidia are observed the two subdivisions may be modified as follows:—

Nature of conidia	Host plants
(1) Conidia of various shapes	
(a) Conidia reniform	<i>Cynodon dactylon</i> <i>C. plectostachyum</i> <i>Digitaria chinensis</i> <i>D. wallichiana</i> <i>Panicum maximum</i>
(b) Conidia lunulate or fusoid	<i>Urochloa reptans</i> <i>U. panicoides</i> <i>Apluda aristata</i> <i>Cenchrus ciliaris</i> <i>C. setigerus</i> <i>Pennisetum hohenackeri</i> <i>Brachiaria ramosa</i> <i>B. distachya</i> <i>Paspalidium flavidum</i>

8. *Sorghum* spp.—The occurrence of *Sphacelia sorghi* on many varieties of cultivated grain sorghums (*S. vulgare*, *S. aurra*, *S. Roxburghiana*, etc.) have been recorded from various parts of India, Burma and Africa. During this year the sugary disease was observed on a number of wild or exotic sorghums also at the Millets Breeding Station, Coimbatore, during December. The species that were involved are *S. halepense* Pers., *S. arundinaceum* Stapf.,

S. verticilliflorum Stapf., *S. nitens* (B. & P.) Snow., *S. caffrorum* Beauv., and *S. membranaceum* Chiov. In all these pearly drops were seen exuding from the spikelets. These later dried into white deposits sometimes connecting together the contacting spikelets. The ground underneath the affected plants was bespattered with white spots. The conidia in all cases were alike being oblong with rounded ends and slightly constricted in the middle measuring on an average $16 \times 7 \mu$ ($12-19 \times 5-8$). The size, shape of conidia, and the symptoms of infection are similar on all the hosts and agree with those of *Sphacelia sorghi* McRae. Sclerotial formation was not in evidence on any of the hosts.

SUMMARY

Six new hosts of *Claviceps* have been recorded and the fungal characters on these hosts are described. These fungi fall into one or the other of the groups previously recorded by Thomas *et al.* (1945) for the ergots occurring in South India. A slight modification of the grouping adopted by Thomas *et al.* (1945-1) in classifying the ergots by the conidial characters, has been made. Wild and exotic species of sorghum were infected by *Sphacelia sorghi*.

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