FURTHER OBSERVATIONS OF THE TOLERANCE AND SUSCEPTIBILITY OF TEA CLONES TO SHOT-HOLE BORER INFESTATION

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One way of combating the shot-hole borer problem is the selection of clones resistant to the pest. Clonal selection for shot-hole borer tolerance has already shown, that some of the high-yielding clones are resistant to this pest. This paper reports further work on clonal selection in respect of 16 additional clones and makes a comparative study of 48 clones as regards their yield, quality, drought resistance and shot-hole borer tolerance.

Of the 16 new clones tested, OT 5/8 was the best clone as regards borer tolerance although it was a very poor yielder (with less than 200 lb made tea per acre per year). Two clones from the Passara District, MPA 1 and NK 4B/29 were found to be moderately good for shot-hole borer tolerance as well as for yield and drought resistance. The quality of made tea of these two clones, however, is not yet known, and their acceptance as suitable clones will have to await this information. Clones H6A1, TRI 2016 and TRI 2024 were found to be very susceptible to borer infestation. Clone H6A1 has been so severely attacked by Shot-hole Borer that it has failed to build up into a bush even five years from planting.

The 16 clones of the experiment **MVP2** laid out in 1962 were relatively low yielders and none of them was better than TRI 2023 and DG 39 as regards suitability for propagation in the mid-country.

Introduction

Calnaido and Kanapathipillai (1967) evaluated shot-hole borer infestation in 31 clones and one seedling selection on the clonal testing experiment **MVP1** laid out in 1961. By applying the same techniques the borer infestation in 16 additional clones of the 1962 experiment **MVP2** have been evaluated, and performances of these clones compared with those in **MVP1.**

Materials and methods

The clonal testing experiment **MVP2** (1962), at the Mid-Country Station, Kandy, consisted of 16 clones, arranged in eight randomized blocks of which four are shaded by *Gliricidia maculata* spaced 14 ft apart, and four are unshaded. Each block had eight plots to which were alotted at random, eight clones, so that each clone was replicated four times, two of the plots being shaded and the other two unshaded. Each plot had 36 plants planted in six rows at a spacing of two ft in the row and four ft between rows.

Borer damage in the clones was assessed by the number of 'branch breakages' in all plants, in February 1966 (20 months from prune), June 1966 (24 months from prune), October 1966 (28 months from prune), February 1967 (32 months from prune) and in June 1967 (36 months from prune). Further, an estimate of the total number of galleries in the prunings (mean per 25 branches per plot) was taken in July 1967 and weights of the prunings were used to make corrections to account for the variations of the number of branches per bush of the different clones. (Calnaido & Kanapathipillai 1967).

Results

Relation of branch breakage and shot-hole borer attack

There was a highly significant correlation ($r = +0.62$ at $P < 0.05$) between branch breakage per bush and total galleries per bush. This is in accordance with the observations on **MVP1**, and suggests that branch breakage in infested tea plants can be regarded as a good criterion of borer infestation.

Rate of healing of borer galleries

A simple regression on total galleries and healed galleries was highly significant ($b = 0.8392$ at $P < 0.001$) and the very high correlation ($r = +0.99$) between healed galleries and total galleries (open and healed) per branch of the prunings, indicates that galleries heal at about the same rate in all clones and that no clone had any special ability to gallery healing. This too, is in accordance with the observations of work on experiment **MVP1.**

Tolerance and susceptibility of clones to borer attack

The significant differences in the infestations of the 16 clones of experiment **MVP2,** as measured by the two distinct methods, are given in Table 1. Clone OT 5/8 was very tolerant to borer attack although it was a very poor yielder. The clones MPA 1 and NK 4B/29 could be regarded as moderate in respect of shot-hole borer tolerance, yield and drought resistance, although their quality is not yet known. Clones H 6 Al, TRI 2016 and TRI 2024 were found to be very susceptible to borer infestation. Clone H 6 Al has been so severely attacked by Shot-hole Borer that it has failed to build up into a bush even five years after planting.

