

NOTES ON THE SHOT-HOLE BORER OF TEA

Xyleborus fornicatus Eichhoff *fornicator* Eggers

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1. NOMENCLATURE

At one time the Shot-hole borer of tea was named simply *Xyleborus fornicatus* by Eichhoff and the beetle was thought to have a wide variety of host plants, including castor and tea. It is now known that the beetle which commonly attacks castor is not the same as that which, in Ceylon, commonly attacks tea. The two are certainly very much alike to look at, and it would be extremely difficult from the examination of a single specimen to say by its appearance which species it was.

On biological grounds, however, the distinction is quite clear, since the tea borer does not attack castor; and while the castor borer may attack tea to a slight extent, it only does so in the vicinity of attacked castor plants. For this reason it was desirable to give the former the distinctive sub-specific name as above, that for castor being *X. fornicatus fornicatus* Eichh.

2. THE FAMILY SCOLYTTIDAE

In order to appreciate the economic significance of the tea shot-hole borer, it will be instructive to look at it against the background of the family to which it belongs, and which is commonly referred to as "Bark borers."

The family is a very large one, containing thousands of species, many of which are very common. Nearly all of them attack woody plants, mainly trees. Many are serious pests. They concern the forester very closely and compel him to incorporate into his routine, methods designed to alleviate the damage they may cause. It is our purpose to examine this damage.

Stands of trees are planted by the forester for economic reasons. Sometimes they are of one variety. They are allowed to grow for a certain term of years before being judged fit for market and

felled. During this period, some may get damaged in one way or another, others may become unthrifty. Wherever there are dead or dying branches, bark borers begin their attack. If allowed to persist, they not only reduce the quality of the timber by the galleries they make, but increase their population to such an extent that when the timber is felled the new generations of beetles attack it wholesale. Therefore, the forester must be continually cleaning up, cutting away dead branches and perhaps removing altogether unhealthy trees. When the time for felling arrives, he knows that the timber will soon become the prey of these beetles — some attack almost at once, others wait for varying intervals of time until chemical decomposition in the sapwood has proceeded sufficiently far for their particular desires — so he arranges for the disposal of the logs as soon as possible.

The damage which the forester fears is that due to the borings of the beetles, which renders the timber unfit for constructive purposes. If tea branches were valuable timber, then shot-hole borer could be described as a very serious pest.

Another type of damage which also depreciates his timber is the development of rots into the heart wood from snags, broken branches and wounds in the bark, which make tree surgery so important a part of his duties.

In text books on forestry, forest entomology and other publications on these subjects I have nowhere seen it suggested that the development of rots in trees ensues from the gallery systems of bark borers. Both are so common that there is no doubt whatever that if such a relationship exists it could not have been overlooked. It is necessary to stress this point, since it is held strongly by some that the wood-rot which is so common in tea is due chiefly, if not entirely, to the ravages of shot-hole borer. This point will be discussed later in greater detail.

The forester, then, has a good deal to contend with from the borings of different species of beetles, and the only means of dealing with them at his disposal lies in attention to the trees, and not in an attempt to control the beetles themselves, for there is no established method of doing so. Nor does nature help very much in the matter of parasites and predators. Of the thousands of species of this family which have been described, there are perhaps a couple of dozen known to be attacked by parasites or predators. The former are hymenopterous, the latter either beetles or flies, but not one of them has a controlling effect in the economic sense.

We may sum up the position regarding the family *Scolytidae* by saying that it is a very extensive family of bark-boring beetles,

containing thousands of different species, many of which are serious pests of forest areas throughout the world. Their importance is in proportion to the damage they do to otherwise saleable timber by their gallery systems. Attacks are mostly confined to dead or dying logs and branches, and the forester can only cope with the damage by hygienic silvicultural methods. Few natural enemies are known, and they are of little economic importance.

3. SHOT-HOLE BORER AND BIOLOGICAL CONTROL

The tea shot-hole borer is a member of the family *Scolytidae* and the general remarks on biological control mentioned above apply with special force to *X. fornicator*, since no natural enemy has so far been discovered. It is proposed now to discuss the probabilities of doing so.

In order to examine the situation intelligently, we must again consider generalities, and so for convenience we will divide parasites (including predators) as a whole into 2 classes.

1. Those which attack only one species of host.
2. Those which attack several species of hosts.

Parasites which belong to group 1 are very greatly outnumbered by those in group 2, but the only great successes in the application of the principles of biological control have been won with these forms in or tending towards group 1. As far as numbers go, the parasites are dependent on the population of the host. When the latter becomes rare, the parasite becomes rarer still. Therefore, from the point of view of survival, the parasite is running a risk in attaching itself to one host alone. On the other hand, the group 2 species spread their risk over several hosts, as a wise man spreads his savings over different classes of investment. The effect on any one host, however, will naturally be less marked. For this reason, when searching for an effective parasite, one looks for one which shall be as specific as possible on the host in question. The alternative is to obtain several parasites which attack the host.

As regards the tea shot-hole borer, we start at a disadvantage. No parasite of the tea shot-hole borer is known in any country where shot-hole borer exists. What then is the next step? We must look for closely related beetles which act in a manner similar to the shot-hole borer. Already the scope of the enquiry is greatly narrowed, for very few borers behave like our shot-hole borer. The majority of the genus *Xyleborus*, like the great bulk of the family, bore into the trunks of trees which are dead or dying. Some bore into the smaller stems and branches of shrubs which are mostly dead. The nearest relation of the tea borer is the castor beetle,

but no parasites are known of this variety, either. Then there is the species *X. morigerus*, a coffee borer, which has been known to attack the roots of tea seedlings and withered tea twigs in Java. No parasites have been reared from it from tea, but at least one species of parasite has been recorded from it on coffee. Its relationship to the tea plant makes it improbable that the parasite could adapt itself to the habits of *X. fornicator*, and it is significant that not only has this species not yielded any parasite in Java, but that *X. morigerus* is not parasitised while attacking tea. Other species of *Xyleborus* are in no better case.

