S. L. J. Tea Sci. 58 (1), 50–55, 1989. Printed in Sri Lanka.

RECENT OBSERVATIONS ON RESISTANCE AND SUSCEPTIBILITY OF TEA CLONES TO THE SHOT - HOLE BORER BEETLE, *XYLEBORUS FORNICATUS* EICHH. (COLEOPTERA: SCOLYTIDAE)

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This study is an attempt to determine the tolerance of several clones including recent introductions like the 3000 and 62 - series to the shot-hole borer. These studies were carried out in the clones of the clonal proving trials in the Uva, mid-country and in the low country as well as on other estate selections employing the improved technique of using the basal primary type branch to estimate the total number of galleries. The results indicate broad categories of tolerance or susceptibility of the clones studied to the borer beetle.

INTRODUCTION

The shot-hole borer beetle is the most serious insect pest of tea in Sri Lanka. There are many ways of managing the shot-hole borer induced damage in tea. One way is to find a tea clone that is resistant as suggested by Judenko (1960) and also has other desirable characters, such as high yield, quality and resistance to other pests and diseases. Judenko's study was confined to 37 tea clones at elevations ranging from 35-1150 m. Later, Calnaido and Kanapathipillai (1967) who were working with 31 tea clones and one seedling progeny showed that there was variation in the tolerance and susceptibility of clones to beetle damage.

Thirugnanasuntharan and Calnaido (1968, 1969) followed up this work with additional clones and published comparative lists of tea clones in respect to their tolerance and resistance to the borer beetle and attempted to relate them to the known characteristics of yield, manufactured quality of tea and drought resistance.

This paper deals with the studies on resistance and susceptibility of the new tea clones introduced in the recent past to the shot-hole borer beetle and was carried out in different locations, *viz.* Uva, mid-country and low country. This study was carried out employing the improved method of assessment, i.e. basal primary type of branch (Sivapalan, 1975) instead of the conventional "standard unit" method (Judenko, 1958).

MATERIALS AND METHODS

The following clonal test plots and blocks were utilized to assess the shot-hole borer infestation :

Location	*Clonal test plots/blocks*	*Altitude(m)*	*No. of clones*	*No. of replicates*
TRI Uva Station ...	62-series	1030	13	Unreplicated
TRI Uva Station ...	UVP 6	1030	33	2
Deniyaya State Plantation...	LVP 16	420	20	3
Estates (many) ...	—	700-1250	12	Unreplicated

In each location, 12 entire branches were sampled at random from each clonal test plot or block and brought to the laboratory. Only 10 branches were chosen for dissection and the branches were categorized into primary, secondary and tertiary types. In these branches, estimation of shot-hole borer infestation was measured in terms of total galleries (open, healed and other). Since the greatest number of galleries are found in the basal part of the primary branch type (Sivapalan, 1975), only the basal 15 cm (6 inches) of the primaries was considered for assessment. Thus, shot-hole borer damage is measured as mean number of galleries per basal primary (15 cm) (mean of 10 branches). The most resistant clone TRI 2023 was used as the standard clone to compare the susceptibility of the clones tested.

RESULTS AND DISCUSSION

Shot-hole borer infestation in tea depends on (1) the degree of susceptibility or resistance of the clone; (2) the locality and altitude, and (3) months from last prune in the current pruning cycle. The tea clones tested, showed significant variations in the degree of resistance or susceptibility to borer damage (Tables 1-4). Altitude which is a determinant of temperature, is a regulatory factor on the borer damage. Nevertheless, there is evidence to show that due to localized climatic variations, the borer damage could vary considerably. A good example was observed at Kirkoswald Estate, Bogawanthalawa, where in a field situated at 1100 m altitude, the clone WT 26 was completely riddled with shot-hole borer to the extent that this field could not be brought into plucking, even after three years from planting. The galleries are formed from 10-12 months from prune, reach a peak around 18-20 months and thereafter gradually decline towards the end of the cylce. Since galleries are cumulative i.e. once galleries are formed they remain even though healed (Calnaido and Thirugnanasuntharan 1966), it is best to carry out assessment for borer damage towards the end of the pruning cycle.

