

THE MITE PESTS OF CEYLON TEA : RECOGNITION AND CONTROL

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This note is written to advise planters on the recognition and chemical control of the mite pests of Ceylon tea.

Previous work reported by Baptist and Ranaweera (1955) and by Ranaweera (1958) dealt chiefly with Scarlet Mite (*Brevipalpus* spp.), following the years when this pest caused considerable concern to planters in up-country districts. Cranham (1960) gave a brief review of the existing knowledge on the mite pests of tea, which the reader may wish to refer to or read in conjunction with the present article. That review was not intended to tell planters what to do about mite pests, since there was then little or no basis for amending the recommendations made previously by Baptist and Ranaweera. The review revealed certain marked needs for the improvement and extension of our recommendations, and the efforts of the last three years, in work on chemical control, have been directed towards providing for these needs.

Naturally, the search has been for non-tainting acaricides to replace sulphur which, although it is cheap and effective, taints teas very badly and necessitates the discarding of at least three plucking rounds after spraying. Chlorobenzilate (Akar) was the first non-tainting acaricide found to be effective against Scarlet Mite (Baptist & Ranaweera, 1955) and Red Spider Mite (*Oligonychus coffeae* Nietn), but against Yellow Mite (*Hemitarsonemus latus* Banks) it was later found to be ineffective and not as good as sulphur for Scarlet Mite. Yellow mite proved to be difficult to control and many of the acaricidal materials tested were ineffective. Fortunately, Kelthane, which had been found to be excellent for Scarlet Mite control, was found to give good control also of Red Spider and Yellow Mite. Purple Mite (*Calacarus carinatus* Green) is also controlled.

Efforts were also directed towards making the method of spraying less tedious and more practically useful. Employing conventional knapsack sprayers, considerable volumes of spray fluid are necessary to obtain adequate coverage and good control, and water is quite often in short supply. The recommended use of 100 gallons per acre for Scarlet-mite control, spraying to cover the undersides as well as the upper sides of the leaves, is particularly tedious.

Trials were carried out in 1962 with applications by Knapsack mist-blowers employing the same dose of acaricide per acre in 10 and in 20 gallons of water (see Cranham, 1961): The spray was directed down into the bushes by the normal method for insecticidal mist-blowing (Cranham, 1961a), i.e. there was no attempt to spray from below the foliage. By this method, Kelthane gave good control, not only of the more exposed Red Spider Mite and Yellow Mite but also of Scarlet Mite on the undersides of the leaves.

Recent work has therefore established Kelthane as an excellent non-tainting acaricide which can be successfully applied through mist-blowers, or by knapsack sprayers, for the control of all tea mite pests. It is now possible to revise the recommendations on mite control. It is intended to publish separately the details of the work leading to these recommendations.

Recognition

Before proceeding to the subject of control, however, a few notes on recognizing the mite pests may be useful. Colour plates would be an advantage, and it is hoped to publish them later, but the differences between the attack of the four mite species are distinct and can be described.

Mites are very small creatures (as the name implies) related to ticks and with 4 pairs of legs (except the Eriophyidae, including Purple Mite, which have only 2 pairs). A low-power magnifier or eye-glass is useful when looking for them. Of the pests on tea, Red Spider Mites can easily be seen individually with the naked eye running about actively. Scarlet Mites can just be seen individually and are much slower in movement. Yellow Mite is smaller still but can be seen in a mass as a fine 'meal' on the leaf. Purple Mite is so small that it is not too easy to pick out the individual mites with a 10 × hand lens.

Yellow Mite is the only species which attacks the flush and youngest leaves and causes a direct loss of crop. The flush becomes stunted, deformed and brittle, and paler or yellower in colour. The mites feed *only* on the bud and first, second and third leaves; with a 10 × lens, hundreds of minute translucent pale or amber-coloured mites can be seen on the undersides of leaves. From the second or third leaf downwards, as the leaves grow, the feeding area remains as a light corky brown necrotic stripe over the mid-rib, on the undersides of the leaves, or as two corky lines parallel to the mid-rib on either side. These lines are often pressed out on the top of the leaf. Planters sometimes notice this damage on the younger maintenance foliage when the attack is over; the condition of the flush and the presence of mites will show whether attack is still going on.

The only pest or disease with which Yellow mite can be confused is the insect Thrips, a small elongated sucking insect that causes similar corky lines on the under-surfaces of the young leaves. There is never a broad corky stripe right over the mid-rib. Damage is generally less common and less severe.

