CHAPTER 4
PLANT PROTECTION

4. Plant Protection

4.1 Introduction

Development of appropriate strategies of controlling pests and diseases is essential to sustain tea production. Tea yields can be significantly reduced if pests and diseases are not controlled. The main aims of the plant protection programme are therefore to develop appropriate strategies for controlling pests, diseases and weeds of tea and for minimizing physiological disorders of the crop.

4.2 Pest Control

4.2.1 Carpenter Moth

Carpenter moth (*Teragra quadrangular*) is a potentially serious pest especially of young tea. The moth lays its eggs in February, March and April which are deposited in cracks on the bark, in dry cracked snags, on the bush frame itself or in pruning litter on the ground. The eggs hatch within 15 – 20 days.

The newly hatched larvae are 1 – 2 mm long, reddish brown in colour and are difficult to see. A high percentage of these develop on the pruning litter up until August/September, by which time they have grown to 8 – 9 mm in length. Their presence on the bush becomes noticeable by webs, spun by the caterpillars. A small proportion of caterpillars complete their life cycle on the litter alone. However, most caterpillars make a hole into the wood of the tea bush, where they are protected from predators. The caterpillar feeds on the bark of the stem and branches, resulting in ring barking, the effect of which varies with the age of the bushes.

In mature tea, feeding is mainly concentrated on the branches. More than one caterpillar can infest the same bush and as many as 50 have been recorded on a single bush. Feeding on the bark usually results in calluses and knots, but most branches show no sign of stress and remain productive, although severe damage may result in dieback, which has been observed in mature vegetatively propagated cultivar tea.

In young tea, ring barking around the collar region of the main stem eventually results in death of the young plant, and ring-barked branches usually die back. An outbreak of the pest in young tea can be very damaging, often with up to 50% of plants being killed.

Chemical control

Control in Mature, Un-Pruned Tea

A trial was conducted in un-pruned mature tea at Eldorado Estate, Mulanje during 1996/97 season to investigate the most effective methods of spraying against carpenter moth. The litter was sprayed during the period April – September, using a range of spray timings. Karate (*lambdacyhalothrin*) 5% EC (5 G A.I. ha $^{-1}$) was applied twice at monthly intervals; on each occasion 270 – 530 litres of solution per hectare was sprayed using a 200 ULV nozzle on a CP15 knapsack. Counting the number of new webs on the bushes in September and November 1996, and January 1997 assessed the efficacy of treatments. Results from the trial are shown in Figure 4.1

