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CLONAL SUSCEPTIBILITY AND POPULATION DYNAMICS OF TEA RED SPIDER MITE, *OLIGONYCHUS COFFEAE* NIETNER (ACARINA : TETRANYCHIDAE) UNDER LABORATORY CONDITIONS

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Ten widely planted tea clones (TRI 2023, 2025, 2026, 2027, CY 9, DG 39, DN, DT 1, KEN 16/3 and MT 18) grown in mite prone areas were tested for their susceptibility to the tea red spider mite in the laboratory, employing the 'detached leaf' method. Periodical observations on the rate of egg laying and the development of the young to adult stages were also made. This study revealed that the clones MT 18 and TRI 2027 are resistant, while the clones CY 9 and DT 1 are susceptible to this pest. The egg to adult stage varied from 15 to 21 days in different clones with a mean value of 17.6 days. Peak populations were seen 26 - 28 days after inoculation.

INTRODUCTION

The red spider mite, *Oligonychus coffeae* Nietner, is a seasonal pest of tea in Uva, mid-country (wet zone) and some parts of up-country tea districts. This pest is more serious in Uva during May to September when a prolonged drought is experienced. In the mid-country (wet zone) and in the up-country, outbreaks are common only during January to March, which are the drought months in these areas (Cranham 1966*a*).

The tea red spider mite feeds on the mature leaves, by sucking the cell sap. If the damage is severe, the leaves exhibit prominent ruddy bronzing, in patches on the upper surface, leading to defoliation (Cranham, 1966 *a*). Affected bushes are more prominent along road sides and rocky areas in some fields which could be identified as 'mite prone' areas.

As in the case of many pests and diseases, the recommended tea clones do exhibit variations in susceptibility to the tea red spider mite, but so far no studies have been made on this aspect except for evaluating the clonal susceptibility to the Scarlet mite, *Brevipalpus californicus* Banks estimated in terms of number of mites per leaf, under field conditions (Cranham, 1966*b*). In view of this an investigation was initiated in the laboratory to assess the susceptibility of some of the widely planted clones to the tea red spider mite attack. In the same study, an attempt was also made to determine the life cycle of the mite, under laboratory conditions.

MATERIALS AND METHODS

Ten widely planted tea clones in the mite prone tea districts were selected for this study: TRI 2023, TRI 2025, TRI 2026, TRI 2027, CY 9, DG 39, DN, DT 1, KEN 16/3 and MT 18. Healthy, mature leaves from these clonal plants in the field (St. Coombs, Talawakele) were collected in polythene bags, brought to the laboratory, washed and cut into a fixed size (diamond shape) of 7.0 x 3.0 cm with the petiole intact.

The petioles were inserted into glass tubes and held in position in water trays as shown in Fig. 1 (0omen, 1982). Each clone was replicated 10 times. Young females collected from laboratory culture, maintained in mature tea leaves, were deposited on the upper surfaces of these leaves at the rate of one female per leaf. The assessment of eggs and other stages (larvae, protonymphs, deutonymphs and adults) were made regularly once in two days up to 40 days. If the deposited females were found missing or dead, they were replaced by new ones only up to 10 days. The average temperature during the period of the study was 22°C (range 20° - 25°C) with a relative humidity of 65% (range 60 - 70%).

