

NOTE

A FURTHER NOTE ON FUNGUS ASSOCIATION
IN THE SIRICIDAE

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AN investigation into the relationship existing between fungus and insect in the Siricidae was commenced in 1928 on the suggestion of Dr R. Neil Chrystal.

Buchner (1928) had described and figured the occurrence in *Sirex gigas* of paired glandular structures which occur at the base of the ovipositor. These glands open into the insect's vagina and in them fungus "oidia" were observed by him. These "oidia" in some cases possessed clamp connexions and the fungus was, therefore, placed in the Basidiomycetes. A note on this investigation was published by the author (Cartwright, 1929), *S. cyaneus* being the species mainly under investigation. *S. gigas* was only cursorily examined owing to lack of adequate material. Since this note was published the investigation has been continued as material became available and as time permitted. Material of both *S. cyaneus* and *S. gigas* has been received from several different localities, and a limited amount of material of *Xiphydria prolongata*. It is proposed, when the entomological side of the investigation has been completed, to publish a full account, but a summary of progress is given here in the hope that it may prove of interest to other workers in the same field.

Since the publication of the original note (Cartwright, 1929) the results there recorded in respect of *Sirex cyaneus* have been confirmed. A fungus has been isolated from glands, eggs, oviposition and larval tunnels of both *S. cyaneus* and *S. gigas*. It has not been possible to establish with certainty the identity of the fungus associated with *S. cyaneus*, but it closely resembles that obtained from *S. gigas* and, although there are certain constant differences, these are hardly sufficient to warrant considering it more than a form of the same species. The culture is characterized by the formation as it ages of a greyish lilac colour, this coloured area possibly representing a rudimentary hymenial surface. The colour resembles that of the fruit body of *Peniophora quercina*.

The mycelial characters of the fungus associated with *Sirex cyaneus* are very similar to those found in *Stereum sanguinolentum*, and cystidia with crystalline incrustations are produced, but in greater abundance. In particular, the sweet odour characteristic of *S. sanguinolentum* is pronounced. A few basidiospores were produced in one culture and these came within the range of measurement of those of *S. sanguinolentum*. The rate and type of growth on malt agar is also very similar. On the other hand, a constant difference is apparent between typical *S. sanguinolentum* and all isolations from *Sirex cyaneus*. This is the pinkish cinnamon colour produced in cultures of the latter as compared with the more yellowish tints produced in the former. Another point of difference is that the fungus in the case of *S. cyaneus* appears to develop a definite mycelial growth which invests the egg previous to oviposition, whereas in the case of *S. gigas* the short segments remain in this condition until after

oviposition, but an insufficient number of insects have been so far examined to state whether this difference is a constant one. As there is a fairly wide variation in cultural characteristics between different isolations of *Stereum sanguinolentum*, it is thought probable that the fungus associated with *Sirex cyaneus* is a form of *Stereum sanguinolentum*, although, until characteristic fruit bodies are obtained, it is not possible to confirm this opinion.

The fungus isolated from *Sirex gigas* has been identified by means of comparison with standard cultures as *Stereum sanguinolentum*. Small samples of larch were inoculated with a culture isolated from a gland of *Sirex gigas*, and fruit bodies of *Stereum sanguinolentum* were produced on the wood, thus confirming the identification. Further corroborative evidence was obtained by the formation of fruit bodies of this fungus appearing on wood samples from which *Sirex gigas* had emerged after these had been kept moistened in a potato dish in the laboratory.

Under the moisture conditions occurring in wood in which live larvae are present no advanced stage of rot has been observed although, in a specimen of larch wood taken from a felled log in which old *Sirex* attack was evident, the decay had progressed to a considerable extent. In one instance a pupa of *S. gigas* was sent to me by Dr Chrystal, which was dead and surrounded by a web of mycelium. The fungus proved to be *Stereum sanguinolentum*. In this case the moisture conditions had apparently become favourable for the rapid development of the fungus, with fatal results to the *Sirex*. It appears that conditions of moisture in the wood favourable to *Sirex* are those that are just sufficient to support a slow development of the fungus.

In both the case of *S. cyaneus* and *S. gigas* there is very strong evidence for stating that a definite species of fungus is associated with each species of insect in so far as this country is concerned, and further evidence to the same effect has been obtained by Clark (1933) working in New Zealand with *S. noctilio*.

Females of both *S. cyaneus* and *S. gigas* have been observed ovipositing in wood free from all traces of fungus; the tunnels have been opened up and the eggs removed immediately after oviposition, and also at varying times after oviposition. Sections cut across these oviposition tunnels show all stages of development of the fungus from the egg, so that no doubt remains but that the fungus is introduced into the wood during oviposition.

Clark (1933) in New Zealand has carried the work a stage further, claiming to have found fungus in the larva apart from that which is obviously present in the digestive system owing to the larva feeding on wood containing fungus. In my preliminary examination, fungus was observed in a partially digested condition in the larval gut. Sections across late stage pupae also showed fungus to be present in glands at the base of the ovipositor in the case of female pupae.

Work has now commenced following up the development of the special fungus-carrying glands with a view to finding at what stage in the life history of the insect the fungus becomes segregated in these structures; this is being investigated by my entomological colleagues.

Xiphydria prolongata.

A small quantity of willow containing this insect has also been examined. Up to the present the investigation has been confined to the isolation of the fungus from the adult female and from the egg and larval tunnels. From the original material

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received, *Stereum purpureum* was isolated from old larval tunnels, but from material in which larvae were still active, and from which adults emerged later, isolations both from larval tunnels and from glands from the adult female have given a culture resembling closely in macroscopic appearance that of *Daldinia concentrica*, but differing from it microscopically in certain respects.

The fungus belongs almost certainly to the Pyrenomycetes and is one which can cause some decay of the wood.

SUMMARY

1. Earlier work on the association of *Sirex cyaneus* with a Basidiomycete fungus has been confirmed. The culture of the fungus closely resembles, but is not identical with that of *Stereum sanguinolentum*; it is therefore thought that it is a form of *S. sanguinolentum*.

2. The fungus isolated from *Sirex gigas* has been identified as *Stereum sanguinolentum*.

3. At the moisture content favourable for the development of the larvae, only slow development of the fungus can take place. Under more moist conditions vigorous fungus growth occurs, with apparently fatal results to the larvae.

4. The fungus is introduced into the wood during oviposition in the case of both *Sirex cyaneus* and *S. gigas*.

5. Fungus was found to be present in glands at the base of the ovipositor in late stage female pupae.

6. A fungus, the culture of which resembles in appearance that of *Daldinia concentrica*, has been isolated from larval tunnels and from glands in adult females of *Xiphydia prolongata*.

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