

THE CONTROL OF TEA TERMITES

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THE termites which are of importance in connection with the cultivation of tea in Ceylon are, with few exceptions, species which nest above the ground, and they belong to the genus *Calotermes*. There are three local species which attack tea, *Calotermes militaris*, *Calotermes dilatatus* and *Calotermes greeni*.

Calotermes militaris is mostly active at higher altitudes and is a serious pest in the Maskeliya and Dimbula districts, although it occurs, also, in other districts and we have three records of tea being attacked in the Ratnapura district by this species. Bushes attacked by *Calotermes militaris* are completely hollowed out, often only a shell of bark and cambium remaining.

Calotermes dilatatus is mainly a low-country species although we have found it as high as the Kandy district. It is probably the species which most planters are familiar with. It does not excavate the large central cavities characteristic of *Calotermes militaris*, but forms an extensive system of galleries in the branches and upper portions of the bush, only descending to soil level in advanced cases of attack.

Calotermes greeni occurs from sea level to about 4,000 feet. It forms galleries somewhat similar to *Calotermes dilatatus*, only that they are larger and more extensive. It is probably the most widely distributed of the Ceylon *Calotermes* but fortunately it is the least common species found in tea bushes. A very favoured host plant is *Grevillea*, and trees killed by this species are commonly met with in most parts of the Island where they are grown. It is possible that the previously unexplained mortality of *Grevilleas* over large areas in certain districts has been due to the agency of this species. The appearance of attacked trees is very characteristic, the tops dying back. The termites gain entry, in the winged stage, only through the dead snags of branches which have been carelessly lopped.

A new species of *Calotermes* has been found in the Maskeliya and Pundaluoya districts, but so far only in tree stumps and toona, but there is no reason why it should not also attack tea.

One is often asked where these pests of tea have come from. The species represented here are all peculiar to Ceylon, although, of course, other species of *Calotermes* occur in other countries. Originally our species inhabited jungle trees. We have a very extensive list of host plants of the different species which includes many jungle trees. Large areas of a woody plant like tea furnished with ample points of entry for the winged stages in the form of dieback branches and dead wood provide, on a large scale, eminently suitable breeding grounds for these insects which are undoubtedly on the increase and, in my opinion, constitute a very serious menace to the Ceylon tea industry in the future. Most other pests of tea cause some loss of crop which is often slight and may be merely seasonal. *Calotermes* kills the bushes which it infests and, consequently, these pests are responsible for considerable capital depreciation of estate properties.

Unfortunately we still have a good deal to learn regarding the habits of tea termites, and it is essential that their habits should be completely understood before we can hope to arrive at a satisfactory form of control. The period occupied during the life-cycle from egg to winged adult is not known. We have been breeding them in captivity for the past three years but well-grown larvae obtained from eggs two and a half years ago still show no indication of transforming to the winged reproductive state. There are several different castes or stages of the same insects in a *Calotermes* colony. In addition to the original founders of the nest, the so-called royal couple, there are eggs, larvae, nymphs in various stages of development, soldiers and wingless reproductive adults. As a rule the latter are only produced when the Colony has been orphaned by the death of either the king or queen or both. We have produced this stage from eggs in captivity in nine months in the case of *Calotermes militaris* and also *Calotermes dilatatus*. The function of the soldiers is supposed to be concerned, chiefly, with the defence of the colony against invaders. They are an important aid to the identity of the species, the arrangement of the teeth of the mandibles being a valuable specific character. *Calotermes* colonies are normally established by a winged pair which enter woody plants to which they are attracted through a wound or snag. They excavate a small cell, seal over the entrance, shed their wings and become the founders of a new community. The number of individuals in a colony may be anything up to 5,000 or more. We believe that the winged reproductive stage is only produced when required and that the transformation to this state is only proceeded with when overcrowding or shortage of food renders this step necessary. It is when a flight takes place that the insects pair off, enter plants and found new colonies.

Turning to the matter of control, this presents three distinct problems, firstly the prevention of initial attack, secondly the destruction of the colonies in plants which have become infested and thirdly, the prevention of re-attack of bushes which have been relieved of their invading colonies by treatment. Of these problems, the most important is, obviously, the prevention of attack in the first place. It has already been mentioned that entry to woody plant is effected by means of the winged stages through decayed wood in the form of snags, etc. In the absence of such weak spots the insects are incapable of penetrating to the heartwood of the plants to which they are attracted. Unfortunately the periodical pruning of tea bushes leads to the dying back of a certain number of the pruned branches and the decay of these branches extends into the sound wood resulting in the condition usually known as "branch canker" or "wood-rot." This condition is extremely prevalent in Ceylon and is responsible for the loss of a considerable amount of frame on the majority of tea estates. There are many views as to the cause of diebacks such as lack of food reserves in the root system, method and season of pruning, and so on, but it is certain that there is still much to be learnt on this important subject. Personally, I consider this matter is more in need of immediate investigation than any other problem connected with the tea industry in Ceylon at the present time. I feel confident that if diebacks after pruning can be prevented the problem of *Calotermes* control will be automatically solved. Until we know the cause of diebacks after pruning and until their occurrence can be avoided we are unable to prevent termites from gaining admittance to the bushes, and have to resort to a method of destroying the insects after they have gained entry.