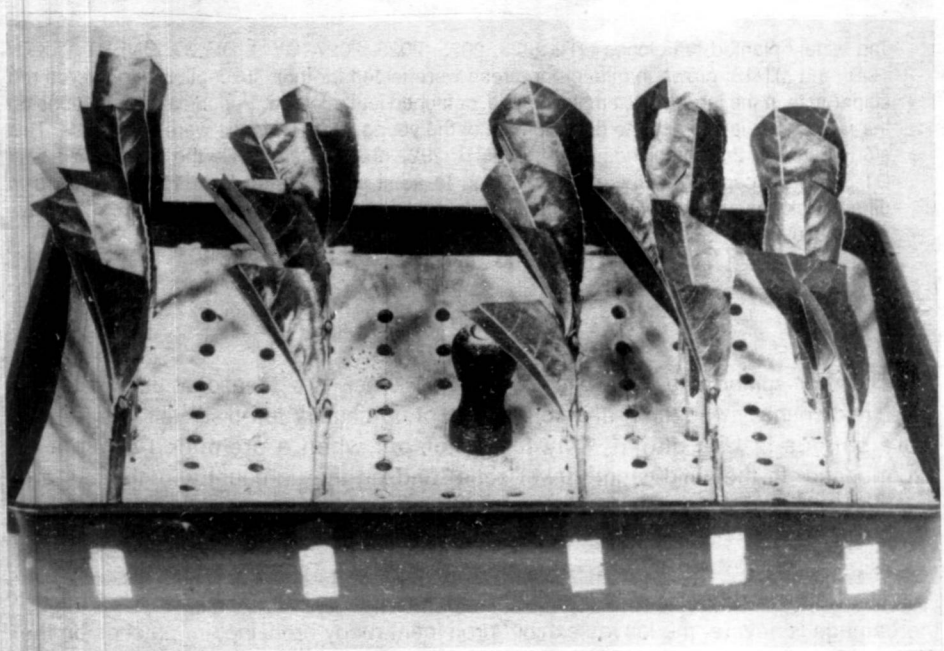

Fig. 1 – *Water tray with leaves cut to diamond shape of 5 tea clones in 5 replicates*

Analysis of data

The counts of eggs as well as of all stages were treated separately. Since the numbers were cumulative at the initial stages, it was possible to plot the numbers on a logarithmic scale and form a smooth curve. The technique adopted by Calnaido and Thirugnanasuntharan (1966) was employed to read off logarithmic points daily and to convert them back to antilogarithms which result in calculated numbers of eggs for each successive day. From these, it was possible to deduce the number of eggs laid each day for each clone.

RESULTS

Rate of egg laying

The mean number of eggs laid by each female per day during the first generation for each clone is given in Table 1.

TABLE 1 – *Rate of egg laying of mites in each clone*

Clone (*in ascending order*)	Number of eggs laid/female/day (*Mean of 10 replicates*)
TRI 2027	2.2
DN	2.6
TRI 2026	2.7
DT 1	2.8
TRI 2025	2.9
MT 18	2.9
KEN 16/3	3.0
TRI 2023	3.1
DG 39	3.4
CY 9	3.5
Mean	2.9

Generation peaks

The generation peaks of mite numbers in different clones are given in Table 2. The time interval between two successive peaks for each clone is considered as one life cycle of the mite for that clone.

TABLE 2 – *Generation peaks (days) of mite numbers in clones*

Clone (*in ascending order*)	*First peak*	*Second peak*	*Interval* (days)
MT 18	4	19	15
TRI 2026	5	21	16
CY 9	5	21	16
TRI 2023	5	22	17
DN	5	22	17
DT 1	6	23	17
DG 39	4	22	18
TRI 2027	3	22	19
KEN 16/3	5	25	20
TRI 2025	3	24	21
Mean	4.5	22.1	17.6

Population dynamics

The mite numbers (total population including eggs, immature stages and adults) shown in Fig. 2 are on logarithmic scale while the calculated number of eggs laid per day by the females in both generations are given in arithmetic numbers. As seen from these Figures, maximum population always occurred during 26 - 28 days, after inoculation of the females, in all the clones tested.