TABLE 1—*Shot-hole borer attack on* 16 *clones of the experiment* **MVP2** *laid out in* 1962 *as measured by* (1) *'branch breakage' and* (2) *content of total galleries in pruned branches*

Clone	'Branch breakage' per bush (Mean of 5 observations)	Clone	Total galleries per 25 branches per plot (in prunings)
MPA 1	0.17	OT 5/8	45.50
NK 4B/29	0.18	MPA 1	50.00
CH 13	0.36	MG	51.25
KP 204	0.36	NK 4B/29	63.75
TRI 2043	0.36	CH 13	65.75
D	0.39	D	69.25
OT 5/8	0.43	KP 204	90.75
N 3	0.69	TRI 2020	91.50
MG 3 B1	0.72	TRI 2022	104.50
MG	0.74	TRI 2043	109.00
TRI 2024	0.81	N 3	115.25
TRI 2022	0.85	TRI 2039	128.00
TRI 2020	1.05	TRI 2024	128.25
TRI 2016	1.61	MG 3 B1	136.25
H 6A1	1.75	TRI 2016	204.50
TRI 2039	1.89	H 6A1	—
LSD at $P = 0.05$	0.79		58.52
$P = 0.01$	1.05		78.22
$P = 0.001$	1.37		102.84

Both experiments **MVP1** and **MVP2** completed their first pruning cycle and the estimations of borer infestation of all clones in these two experiments are given in Table 2. As yield is the primary desirable characteristic, we have made an arbitrary comparison of all the 46 clones examined to date as regards yield (arranged in order of merit) and showing the other characteristics of quality of made tea, ability to resist drought and shot-hole borer tolerance from the information available to date (Table3). It will be seen from Table 3 that the clones of experiment **MVP2** are relatively poor yielders and, therefore, the favourable positions held by clones TRI 2023 and DG 39 for shot-hole borer tolerance, in relation to the other desirable characteristics, remain.

TABLE 2—*Shot-hole borer attack on* 48 *clones of the* 1961 *and* 1962 *experiments* (**MVP1** and **MVP2**) *as measured by the content of total galleries in pruned branches*

Clone	Total galleries per 25 branches per plot (in prunings)	Clone	Total galleries per 25 branches per plot (in prunings)
QT 1/5	13.75	*TRI 2020	91.5
TRI 2023	19.5	GMT 9	91.75
NL 4/2	20.0	PO 26	92.0
DN	34.5	CY 9	95.0
BG 18	36.0	K 136	95.0
MT/BG	39.0	KEN 16/3	96.75
T 5/35	44.5	*TRI 2022	104.5
*OT 5/8	45.5	*TRI 2043	109.0
*MPA 1	50.0	*N 3	115.25
*MG	51.2	TK 48	119.0
UH 9/3	55.25	TRI 2024	121.75
PAS 22	56.5	CV 5 B1	122.5
DG 39	56.5	CR 4	127.5
K 150	58.25	*TRI 2039	128.0
*NK 4B/29	63.75	*TRI 2024	128.25
*CH 13	65.75	DT 1	134.75
CV 4 B1	68.5	*MG 3 B1	136.25
EN 31	68.75	TRI 2151	136.5
*D	69.25	TRI 2027	138.25
Seed	78.75	T 5/3	147.5
TRI 777	85.25	NL 3/1	174.0
KEN 15/7	88.75	TRI 2025	200.5
TRI 2026	88.75	*TRI 2016	204.5
*KP 204	90.75	*H 6 A1	—

