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OBSERVATIONS ON THE OCCURRENCE AND BEHAVIOUR OF LIVE-WOOD TERMITES (*GLYPTOTERMES DILATATUS*) IN LOW-COUNTRY TEA FIELDS†

P. Sivapalan, K. A. D. W. Senaratne and A. A. C. Karunaratne

(*Tea Research Institute of Sri Lanka, Talawakele, Sri Lanka*)

Die-back and rot following pruning seems to be a significant factor facilitating termite attack in tea. The recently planted high-yielding clonal tea fields have soft-wooded frames that suffer extensive die-back and rot following subsequent pruning. Increased levels of nitrogen fertilizers also seem to have accentuated die-back and rot. A large number of incipient termite colonies have been observed in the rotted stumps of shade trees. These trees therefore seem to have functioned effectively as diversionary hosts and have helped to reduce termite incidence in shaded fields. Removal of shade thus seems to have accentuated the termite problem.

INTRODUCTION

The low-country live-wood tea termite, *Glyptotermes dilatatus* Bugnion & Popoff, was first recognised as a pest in 1908 and formally described two years later. Jepson (1926) and Pinto (1941) studied the biology of this and other Kalotermitidae.

Although recognised early as a pest in seedling tea, its attacks only became of widespread importance with the introduction of high-yielding soft-wooded clonal tea during the last 20 years. Reduction in standards of pruning and plant sanitation coupled with removal of shade trees and application of high levels of nitrogenous fertilizers appear to have accentuated the problem, in spite of the temporary increases in yield that they brought about. Attempts to treat the infested plants chemically have, proved only palliative and costs of treatment have been high owing to the density of planting (1200 plants/ha).

The aim of the work described here was to find out if the changes in cultivation methods of recent years were genuinely responsible for the termite outbreaks, or whether other factors should be considered.

METHODS

A preliminary questionnaire to 200 tea plantations achieved the unusually high response of around 60%. This enabled surveys to be conducted in affected areas from 1971 to 1974. The following factors were particularly noted when recording termite incidence: 1. condition and variety of damaged plants, 2. Influence of pruning methods and pruning heights, 3. proximity to a source of infestation, 4. presence or absence of shade trees, 5. nitrogenous fertilizer levels.

Intensity of termite attack was estimated by inspecting fields at pruning and by detailed dissections of plants removed from randomly selected sections of the

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field under survey. The hardness of the frame wood of tea plants of different clones was estimated by the ease of cutting at pruning and by adopting a system of arbitrary scoring. Examination for termite colonies in shade trees was confined to dissection of rotting stumps of lopped branches *in situ*.

Relationship between the type of plant and termite incidence

In seedling tea fields few plants were found so severely attacked that the collar region was reached by the gallery system. Only randomly scattered individual plants or small groups were damaged and the rate of spread appeared slow. The access points in seedling tea plants by which colonising alates could enter were few in comparison to clonal plants and the rate of gallery construction also appeared slower. In clonal tea fields severely attacked plants were more uniformly distributed and the spread of damage more rapid.

The soft-wooded, high-yielding clonal varieties with wide frames showed very rapid gallery construction and serious levels of damage in 8-10 years. Where the gallery system had reached the collar, alates were often encountered. Table 1 shows the results of a survey of clonal varieties in which wood strength and termite infestation were assessed comparatively by scoring. The experiment was adjacent to a source of infestation.

TABLE 1—*Correlation of wood strength with severity of termite incidence in test clones*

Clones	*Wood strength**	*Termite Incidence*
TRI 777	Hard	Vey light
TRI 2023	Soft	Severe
TRI 2025	Medium-hard	Light
TRI 2026	Soft	Severe
TRI 2027	Soft	Severe
TRI 2151	Very soft	Very severe
EN 31	Very hard	Very light
K 150	Medium-hard	Medium
NL 3/1	Hard	Light
PO 26	Soft	Severe
UH 9/3	Soft	Severe

*Scoring based on the ease of cutting at pruning.