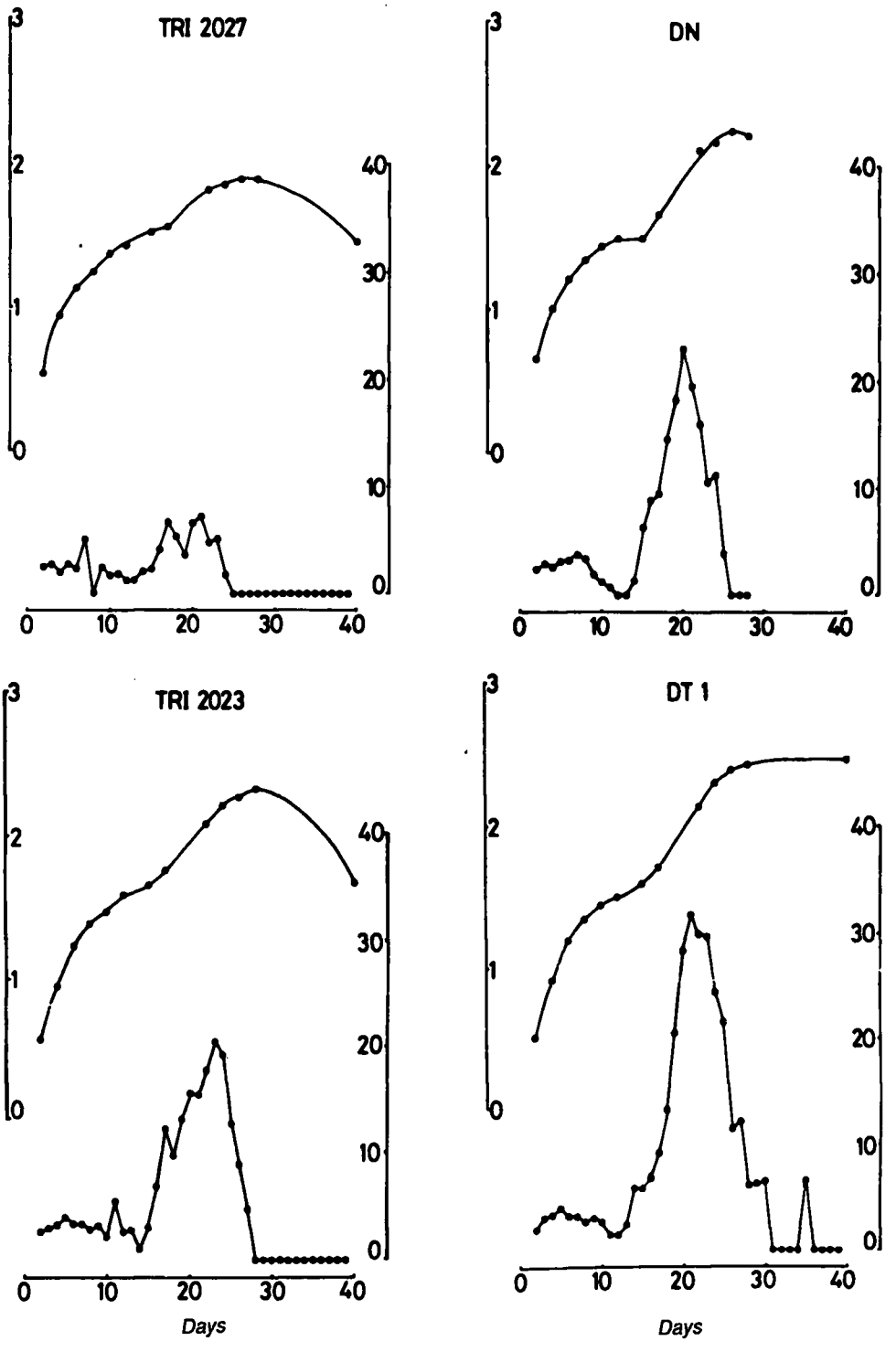

Fig. 2 - *Mite Population build up and rate of egg laying*

TRI 2027 - resistant Clone;
DN - Moderately resistant Clone;
TRI 2023 - Susceptible Clone;
DTI - Very Susceptible Clone;

Clonal susceptibility

The maximum mite population (eggs, immature stages and adults) obtained from all the 10 replicates of each clone, are presented in Table 3. These numbers indicate the relative resistance or susceptibility of the clones to the mite infestation.