Several studies have been carried out to determine the tolerance of tea clones to the borer beetle (Calnaido, 1971; Calnaido and Kanapathipillai, 1967; Judenko, 1960; Thirugnanasuntharan and Calnaido, 1968, 1969). Since then, many new clones have been released to the industry. In the present study, out of the 13 clones of the TRI

62-series, only clone TRI 62/6 showed some degree of resistance while many were susceptible (Table 1). In contrast, in the 32 clones of the TRI 3000 series, as many as 17 clones showed fair degree of resistance (Table 2). In the low country experiment LVP 16, out of 20 clones tested, only 3 showed fair degree of resistance while many were susceptible (Table 3). Of the estate clones tested, only Welimada WM was comparable to the standard clone, TRI 2023 (Table 4). The clones CH 13, K 145, N 2 and DN showed moderate resistance while Clones CY 9 and KEN 16/3 showed high susceptibility. Based on the results of this study it seems probable to categorise these clones into four very broad categories in the order of increasing susceptibility :

TABLE 1 — *Shot-hole borer infestation in clones of the 62-series at TRI Uva Station, Passara.*

Clones	*Mean No. of galleries in basal primaries (15 cm) (Mean of 10 branches)*
TRI 62/6	1.5 a
TRI 62/3	1.7 b
TRI 62/4	2.0 b
TRI 62/12	2.2 b
TRI 62/2	2.4 b
TRI 62/8	3.0 c
TRI 62/10	3.0 c
TRI 62/13	3.1 c
TRI 62/1	3.2 c
TRI 62/5	3.3 c
TRI 62/11	4.2 d
TRI 62/7	4.4 d
TRI 62/9	4.4 d

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

TABLE 2 — *Shot-hole borer infestation in clones of the clonal trial UVP 6 (3000 series) at TRI Uva Station, Passara.*

Clones	*Mean No. of galleries in basal primaries (15 cm) (Mean of 20 branches)*
TRI 3030	0.10 a
3037	0.15 a
2023	0.20 a
3013	0.25 a
3023	0.35 a
3042	0.35 a
3014	0.50 a
3021	0.50 a
3029	0.50 a
3033	0.50 a
3016	0.60 a
3018	0.60 a
3031	0.60 a
3022	0.65 a
3057	0.65 a
3058	0.70 a
3027	0.75 a
3015	0.85 a
3026	0.99 a
3034	1.05 b
3044	1.10 b
3060	1.10 b
3041	1.20 b
3020	1.30 b
3019	1.35 b
3035	1.35 b
3056	1.40 b
3036	1.60 b
3051	1.75 cd
3025	1.85 cd
3039	2.30 cd
3049	2.35 cd
3017	2.55 d

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

TABLE 3 — *Shot-hole borer infestation in clones of the clonal trial LVP 16 at Deniyaya State Plantation, Deniyaya.*

Clones	*Mean No. of galleries in basal primaries (15 cm) (Mean of 30 branches)*
TRI 2023	1.23 a
TRI 2043	1.46 a
MT 18	1.66 a
TRI 2027	2.10 b
TRI 2026	2.10 b
TRI 2024	2.23 b
DG 7	2.50 bc
TRI 2022	2.53 bc
H 1/58	2.63 bc
TRI 62/5	2.63 bc
TRI 62/6	2.66 bc
DG 39	2.70 c
DG 3	2.80 c
TRI 2025	2.80 c
TRI 2021	2.80 c
MPA 1	3.00 c
S 106	3.05 c
TRI 62/9	3.17 c
KEN 16/3	3.20 c

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

TABLE 4 — *Shot-hole borer infestation in estate clones.*

Clones	*Mean No. of galleries in basal primaries (15 cm) (Mean of 10 branches)*
TRI 2023 (Standard)	1.1 a
WM	1.1 a
CH 13	1.7 b
K 145	1.9 b
N 2	2.0 b
DN	2.4 b
TC 26	2.8 c
DG 39	3.0 c
DT 1	3.3 c
TC 9	3.6 c
CY 9	4.2 d
KEN 16/3	5.3 d

(a) Resistant clones : TRI 3030, 3037, 2023, 3013, 3023, 3042, 3014, 3021, 3029, 3033, 3016, 3018, 3031, 3022, 3057, 3058, 3027, 3015, 3026, WM, TRI 2043, 62/6, MT 18.

(b) Moderately resistent clones : TRI 3034, 3044, 3060, 3041, 3020, 3019, 3035, 3056, 3036, 62/3, CH 13, K 145, N 2, TRI 62/4, 2027, 2026, 62/12, 2024, 62/2, DN, DG 7.

(c) Susceptible clones : TRI 3051, 3025, 3039, 3049, 2022, H 1/58, TRI 62/5, DG 39, DG 3, TRI 2025, 2021, TC 26, TRI 62/8, 62/10, MPA 1, S 106, TRI 62/13, 62/1, DT 1, TC 9.

(d) Very susceptible clones : TRI 3017, CY 9, TRI 62/11, 62/7, 62/9, KEN 16/3.

It is to be stressed that these results are subject to test by further experimentation and provide broad guidelines in selecting clones in shot-hole borer prone areas.

ACKNOWLEDGEMENTS

The authors wish to gratefully acknowledge : (1) Officer-in-Charge, TRI Uva Station, Passara (2) Officer-in-Charge, TRI Deniyaya Station, Deniyaya, (3) The Superintendents of Estates, for facilities provided to carry out assessments. They also thank the technical assistance rendered by the staff of the Entomology Unit, TRI, Talawakele.

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