Of the species which feed primarily on the maintenance foliage, Red Spider Mite causes bronzing and discoloration in patches on the upper surfaces of leaves; Scarlet Mite causes dark necrotic areas on the under-sides. Both these species cause defoliation. Purple Mite causes an overall dull and indefinite bronzing with a purple tinge; there is no defoliation and no mites can be seen with the naked eye. Purple mite attack does not last for long and often precedes attack by Red Spider Mite and Scarlet Mite so that the symptoms of attack by all three mites are sometimes seen together. However, large areas up-country are attacked by Scarlet Mite only, and Red Spider Mite often builds up alone.

Patches and fields of tea attacked by Red Spider can hardly be missed. The ruddy bronzing of the upper leaf surfaces shows from a distance and examination shows the red mites running actively on the tops of the leaves. When the attack has passed, we are left with the bronzing and the tiny white cast skins of the mites.

Scarlet-mite attack is more insidious and often defoliation of the maintenance foliage, working up from the bottom, is the first sign noticed. This sort of defoliation of scattered bushes or small scattered patches is also caused by eelworm and *Poria* but the feeding areas of Scarlet Mite on the underside of the leaves are diagnostic. These start as a brown to very dark discoloration of the mid-rib spreading out from the basal junction with the petiole, later spreading to very dark necrotic patches around the leaf margin.

We may summarize how to distinguish the attack of these four mites as follows:—

1. Attacking the flush: which becomes stunted, pale and brittle Yellow Mite
2. Attacking the maintenance foliage:
 - dull, indefinite bronzing with a purple tinge; no defoliation Purple Mite

- prominent ruddy bronzing on the upper surfaces of the leaves, leading to defoliation ... Red Spider Mite
- dark necrosis of the mid-rib on the undersides of the leaves and marginal dark necrotic patches; leading to chronic defoliation ... Scarlet Mite

Occurrence of mites on tea

The occurrence of Scarlet Mite as a pest is common up-country, and considerable acreages in Dimbula, Dickoya, Maskeliya and Haputale are seriously affected by it from time to time. Outbreaks are not uncommon down to 2,000 feet elevation, but in the low country they are unusual. This mite has by far the slowest rate of increase in numbers of the four species on tea. Numbers never develop very rapidly. On mature tea it is seldom a pest until the second year after pruning, and usually most abundant in the third and later years. The numbers reach an annual peak in the dry weather, from December to May in the S.W. monsoon zone, and in June-September in Haputale, and they decline greatly in the wet season.

Purple mite is also an up-country pest but it is very rarely serious enough in Ceylon, unlike South-India, to merit special control measures. It is also a dry weather pest.

Red Spider Mite and Yellow Mite can occur at all elevations and in all districts, and the rate of increase, especially for Yellow Mite, is rapid. Red Spider Mite is most common in mid-country districts in the Kandyan, Uva and Sabaragamuwa Provinces. It can increase in dry or in showery weather at any stage of the pruning cycle and will withstand a good deal of rainfall.

Yellow Mite is commonest on tea recovering from pruning and young tea in the post-monsoon periods from August to October and January to March. In prolonged dry weather, the numbers decline, surviving longest under shade. The development of an outbreak is usually so rapid and the decline just as fast that the attack is not infrequently over before the planter gets round to spraying. Nevertheless, a few weeks of severe attack by Yellow Mite can result in damage that lasts much longer.

Yellow Mite and Red Spider Mite are the commonest mite pests of young tea and nurseries, but the slower developing Scarlet Mite is occasionally found doing serious damage.

The above observations on occurrence refer to natural trends. The effect of DDT spraying can result in outbreaks of Red Spider and Scarlet Mite at times and places outside the normal occurrence. So far we have no conclusive evidence that DDT will increase the numbers of Yellow Mite.

Control

NON-TAINING AGARICIDES

Kelthane is at present available in Ceylon as 'Kelthane W.P.', a wettable powder containing 18.5% of the toxicant, from Messrs Colombo Chemical & Fertilizer Co. Ltd., P.O. Box 1222, Colombo, at about Rs. 5/50 per lb. The recommended dosage per acre for all four mites is 2 to 4 lb applied in a suitable volume of water for coverage, in one or two spraying rounds.

Chlorobenzilate is sold as 'Akar 338' emulsifiable liquid containing 25% Chlorobenzilate by Messrs Fisons 'Ceylon' Ltd., Harrison & Crosfield Ltd., and A. Baur & Co., Ltd., Colombo. It costs about Rs. 10/50 per pint when bought by the gallon. The recommended dosage for Scarlet Mite, Red Spider Mite and Purple Mite is two spraying rounds of 1½ pints per acre in a suitable volume of water for coverage; it is not recommended for Yellow Mite control.