TABLE 3 – *Susceptibility of clones to tea red spider mite*

Clone (*in ascending order*)	Maximum mite numbers (*mean of 10 replicates*)
MT 18	81.7 a
TRI 2027	91.5 a
TRI 2026	138.2 b
DG 39	172.0 b
DN	181.2 b
KEN 16/3	190.3 b
TRI 2025	213.0 b
TRI 2023	213.1 c
CY 9	293.5 d
DT 1	337.2 d
Mean	191.2

Means followed by the same letter not significantly different to each other - Duncan's Multiple Range Test.

Categorization of clones

Based on the clonal susceptibility (maximum mite numbers), clones were categorized as very resistant, moderately resistant, susceptible and very susceptible (Table 4). For this purpose, the mean value of 191.2 (Table 3) was considered as 50% mite numbers

TABLE 4 - *Categorization of clones in relation to susceptibility*

Clones	Percentage mite numbers (mean as 50%)	Degree of resistance/ susceptibility
MT 18, TRI 2027	0 - 25	very resistant
TRI 2026, DG 39, DN, KEN 16/3	25 - 50	moderately resistant
TRI 2023, TRI 2025	50 - 75	susceptible
CY 9, DT1	75 - 100	very susceptible

DISCUSSION

Since replanting, large scale infilling and new planting of tea fields with recommended tea clones is obligatory, it is inevitable to study these clones for their resistance and susceptibility for major pests. Though studies were made in the past, for pests such as the shot-hole borer, the live wood termites and nematodes, similar studies were not made for the red spider mite. Since the study described here, was conducted under laboratory conditions, these findings have to be confirmed by well

replicated field experimentation in 'mite prone' areas where the attack is a recurrent feature. As this study was confined to only 10 clones testing of more clones also becomes desirable. Counting of mite numbers (eggs, immature stages and adults) in 10 clones with 10 replicates, totalling 100 leaves, once in every two days necessarily become laborious, painstaking and time consuming, particularly when the numbers are in hundreds. As such, this study was conducted in two stages with five replicates each, and the results were pooled together. Among the clones studied MT 18 and TRI 2027 were resistant while CY 9 and DT 1 were susceptible (Table 3).

The net reproductive rate, as measured by the rate of egg laying per female per day is not related to the clonal susceptibility, as measured by maximum mite numbers. This is evident from Tables 1 and 3. For example, the most susceptible clone DT 1 had an egg laying rate of 2.8 per day, whereas the most resistant clone MT 18 had an egg laying rate of 2.9 per day.

King (1936) found that the life history of the red spider mite lasted 14 - 15 days at 71-72° F (22° C), which included larval (8 days), first nymphal (4 days) and second nymphal stages (2-3 days). He also observed that the females laid as much as 40 - 50 eggs. However, Das (1959), observed that the life cycle took 9 - 12 days in May - June when the temperatures were high and as much as 28 days during the months of low temperatures. Kathiravetpillai (1969) developed a simple inexpensive technique using tea leaf discs for laboratory culturing of this mite and found that the life cycle was 33 days at 21C° and 74% RH. This included egg stage (8 days), protonymph (5.3 days), deutonymph (3.7 days) and adult (16 days). He also observed that the adults laid an average of 35 eggs. Das and Das (1967) found that temperature and humidity varied pre-oviposition, oviposition and post-oviposition periods of adult females. These studies show that temperature and humidity have a significant effect on the duration of the life cycle of this pest. Under the laboratory conditions in which the present study was conducted the life cycle varied from 15 - 21 days with a mean value of 17.6 days.

CONCLUSIONS

Based on the results obtained under laboratory conditions, the following conclusions could be made:

1. The rate of egg laying varied from 2.2 to 3.5 in different clones with the mean value of 2.9 eggs per female per day.

2. The life cycle of the red spider mite, *O. coffeae*, varied from 15 - 21 days with a mean value of 17.6 days.

3. In all clones, the maximum population of the mite numbers occurred during 26 - 28 days after inoculation of the female.

4. Significant variations in clonal susceptibility have been observed among the ten clones tested. Clones such as MT 18 and TRI 2027 were found to be very resistant while clones such as CY 9 and DT 1, very susceptible. Other clones showed intermediate resistance or susceptibility.

5. Net reproductive rate is not related to the clonal susceptibility.

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