LSD at $P = 0.05$ ... 59.91
$P = 0.01$ ... 78.98
$P = 0.001$ ... 101.98

*Clones in experiment **MVP2**

TABLE 3—*Tentative list of clonal characteristics for the Mid Country*

Yield (in order of merit)	Quality	Drought resistance	Shot-hole borer tolerance
TRI 2023	**	*	***
TRI 2026	—	—	—
TRI 2025 (>2000 lb)	*	**	—
DG 39	**	**	**
TRI 2151	**	*	—
KEN 16/3	*	*	*
TRI 2027	*	**	—
T 5/35	*	*	**
MT/BG	*	**	**
BG 18	—	*	**
NL 3/1	**	*	—
TRI 2024 (>1400 lb)	**	—	—
DT 1	***	**	—
K 136	**	*	*
KP 204	?	—	*
GMT 9	?	*	*
DN	*	***	**
MPA 1	?	**	**
NK 4B/29	?	***	**
QT 1/5	*	*	***
PAS 22	—	—	**
POR 26	*	—	*
T 5/3	—	*	—
EN 31 (>1000 lb)	**	**	*
TRI 2043	—	*	—
TRI 2043	**	**	*
KEN 16/7	**	**	*
UH 9/3	*	—	**
Seed	—	*	**
TRI 2022	*	—	—
NL 4/2	***	—	***
TRI 2016	*	**	—
CY 9	—	**	*
K 150	**	—	**
CH 13	*	**	**
MG 3B1	?	*	*
TRI 777	***	**	**
CV 5 B1	—	***	*
CR 4	—	**	—
N 3	**	**	—
TRI 2039	?	**	—
MG	?	—	**
D	**	**	**
CV 4 B1	**	***	**
TRI 2020	**	***	**
OT 5/8	?	***	***
H 6 A1	***	*	—

		Grade	Score	Galleries in prunings
Excellent	***	A 1	>85%	<20%
Good	**	A 2	>45%	<40%
Moderate	*	B	>25%	<60%
Bad	—	C	>25%	>60%

NB—Clones of experiment **MVP2** appear in italics

Discussion

Both clonal testing experiments **MVP1** and **MVP2** at the TRI Mid-Country Station, Kandy, had run for a period of three years in their first pruning cycle : **MVP1** from October 1963 to October 1966 and **MVP2** from July 1964 to July 1967. It is, therefore, interesting to note that borer infestation, as measured by the total number of galleries in prunings were about the same level in TRI 2024 which is used as a standard clone. This was also true for the mean number of galleries per bush for all clones in both experiments, despite the overlap in time of one year. This is indicated below :

	Total number of galleries per bush (calculated)	
	TRI 2024	*Mean per bush of all clones*
MVP1 (1961) — (32 clones)	40	25
MVP2 (1962) — (16 clones)	38	27

This is possibly because the plants in both experiments may have been in a susceptible stage during the same period of time. This result, in any case, justifies a ready compariosn of the borer infestation of the clones in both experiments.

It is also interesting that observations on borer infestation of clones in experiment **MVP2** are in many respects in accordence with, and comfirm the earlier findings from the similar experiment **MVP1** ; for instance, (a) in the relationship between 'branch breakage' and borer infestation of clones and (b) the near-consistent rate of healing of borer galleries in clones. In one respect, however, the results of the two experiments differ. In experiment **MVP1** the shaded plots had significantly heavier borer infestation, while in experiment **MVP2** the unshaded plots were significantly more heavily infested. There is no explanation for this at present and this point is being investigated further. The galleries, however, healed quicker under shaded conditions in both experiments.

These observations are applicable only to mid-country districts and the order in the list of clonal characteristics given here are subject to alteration, as and when fresh evidence becomes available.

Summary

Observations on the clonal susceptibility or tolerance to shot-hole borer infestation of the 16 clones of experiment **MVP2** laid out in 1962 are reported and this information has been compared with the results of a similar experiment **MVP1** laid out in 1961, on 31 clones and one seedling selection. The new information is that clones MPA 1 and NK 4B/29 are moderately good clones as regards borer tolerance, yield and drought resistance. Most of the clones of experiment **MVP2** were, however, relatively low yielders and, therefore, when all 46 clones were considered the priority list of clones, with regard to borer tolerance in relation to the other desirable qualities, did not change drastically. Clones TRI 2023 and DG 39 are still probably the best clones for propagation in the Mid Country.

Reference

CALNAIDU, D. & KANAPATHIPILLAI, P. (1967). Tolerance and susceptibility of tea clones to shot-hole borer infestation. *Tea Q.* **38,** 275-281.