Influence of pruning on termite damage

Pruning results in die-back from the cuts, followed by rotting of the dead wood (Fig. 1). The softest clones died back further and rotted most quickly. Termite damage was only found after this stage, and greatest incidence occurred in fields that had been pruned three to four times without the adoption of proper sanitary measures. Pruning at a high level (*i.e.* 'cut-across') also increased termite damage.

Proximity to source of infestation

Termite attacks were found to spread readily from contiguous infested fields. At the early stages of attack more severe infestations are observed at the boundaries of infested sources with the intensity of attack diminishing with increasing distance from the source. Fields isolated from infested sources only rarely show signs of infestation.

Influence of the presence or absence of shade trees on termite damage

Termite incidence was low in fields with shade trees (*Gliricidia sepium*) whilst more serious attacks were observed in unshaded fields. Detailed examinations of tea plants showed termite incidence in only about 18% of the plants under shade whilst this incidence was as high as around 55% in unshaded fields.

Frequent occurrence of incipient termite colonies was observed in the rotted stumps of shade trees (Fig. 2). Several dealate swarmers, at times 5 to 6 pairs, were found congregated in wood-rotted stumps of these trees. In all of the examinations it was observed that although there were typical galleries constructed into healthy wood, these were found abandoned.

Table 2 shows the results of a survey of clonal varieties in which termite incidence was assessed in relation to the presence and absence of shade trees. This experiment was adjacent to a source of infestation.

TABLE 2—*Correlation of the severity of termite incidence with test clones under shade and no shade*

Clones	*Termite incidence* (%)	
	Unshaded	*Shaded**
Soft-wooded		
TRI 2023	78	57
TRI 2026	85	20
TRI 2027	89	8
TRI 2151	97	40
PO 26	79	3
UH 9/3	79	14
Medium-hard-wooded		
TRI 2025	11	22
K 150	61	29
Hard -wooded		
TRI 777	9	6
EN 31	6	0
NL 3/1	17	3

*Shade trees (*G. sepium*) spaced at 4.2 x 2.1 m.

Influence of nitrogen fertilizer application on termite damage

Clonal tea fields receive higher levels of nitrogen fertilizers than seedling fields (a maximum of 350 kg/ha in clonal fields and 200 kg/ha in seedling fields). Termite damage is very much greater in clonal fields than in seedling fields. Severity of termite attack was found to be much more serious in clonal fields receiving nitrogen levels more than the recommended maximum when compared with adjacent fields of comparable age receiving within the recommended level.