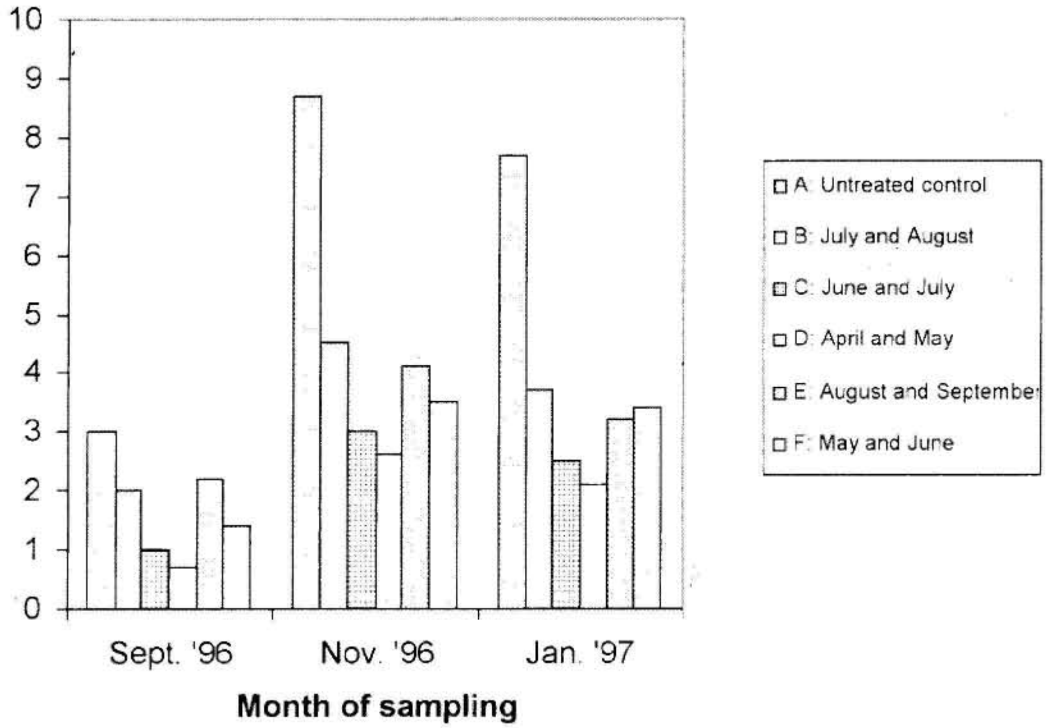

Figure 4.1 Mean number of new carpenter moth webs per bush following different spraying time treatments using karate.

There was a significant (P = 0.05) reduction in the number of webs as a result of spraying.

Control in Pruned Tea

A trial was laid out at Sayama Tea Estate, in Mulanje to investigate the efficacy of a range of chemicals as follows:

1. Seven (*carbaryl*) 85% WP @ 850 g. a.i. ha^{-1}
2. Bulldock (*beta cyfluthrin*) 5% EC @ 5 g. a.i. ha^{-1}
3. Regent (*fipronil*) 200 SC @ 125 g. a.i. ha^{-1}
4. Alsystin (*riflumuron*) 480 EC @ 0.005 g. a.i. ha^{-1}
5. Match (*lufenuron*) 050 EC @ 0.005 g. a.i. ha^{-1}

Regent and Bulldock gave significantly better control than Sevin (Figure 4.2) while Alsystin and Match, both chitin inhibitors, were relatively ineffective. It should be noted that all the chemicals tested in this experiment were generally less effective than Karate (*lambdacyhalothrin*).

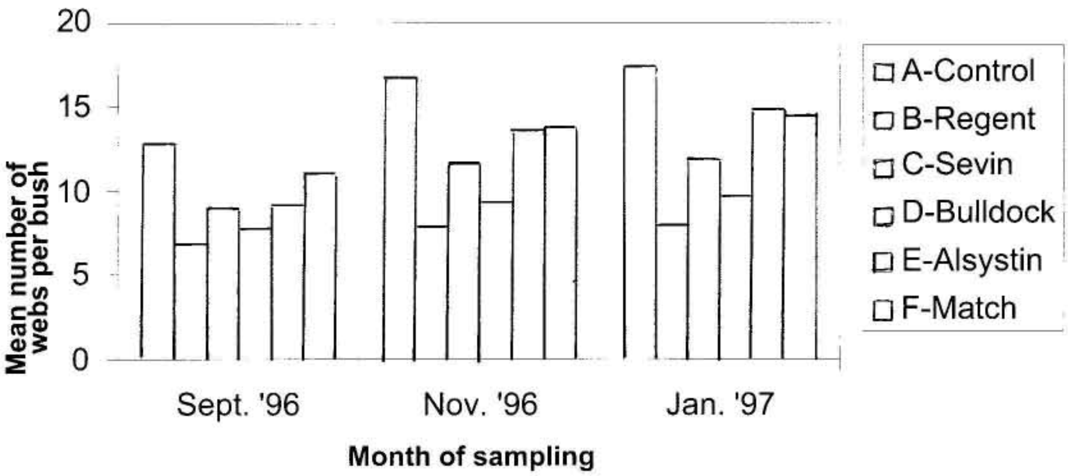

Figure 4.2: Efficacy of a range of chemicals against carpenter moth.