All species of this genus and for that matter, of many other genera, are highly specialised in that they carry about with them the spores of a particular fungus upon which they feed in their galleries. These fungi are apparently all different and not interchangeable. The conditions of growth for each are severely limited, and the propagation of the beetle is bound up with the success of the growth of the fungus. It may here be instanced that although our shot-hole borer may often bore into all sorts of trees and shrubs, it is only in tea and *Mimosa bracaatinga* and in one case, a recently dead rubber stem, that the fungus can grow and permit the beetle to raise a new brood. This specificity is associated with the environment which includes (in this case, excludes) parasitic fauna

It is hardly surprising, therefore, that the outlook for finding some insect enemy to deal with the problem is very far from promising. The success which attended the introduction of *Macrocentrus homonae* against Tortrix seems to have led some to think that what can be done for one pest can also be done for another. Nothing could be further from the truth. There is no analogy whatsoever in the two cases. Every instance of attempted natural control must be considered strictly on its own merits, and this applies as much to closely related species where probabilities can be more easily estimated, as to those with little or no relationship at all.

The tea shot-hole borer has been established in Ceylon for some fifty years. In that period no parasite or predator has been found, and it may be noted that for some years the Department of Agriculture had a special officer working on it. We can take it therefore that nothing is to be gained from any intensive research on the matter in Ceylon. In India, the pest has been up to now unknown in the North-East, and only known recently in South India in a very small area. It is listed both in Java and Formosa, but in none of these countries is it reckoned of importance, with the result that not much is known about it there. The idea of sending someone to investigate the matter in one of these countries has been raised more than once, but the terms of reference would at once be a

matter of difficulty since a time limit would be necessary if expenses were to be kept within bounds, and there is no available evidence to show what period of time might be expected to yield fruitful results.

4. SHOT-HOLE BORER AND WOOD-ROT

Organisms which are responsible for wood-rot in tea bushes attack the heart wood of the branches, access to which must be direct, through wounds, or through dead branches. They are unable to penetrate healthy bark. If the tea bush were allowed to grow as nature intended, into a tree, the chances offered to these organisms by way of wounds, directly to the internal woody parts, would be far less than it is. But the plant is not allowed to grow into a tree. Every two, three or four years it is ruthlessly cut down, each time presenting new surfaces to infection. The shorter the pruning cycle, therefore, the more is the risk incurred of wood-rot developing. In fact, wood-rot is the commonest ailment that the tea bush suffers in all situations, and it certainly cannot be said that it is due entirely to shot-hole borer, since it occurs where the borer is not to be found.

However, it is sometimes averred that shot-hole borer is responsible for a great deal of wood-rot, and the questions to be examined are :—

- (a) Whether the beetle contributes anything at all to wood-rot, and
- (b) If so, how much.

The spores of wood-rotting fungi must be in contact with the heart wood of the bush. The shot-hole beetle may expose this wood by means of gallery formations, or by breakage of a branch due to weakness caused by the presence of a gallery. Thus a fungus may gain entry in one of the three following ways :—

- (1) Spores may drift into a borer gallery.
- (2) They may be carried in on the body of the beetle.
- (3) They may catch on the rough surface of a branch where it breaks.

The first two points can be discussed together, and imply that wood-rot may start from a gallery. It is well known that the beetle carries about with it the spores of a particular species of fungus, known as "ambrosia," which in suitable conditions grows on the walls of the galleries and provides food for both young and adults. It is also recognised that the wood round the galleries becomes

stained some darker colour. It is asserted by some that this stain develops into wood-rot which in turn eventually destroys the bush. Naturally, any fungus growing in such a site falls under suspicion. Fungi isolated from the wood surrounding borer galleries have been subjected to examination and test by Gadd,¹⁾ who inoculated tea stems with them. He was unable to detect the presence of the ambrosia fungus some months after the inoculation. The only other fungi obtained from galleries were those producing stains, and these after inoculation also produced stains — but they showed no signs of developing a rot.

The staining of the wood round shot-hole borer galleries in tea is not only common but invariable. Similar staining, in fact, is the rule with all the bark-boring family in wood. If the stain is really the precursor of wood rot, all branches attacked should develop it. They do not. In fact, careful experiment has entirely failed to demonstrate any connection between wood-rot and shot-hole borer galleries; and, on the other hand, no evidence has been brought forward to support that connection.

The third way in which shot-hole borer attack might lead to the subsequent development of wood-rot is through fracture of a branch made weak at some spot by gallery formation. The surface in such a case may be considerably increased over a cleanly cut one by the brush of fibres standing out, and so the chances of catching a spore are increased. These branches, however, are usually small, for the most part about one-third of an inch or less. It is not at all common to find such small branches developing wood-rot and although the chances of starting on a rough break may be considered greater than on a clean cut, the probability of it happening still remains very low, and in practice these examples are very difficult to find.

We have seen above that no connection has been observed to exist between those bark-beetles which are well known to foresters as pests, and wood-rot. There is no more evidence to connect it with the tea shot-hole borer in particular. The conclusion reached, therefore, is that if the beetle is responsible at all for the development of wood-rot in the tea bush, its contribution is negligible.

REFERENCE

1. Gadd, C. H. (1936)—Annual Report for the year 1935—T.R.I. Bull. No. 13, pp. 26-27.