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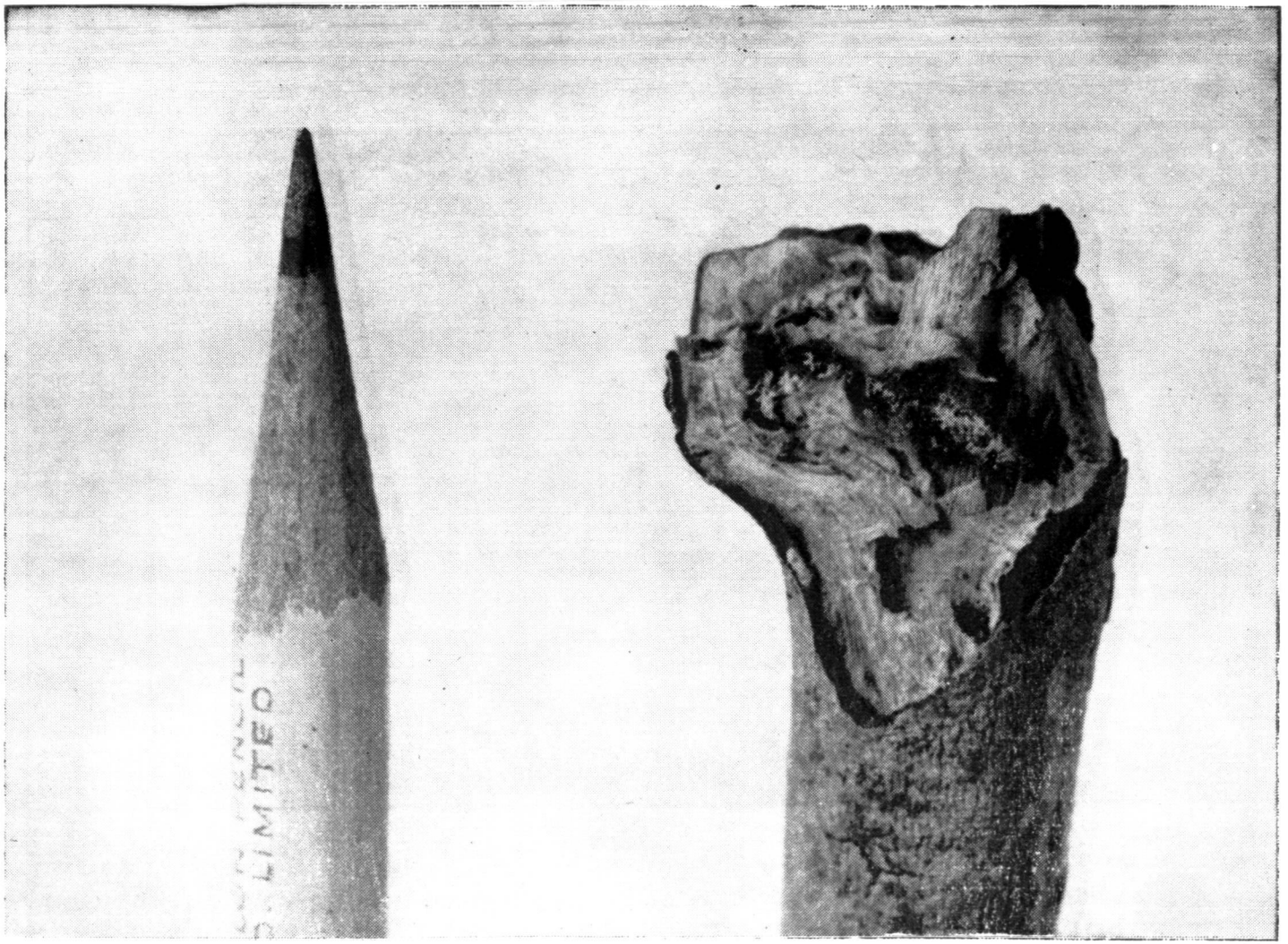