The results from this trial suggest that if spraying is considered necessary the most effective insecticide is Karate (*lambdacyhalothrin*) 5% EC applied at 100 ml product ha-1

4.2.2. Termites

Termites attack tea of all ages, although the most serious damage is caused to bushes in the first 2 – 3 years after planting. Termites ring-bark or sever young plants, which wilt and die. They often tunnel into the wood of mature bushes, progressively killing the limbs. The damage may occur at any time. Prior to the 1980s, termites in young tea were kept under control by the application of Dieldrin and other persistent hydrocarbon insecticides. However, the use of these chemicals is now forbidden. Alternative chemicals, such as Regent (*fipronil*) and Confidor (*imidacloprid)* were tested for the control of termites in tea during the 1990s.

Termite Control in Young Tea

In 1996, a randomised replicated trial was initiated at Kavuzi Tea Estate, Kawalazi Tea Company, in Malawi, with the objective of assessing a range of chemicals for use in controlling termites in young tea. These were:

1. Regent 200 SC @ 250 g. a.i. ha^{-1}
2. Confidor 200 SL at 0.02 g. a.i. per $plant^{-1}$
3. Untreated control

The chemicals were used either as a pre-attack deterrent (treated in the nursery) or post-attack control (in the field), with the same equivalent rates per plant. Following the treatments, assessments of plant deaths were carried out every two or three months from April 1996 to February 1999.

Ancistrotermes was the main species causing damage to young tea plants. Damage was first recorded in April 1996, two months after planting. By March 1997, damage was observed in all the treatments and subsequently there was a gradual increase in plant deaths due termites (Table 4.1). By February 1999, 11.8 – 12.6% of plants had been killed in the untreated control treatment. However, the percentage of dead plants in the chemically treated plots ranged from 2.0 – 7.6%. It should be noted that plant deaths due to other causes, primarily droughts, were high in this experiment.

Table 4.1 Percentage of tea plant deaths due to termites and other causes in March 1997 (and cumulative to February 1999 in brackets)

Treatments	Percentage of dead plants			
	Nursery Treated		Field Treated	
	Due to Termites	Other causes	Due to Termites	Other Causes
Regent 200	2.0	18.0	1.8	33.8
(250 g. a.i. ha^{-1})	(7.6)	(23.9)	(5.9)	(35.3)
Confidor 200 SL	2.2	19.8	0.6	30.2
(0.02 g. a.i. per $plant^{-1}$)	(6.8)	(24.3)	(2.0)	(33.1)
Untreated control	5.4	17.6	4.2	29.6
	(12.6)	(22.6)	(11.8)	(32.8
SE	2.17	1.99	1.76	2.21
LSD (P=0.05)	4.8*	4.2	3.7	4.7

Resistance to Termite Damage

Two experiments were established at Kawalazi Estate, Nkhata Bay, to study the resistance of vegetatively propagated (VP) cultivars to termite damage under irrigated and rainfed conditions.

Irrigated Tea

The trial was established in 1999 and contained 25 cultivars. Assessment of damage by termites was made on a 3 – 6 monthly basis. The results indicated a steady increase in the percentage of plants killed by termites (Table 4.2). The percentage of plant deaths (all cultivars) by April 2001 (2_ years after field planting) was 9.4%. There were cultivar differences, but termites' damage was very patchy, and more likely related to the locality of particular cultivar plots in relation to random or soil-related infestation by the termites, rather than indicating any specific resistance/susceptibility to attack. All of the damage was caused by *Ancistrotermes* spp.

Rainfed Tea.

This trial was planted in January 2000 and contained 24 VP cultivars. The plants were irrigated between January 2000 and June 2000 in order to ensure survival. Assessments indicated that damage was mainly due to Ancistrotermes. By April 2001 (1_ years after field planting) the mean plant deaths due to termites was 7.2%. Further damage was again patchy and probably related to factors other than the specific resistance or susceptibility of any particular cultivar.

Table 4.2. Plants killed by termites in experiments at Kawalazi Estate (Cumulative of all cultivars).

