

# RESEARCH WORK ON SHOT-HOLE BORER OCTOBER, 1955, TO AUGUST, 1956

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Professor Azzi, an Italian scientist, said that the plant should be considered as a machine, transforming what is available to it from its environment into yield. To emphasize the economic aspect, I should like to alter Professor Azzi's expression and say that the plant should be considered as a machine transforming these environmental factors into money.

Any useful treatment against shot-hole borer must not only prevent shot-hole borer injury to the bushes, but also increase the amount of money these tea bushes will produce. From the national point of view the treatment must increase the revenue from the export of tea, and from the point of view of the individual owners it must increase profit.

I started my work on shot-hole borer about one year ago. So far no practical recommendations have emerged from my work. This indeed is not surprising since during the period under review I have worked mainly on the biology of the pest. To emphasize the importance of the biological aspect of the problem I should like to describe briefly the history of the research work which was carried out in the campaign against malaria.

Research work on the biology of mosquitoes was started about 1670 by a Dutch Zoologist, Swammerdam. A Scotsman, Ross, who was working in India as a doctor, found in 1897 a parasite of malaria in the stomach of a mosquito. In 1873 an Austrian Chemist, Zeidler, discovered DDT, but he did not realize that this chemical was able to kill insects. This was proved at the beginning of the last war by Muller, a member of the Swiss firm Geigy. After further experiments DDT sprayings were introduced against mosquitoes, and as a consequence malaria has been practically wiped out in many countries.

Many thousands of people, perhaps some in this room, owe their lives to the work done by the scientists whose names I have just mentioned. Few of them, however, realise how long the research work continued on the problem. Quite understandably the majority of sick persons are interested only in the treatment of their illnesses and not in the history of the research work involved. Similarly tea planters would like to know what treatment to apply against shot-hole borer; this and nothing more. Unfortunately, however, no treatment has yet been found against shot-hole borer.

Shot-hole borer was discovered as a pest of tea in this country in 1892. At that time the most important human diseases were malaria, tuberculosis, syphilis and cancer. Medicine has made great advances in the case of the first three of these diseases, but less so in the case of cancer, possibly because the whole biology of this disease is not yet known. Valuable research work on shot-hole borer was started in this country in 1898, but although many points were cleared up by 1955, some details regarding the life history and habits of the pest are still unknown, and this may be one of the reasons why no practical recommendations against shot-hole borer have yet been made. When I joined the Tea Research Institute, the Director, in our first discussion, drew my attention to the biological aspects of the problem,

pointing out that the method of the pest's distribution from bush to bush and from field to field was still unknown; even the proper scientific name of the insect required to be confirmed.

I have begun my work, therefore, by making a study of the biology of the beetle, and I will now give you a brief account of my investigations to date.

**Identification of the Pest.**—Since there was some disagreement among entomologists as to the identity of the beetle, samples were sent for identification to Professor Dr. K. E. Schedl, a senior entomologist of the Federal Forest Research Institute of Austria, who kindly agreed to do this work. Out of 2,963 beetles, collected from dissected branches pruned at Alupolla Group, Denawaka Group, Hedgefield Estate and Millawitiya Estate, Professor Schedl found that all-except two belonged to *Xyleborus fornicatus* Eichoff.

**The Number and Proportion of Beetles found outside Galleries on Tea Bushes.**—In order to find out the number and proportion of beetles living on tea bushes outside the galleries, sticky traps are kept on tea bushes on four estates and beetles are being shaken off bushes on two estates at monthly intervals.

**Method of Distribution.**—Observations under laboratory conditions, and in the field, have shown that females are able to fly to a height of 5 feet. A sticky trap, 14 feet high has been placed in a field, the bottom of the trap being 6 inches above the soil surface. Beetles obtained from the traps, and those shaken from the bushes are sent to Professor Schedl for identification.

**Reproduction.**—In the animal kingdom the normal reproduction ratio of male to female is approximately 50:50. In the case of shot-hole borer this ratio is at least 25:75. This sex ratio, and also the fact that, unlike the female, the male can neither fly nor make galleries, permits the supposition that the females are parthenogenetic. The economical importance of insects which reproduce in this manner is usually greater and control more difficult than in the case of insects which reproduce normally.

To clear up the question of the mode of reproduction of shot-hole borer, Dr. B. E. Wolf of the Institute of Genetics, Berlin Free University, Germany, is kindly carrying out investigations with insects obtained from the low-country of Ceylon.

**Influence of Moisture on Shot-hole Borer.**—Beetles, obtained from dissected prunings and kept in a container with water, lived for a period of from 1 to 16 days (average 4 days), whereas beetles kept simultaneously in an empty container did not live for more than one day. Infested prunings, which were dissected after immersion in water for about 1 day, were found to contain live beetles.

Laboratory experiments showed that emergence of the beetles from prunings was more rapid under dry than under wet conditions, and that subsequent mortality soon after emergence was higher. During the rainfall period 33 per cent of the emerged beetles survived long enough to fly away, whereas during the dry period only 6 per cent of the females flew away. Further preliminary experiments suggest that in dry conditions the ability of the surviving beetle to infest tea is less than under wet conditions.

Clearly the insect is very susceptible to any deficiency of moisture, and the presence of adequate moisture is vital to its development and ability to infest tea.

**Influence of Direct Sunlight on Shot-hole Borer.**—These experiments were carried out during a sunny period in April 1956, and were repeated in August when cloudy conditions prevailed. Prunings, cut into pieces 4 inches long, were spread in

one layer between rows of newly pruned tea. It was found that far more of the beetles died in the galleries during the sunny period than when the sun was covered by clouds.

**Assessment of Infestation.**—Assessments of the degree of borer infestation have in the past been based mainly on (a) the number of broken branches and (b) the presence of chlorosis. Neither of these methods is entirely satisfactory, since, as you will later hear from the papers by Mr. Illankoon and Mr. Tolhurst, the number of broken branches may often depend on the strength of the wind, and the chlorosis may occur independently of shot-hole borer.

It is most important to establish an objective standard for measuring the degree of infestation. The following method is now under investigation. A piece of live branch, 4 inches long,  $\frac{3}{4}$  inch in diameter at the base and top, and free of any secondary branch or green shoot, is taken as a standard unit. One hundred such units are taken at random from a field, and the number of galleries per hundred units is counted and used as a measurement of the degree of infestation.

To date assessments have been made in five fields. In two of these, which were not considered by the superintendent to be suffering from borer damage, the number of galleries per 100 units was 35 and 46. In the other three fields, which were considered to be suffering damage, the number of galleries per hundred units was 123, 148 and 186. Further assessments will be made, on all the Institute's low-country field experiments.

**Conclusion.**—I would like to make one final point. I have been told, directly or indirectly, that some planters are expecting me to find a satisfactory treatment against shot-hole borer. I cannot give any guarantee of this. It would not be proper for any research worker starting a problem to promise success. This is a very difficult problem which has been tackled by many entomologists in this country without any practical recommendation resulting. However, I would like to assure the Hon'ble Minister and you planters, that, as long as I work in this country, I will do all I can to solve the problem.

*Mr. Portsmouth.*—I am sure all of you very much appreciate Dr. Judenko's keenness in this matter, and I would again say what I repeated earlier—if we do not find a solution to this problem it will not be for lack of trying; but we cannot guarantee anything.

I have now been informed that the Director of Agriculture will be leaving with the Minister, and I would like him to say a few words before he goes. I will now call upon Dr. Paul to address us.