Kelthane and Chlorobenzilate are amongst the safest pesticides and no special precautions in use are necessary. The usual common-sense care should be used.

Kelthane and Chlorobenzilate will not taint made teas if spraying is done after a plucking round and if there is one-week interval between spraying and plucking. Nevertheless, in order to minimize residues, you are advised to bulk the tea from sprayed areas with at least ten times as much tea from unsprayed areas for the first and second pluckings after spraying.

SULPHUR PREPARATIONS

The following wettable powders are available in Ceylon:—

'Thiovit' ...	...	...	...	Messrs. A. Baur & Co., Ltd.
'Spersul' ...	...	...	...	Messrs I.C.I. Ltd.
'Shell Dispersible Sulphur' ...	...	...	...	Messrs Shell Co. of Ceylon Ltd.

Sulphur wettable powders cost about Re1/- per lb. The recommended dosage for all mites is two spraying rounds of 4 lb per acre in a suitable volume of water for coverage.

Sulphur has virtually no toxic hazard, but it taints made teas very badly and it is essential to discard the green leaf of three plucking rounds after the last spray application.

Alternatively, if the tea has suffered severe mite damage, it can be a good practice to rest it, which should be for a minimum period of one month after the last sulphur application.

SPRAYING MACHINES

With conventional knapsack sprayers and the usual nozzles for insecticidal spraying, it is necessary to use about 50 gallons of spray fluid per acre for Yellow-mite control, in order to wet the flush much more thoroughly than for blister-blight control. Adequate coverage for red-spider control, spraying from above, requires 60-70 gallons per acre, and scarlet-mite spraying, from above and below, requires about 100 gallons per acre.

Experience with mist-blower applications of Kelthane is most promising, but not yet extensive. Planters could well try this method of spraying and we shall be glad to hear about the results obtained. We suggest the standard dosages per acre in 5-10 gallons of water for Yellow Mite and in 10-20 gallons for Red Spider Mite and Scarlet Mite. The bigger volumes may prove to be advantageous. In order to put out 20 gallons per acre in one hour's time, a spray output of about 1 gallon in 3 minutes is necessary, and some of the 0.85 p.h. machines will not do this.

The suspensibility of 'Kelthane W.P.' is not too good, and in one or two makes of mist-blower where the liquid outlet is very restricted the powder can cause blockages. We have tried some other formulations of Kelthane, two liquids and a wettable powder, which are more suitable for mist-blowers and it is hoped that the agents will soon be able to supply one of these.

We have no experience in mist-blowing 'Akar'. Mist-blowing sulphur is a dangerous practice because of possible drift onto tea in plucking.

SPRAYING ROUNDS

Recent work has shown that to control an attack there is no need for several repeated spraying rounds at low dosage; it is better to use the same total dose in not more than two rounds.

Employing Chlorobenzilate and Sulphur, two spraying rounds are desirable, separated by 5-7 days for Yellow mite, 10-14 days for Red Spider, and three to four weeks for Scarlet Mite.

Kelthane is more persistent in effect and one spraying round will often give good control. One spray of 4 lb per acre is the full dosage; but one spray of 2 lb per acre has given promising results. Where two rounds are considered advantageous they should be at the same intervals given above.

YOUNG TEA AND TEA OUT OF PLUCKING

For tea that is not in plucking—for nurseries, new clearings, mother bushes and mature tea out of plucking—where taint is of no concern, sulphur is the obvious choice on cost. Alternatively, Kelthane can be used.

On young plants sprayed to run-off, use 4 lb sulphur or 2 lb of Kelthane per 100 gallons of water for two spraying rounds. On mature tea, use two rounds of 4 lb of a Sulphur W.P. or 2 lb 'Kelthane W.P.' per acre.

MATURE TEA

The advantage of using non-tainting acaricides to avoid discarding crop, is more valuable when we use acaricides to prevent outbreaks, rather than to cure them when the tea has already suffered bad damage. If the latter has occurred, it may pay us as well if we rest the tea and use the much cheaper sulphur.

With Scarlet mite, in fields prone to severe attack in the second, third and later years of the cycle, prophylactic (protective) spraying with Kelthane early in the dry weather can be done routinely. The time for this is generally about January on the S.W. side, and about May on the Uva side.