Fig. 1 — Rotted pruning snag on tea

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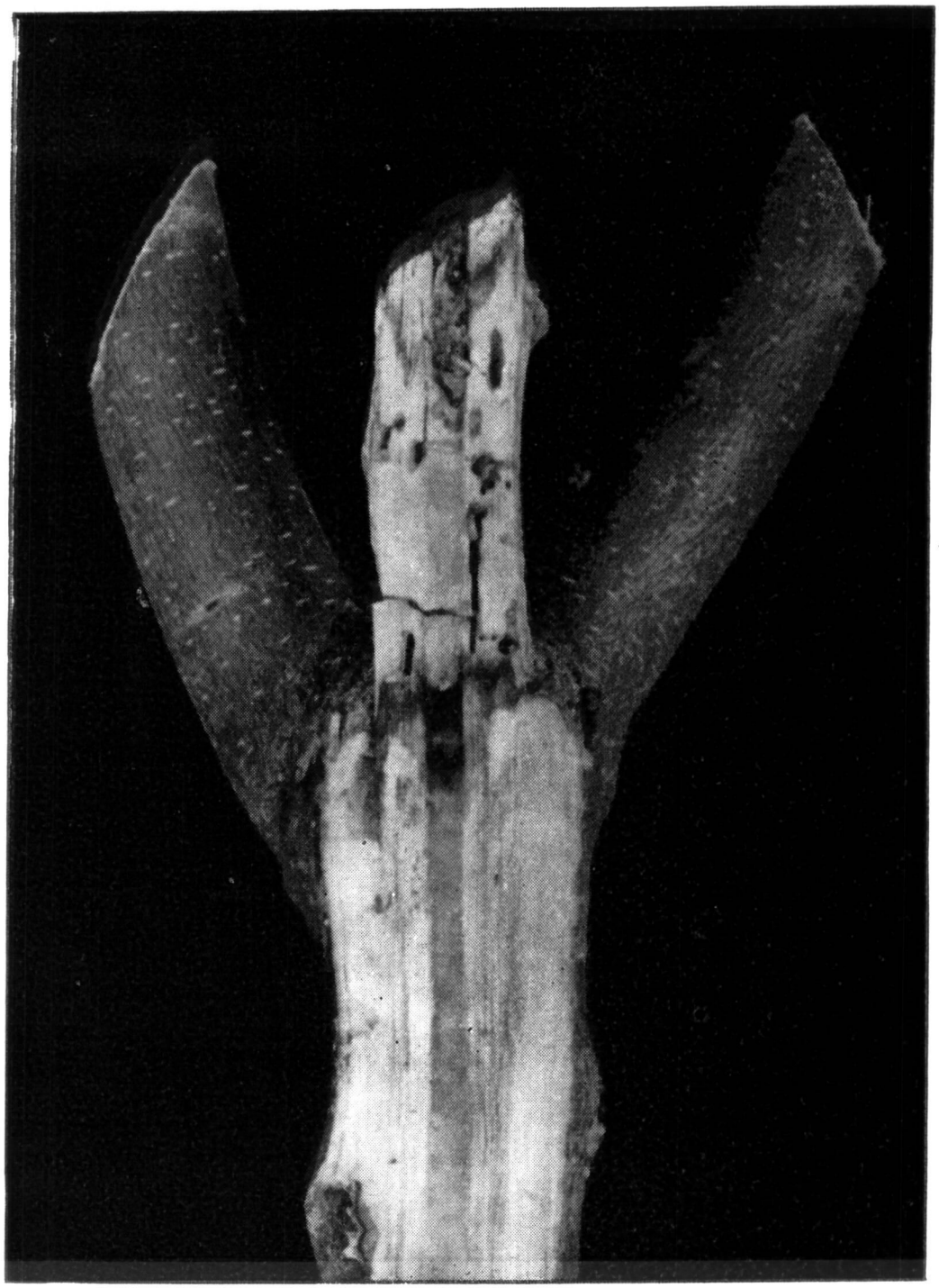

Fig. 2 — Incipient colony of Glyptotermes dilatatus in rotted stump of the shade tree Gliricidia sepium

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DISCUSSION

During the past 15 years large tracts of low elevation tea plantations have been replanted with high-yielding soft-wooded clones. These clones died back further and rotted quickly following pruning thus offering ready access points to alates.

Such clones were found to suffer more severe termite attack than hard-wooded clones. Susceptibility to die-back and rot appears to be a key factor for termite attack. The sanitary practices of cleaning up dead wood and snags have been given up in recent times and this lapse seems to have accentuated the termite problem. Being soft-wooded, gallery construction progresses very rapidly in clonal tea plants which become sources of swarms quite readily and the spread of infestation in such fields is rapid.

Proximity to termite infested fields seems to be an important factor in the easy spread of termite attack. A proper survey of infested fields and the timely elimination of such sources should be an important strategy when replanting is considered.

Shade trees seem to effectively function as diversionary hosts by diverting the swarming alates on to their own wood-rotted stumps thus reducing the attack on tea. The removal of shade trees seems to have eliminated this beneficial cushioning effect.

Increased rates of nitrogen fertilizers appear to have accentuated termite attacks. Heavy doses of nitrogen seem to have softened the plant frames resulting in an increase in the extent of die-back and wood-rot. This condition further facilitates termite attack.

The above changes in crop husbandry have all been introduced almost simultaneously during the past 10 to 15 years. Our observations indicate that such changes have each, in varying measure, contributed to a situation most favourable for a rapid increase in the termite incidence in the low-country tea plantations. These findings warrant further detailed experimental work to study each of the above relationships and if the results are conclusive enough to support the above observations, immediate changes will become necessary to alleviate the problem.

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