Experiment	Date of assessment Apr 1999	Jun 1999	Sep 1999	Jan 2000	Apr 2000	Jun 2000	Sep 2000	Dec 2000	Apr 2001
Irrigated	0.1	1.3	1.7	3.2	5.8	8.5	8.9	9.2	9.4
Rainfed	-	-	-	-	0.7	3.2	4.3	4.8	7.2

4.2.3. Mosquito Bug *(Helopeltis schoutedeni)*

Mosquito bug (*Helopeltis schoutedeni*) is a sap-sucking polyphagus insect and has been a pest of tea in Malawi for at least 75 years. The pest has become very widespread, and in particular caused serious yield losses during the 1980s. Both nymphs and adult mosquito bugs cause damage by sucking the cell sap of tender stems, shoots and young leaves. They inject a toxic substance that causes necrosis of the tissue. Feeding on the leaves produces angular spots, and the leaves become distorted and blackened due to multiple lesions, and will finally shrivel and die. In severe cases the whole of the bush is blackened as if scorched, resulting in a total loss of yield. Feeding occurs mainly on the green part of the shoot and buds, especially in tea recovering from prune. This may result in cankers and death of the shoots, which when severe results in complete defoliation of the bush.

Although there has been a reduction in the incidence of mosquito bug during the 1990s, due in part to improved monitoring and chemical control measures, the problem still persists, especially in some smallholder blocks. The incidence of *Helopeltis* damage in smallholder fields was therefore investigated, prior to establishing what control measures could be implemented.

The incidence and extent of mosquito-bug damage in the Smallholder Tea Authority blocks of Mulanje and Thyolo district were determined by randomly selecting un-pruned fields for assessment in the months of August and September 1998. In Mulanje, 107 fields in 22 blocks were assessed and in Thyolo, 35 fields were assessed in 18 blocks. At least 20% of the bushes were checked throughout the fields. Bushes with dead and dying branches due to Helopeltis damage were removed.

In Mulanje 36% of the fields were found to have a significant infestation (>10% of bushes in the field affected). In Thyolo, 34% of fields were significantly affected. The worst affected fields had up to 85% of bushes showing dieback. Light leaf damage (<10% of bushes affected) was observed in many of the fields.

Chemical control

An experiment was laid out in smallholder fields (as replicates) to test the use of Thiodan (endosulfan) to control mosquito bug following pruning. The chemical was applied at a rate of 1 kg a.i. ha-1 at bud break, in August/September 1998. The *Helopeltis* infestation was very light throughout the study period (July 1998 to May 2000). Some dieback was noticed in two fields only but spraying did not increase yields.

4.3. Control of leaf disorders

4.3.1. Black Petiole

Investigations into the cause of black petiole were carried out during the period under review. Samples of leaves with black petiole damage were sent to IACR Rothampsted, UK, but these showed no evidence of virus (by negative stain) or of phytoplasma infection (by thin sectioning).

Source bushes of PC 1 and SFS 371 that had been affected by black petiole were sprayed with the chemicals Karate, Thiodan, Omite or Chlorphysifos from May 1999 to January 2000. The number of damaged petioles was counted monthly. Spraying of these insecticides/acaricides did not reduce damage, and so it may be concluded that insects or mites do probably not cause the condition.

4.3.2 Tea Narrow Leaf Syndrome

This condition was observed in smallholder field at Mbiya Block, Mulanje. Affected bushes have narrow thick leaves and small, clustered shoots. The conditions were observed on both VP cultivar and seedling tea. Investigations failed to identify the cause. However, given the very limited occurrence, there appears to be little cause for concern. Similar symptoms were observed on tea in the Honde valley, Zimbabwe. However, following improvements in management the problem was alleviated.

4.4 Publications

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3. Rattan, P.S. (2000a). Chemical use and the safety code of practice. *Tea Research Foundation (Central Africa) Quarterly Newsletter* **139**, 15 - 20.
4. Rattan, P.S. (2000b). Termites: A summary of the species that affect tea. *Tea Research Foundation (Central Africa) Quarterly Newsletter* **139**, 21-26.
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7. Ratan, P.S. and Whittle, A.M. (1999). Infection of vegetatively propagated cuttings by grey blight fungus. *Tea Research Foundation (Central Africa) Quarterly Newsletter* **136**, 7.
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