This is probably the biggest use for a non-tainting acaricide on Ceylon tea and one which is likely to show benefits extensively. The older method of spraying with 100 gallons of spray fluid per acre is extremely tedious but the mist-blower method makes it possible to spray large areas quite easily. Labour costs are low and add little to the cost of Kelthane, which is approximately Rs. 11/- (2 lb) or Rs. 22/- (4 lb) per acre. Scarlet mite is an insidious pest and causes little immediate loss of crop, except when very severe. Hence, it is not easy to assess the losses due to chronic debility of the bushes, but there is little doubt that the control of bad attacks is an economically sound proposition at the above costs.

'Akar 338' can be used as an alternative to Kelthane, but the latter has generally given better results, particularly for prophylactic spraying.

Considerable work was done in past years on the use of sulphur for controlling Scarlet Mite after pruning. Trials make it clear that the numbers of mites carried over, to the new cycle are important. Clean pruning leaves less mites than when

some foliage is left, but sulphur spraying is more effective than clean pruning. Sulphur spraying will delay the build-up of mites in the new cycle considerably, but not by more than one year at the most. Since it is cheap, we think that sulphur spraying after pruning is worth-while in fields particularly prone to Scarlet mite. There must be a one-month interval between spraying and tipping.

With Red Spider and Yellow Mite, we can achieve prophylaxis only by spotting incipient outbreaks and spraying without delay. Kelthane and 'Akar' are equally suitable for red-spider control, but 'Akar' is not effective for Yellow Mite. Sulphur is again useful where the tea is rested.

Some fields, recovering from pruning, are prone to Yellow-mite attack before and during the tipping; sulphur spraying, provided there is a one-month period until tipping, can again be useful. Plucking is a partial control measure for Yellow Mite, but hard plucking or stripping is not recommended.

The following table summarizes the present recommendations for the use of acaricides on mature tea.

Mite	Acaricide	Dosage and spray volume of water per acre	Comments on use
Scarlet Mite	Kelthane	One round of 2-4 lb or two rounds of 2 lb; in 100 gal by Knapsacks, or in 10-20 gal by mist-blowers.	Particularly for prophylactic spraying early in the dry season.
	'Akar 338'	Two rounds of 1½ pints in 100 gal by Knapsacks.	Kelthane better for prophylactic spraying.
	Sulphur W.P.	Two rounds of 4 lb in 100 gal by Knapsacks.	1. For curative spraying if tea is rested. 2. For spraying after pruning.
Red Spider Mite	Kelthane	One round of 2-4 lb or two rounds of 2 lb; in 60-70 gal by Knapsacks or in 10 gal by mist-blower.	} Kelthane and Akar are equally suitable for red-spider control.
	'Akar 338'	Two rounds of 1½ pints in 60-70 gal by Knapsacks.	
	Sulphur W.P.	Two rounds of 4 lb in 60-70 gal by Knapsacks.	For curative spraying if tea is rested (post-pruning spraying is not useful).
Yellow Mite	Kelthane	One round of 2-4 lb or two rounds of 2 lb; in 50 gal by Knapsacks, or in 5-10 gal by mist-blower.	Akar is not effective against Yellow mite.
	Sulphur W.P.	Two rounds of 4 lb in 50 gal by Knapsacks.	1. For curative spraying if tea is rested. 2. Between bud-break and tipping as a prophylactic.
Purple Mite	Kelthane, 'Akar 338', or Sulphur W.P.	As for Red Spider Mite.	Measures for other mites will control Purple Mite. It is seldom necessary to spray for Purple Mite only.

NOTE:—1. See text for comments on taint from sulphur.

2. The interval between two spraying rounds should be 3-4 weeks for Scarlet Mite control, 10-14 days for red-spider control and 5-7 days for yellow-mite and purple-mite control.

3. 'Knapsacks' means conventional Knapsack sprayers; pressure-retaining types are the most useful. 'Mist-blowers' means motorised Knapsack mist-blowers.

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References

- BAPTIST, B. A. & RANAWEERA, D. J. W. (1955). The Scarlet Mites of the genus *Brevipalpus* as pests of tea in Ceylon. *Tea Quart.* **26**: 127-137.
- CRANHAM, J. E. (1960). The mite pests of tea: a review. *Tea Quart.* **31**: 1-7.
- CRANHAM, J. E. (1961). Report on a working-party on mist-blowers, 14th April, 1961. *Tea Quart.* **32**: 201-212.
- CRANHAM, J. E. (1961a). The chemical control of Shot-hole Borer (*Xyleborus fornicatus* Eichh.) on tea. *Tea Quart.* **32**: 171-184.
- RANAWEERA, D. J. W. (1958). Acaricidal trials against the Scarlet Mite on tea. *Tea Quart.* **29**: 125-128.