The destruction of large colonies of termites in tea bushes has presented many difficulties. As even a few survivors are able to re-found a colony, nothing less than a 100% mortality could be aimed at. It was necessary, therefore, that the treatment should kill every inhabitant of the termite colony without injuring the bushes or affecting the quality of the leaves required for plucking. We have tried everything we could think of which might have the desired effect but without fulfilling all the necessary requirements. When on leave in 1928 I visited America to consult Dr. Snyder, one of the most prominent termite authorities in the world, regarding our problems here and he advocated trying Paris Green. Now, we had already tried Paris Green against *Calotermes militaris* in 1926 with marked success but we had abandoned it owing to a report that the treatment had led to arsenic being deposited in the leaves of treated bushes. Dr. Snyder suggested that we should renew the trials having careful analysis made of the leaves for some months following

treatment. These trials have now been in progress for over a year and periodical analysis of the leaves of treated bushes have been made by the Government Analyst for a period of twelve months. In no case has any trace of arsenic been found nor has the treatment resulted in any injury to the bushes. Furthermore a 100% mortality can be assured within about three months if the Paris Green penetrates to any portion of the occupied termite workings. The treatment can, therefore, be claimed to be a complete success against *Calotermes militaris* at all events. Many acres have now been treated in this manner in the Maskeliya and Dimbula districts and very encouraging reports of the treatment have been received.

Now, it must be admitted that *Calotermes militaris* lends itself to this method of control more readily than *Calotermes dilatatus* as there is no difficulty in penetrating the active workings of the former insect as they are to be met with about soil level in the main stem. The method of application is to bore a hole into the stem with a gimlet and blow in about one-twelfth of an ounce of Paris Green powder by means of an enema syringe of ball pattern. The perforation should then be plugged with cement, asphalt or other efficient seal. In the case of *Calotermes dilatatus* it is often extremely difficult to locate the site of the galleries. If they can be found, and the Paris Green introduced, the results should be as effective as they are in the case of *Calotermes militaris*. The fact that bushes are attacked by *Calotermes* is often evident to the pruners who, after all, have a better opportunity of discovering infested bushes than anyone else. I suggest that as a means of marking such bushes the pruners be instructed to leave, unpruned, one prominent branch on each bush they find to be attacked. In this way such bushes will be evident to the trained coolies who follow the pruners to treat infested bushes with Paris Green. After treatment the indicator branch can be removed.

Inquiries have been made in America as to the possibility of designing a microphone for locating bushes which are infested by *Calotermes* similar to those used for detecting other boring insects but, although a delicate apparatus for laboratory use might be possible, there seems little chance of obtaining an instrument suitable for work in the field.

The expenditure incurred in destroying large colonies of termites within the bushes which they infest is only partly justified if the treated bushes are liable to become re-infested almost immediately after treatment. The cleaning-up of bushes and the removal of dead and diseased wood are essential if *Calotermes* attack is to be prevented, particularly that of *Calotermes dilatatus* and *Calotermes greeni*. The problem of preventing the

re-invasion of treated bushes is really identical with that of preventing initial attack. The maxim: "prevention is better than cure" is certainly one which should be borne in mind where these pests are concerned. It is obviously preferable to deprive the winged termites of their means of gaining entry to the bushes than to destroy them after they have entered and then attempt to prevent the establishment of new colonies in the same bushes at a later date. In my opinion the true form of control of the tea *Calotermes* is preventive rather than curative. Prevention of attack can only be secured by depriving these insects of the decayed wood which is essential for the commencement of their attack and, again, I consider this end is best secured by the prevention of diebacks after pruning. In short, I believe that the prevention of *Calotermes* attack of tea really resolves itself into the prevention of diebacks.

Any method of destroying these pests in bushes which have become infested is, however, a valuable subsidiary control measure and the Paris Green treatment is the cheapest and most effective method we know of at the present time. The destruction of millions of potential winged reproductive *Calotermes* adults per acre will certainly tend to reduce the risk of invasion of unattacked bushes or those which have been relieved of their infestation by treatment. In this way the spread of the pests on estates will be curtailed as it will, also, from estate to estate and from district to district.