

STUDIES ON COLLAR AND BRANCH CANKER OF YOUNG TEA (*PHOMOPSIS THEAE* PETCH) III—CLONAL RESISTANCE

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The relative resistances of a number of tea clones to Collar and Branch Canker Disease (*Phomopsis theae* Petch) were estimated from the results of inoculation tests and field observations at St Coombs and other estates. All clones inoculated with several isolates of *P. theae* were susceptible to attack by this organism, but there were marked differences in their resistances. Canker assessments and field observations in commercial plantings confirmed this. Based on their average performance, the clones have been divided into three resistance classes, and recommendations on the choice of clones for different districts made accordingly.

An outstanding feature of this study has been the high resistance exhibited by clone TRI 2023. Other clones that showed high resistance were TRI 777, 2025, 2026, DT 1 and K 145. TRI 2027, 2039, 2142, 2151, DT 95, H6A1, KEN 16/3, NAY 3, NL 3/1, E 7/27 and UH 9/3 were considered to be of low resistance and TRI 25, 740, 2016, 2022, MTBG and W 3 of intermediate resistance. TRI 2024 exhibited very low resistance in observation trials in Uva.

All isolates of *P. theae* used in the inoculation tests were pathogenic, but they differed in virulence. A highly significant interaction between different isolates of the fungus and clones was observed, which indicates the existence of biotypes in *P. theae*.

Marked differences in the susceptibility of tea clones to Collar and Branch Canker Disease (*Phomopsis theae* Petch) have been reported previously (Shanmuganathan 1965; Shanmuganathan & Rodrigo 1966). In most estates, especially in the Uva and Udupussellawa areas, the clone recorded as being most severely attacked by *P. theae* is TRI 2024, although a few other clones are also known to be highly susceptible to the disease. Severe disease outbreaks have largely been confined to estates where highly susceptible clones have been used for replanting uneconomic, old seedling tea. It has, therefore, been suggested that losses due to Collar and Branch Canker in young tea might be reduced by the use of resistant clones for replanting. In a recent communication, Shanmuganathan & de Silva (1968) published some advanced information on clonal resistance in order to enable growers to select suitable clones for replanting areas, where the disease is prevalent. This information was derived from field observations and from interim results of resistance trials that were in progress then. This paper gives an expanded account of these observations and trials, which are now concluded and the results fully analysed.

Trial 1—Experiment P18, St Coombs, Talawakele

In this experiment the relative resistances of 20 tea clones to 20 isolates of *P. theae* were determined.

Materials and methods

One-year-old plants raised from 20 TRI and estate clones were planted out during the south west monsoon season of 1964 in rows, at a spacing of 4 ft by 2 ft on No. 7 Field at St Coombs. The planting was carried out in four blocks, and in each block there were 50 plants each of the 20 clones. The plants were bent once and brought into bearing as practised at St Coombs. In May 1965, the plants in one block were inoculated using five isolates of *P. theae* obtained from different localities.

Inoculations were made on the collar through V-shaped cuts, which were bound immediately with polythene tape. Inoculum was prepared as previously described (Shanmuganathan & Rodrigo 1967). Each isolate was inoculated once on each plant and replicated on ten plants per clone, making a total of 1000 inoculations for the five isolates and 20 clones.

Results of these inoculations were recorded in August by measuring the vertical length of the lesions produced.

The inoculations were repeated in the second block in February 1966, in the third in March 1967 and in the fourth in February 1969, using on each occasion five different isolates of the fungus. The sources of the 20 isolates used in this experiment are given in Table 1, together with other relevant data. The mean length of the lesions developed on each clone was taken as a measure of the susceptibility of that clone, and the mean length of the lesions produced by each isolate as a measure of the virulence of that isolate.

TABLE 1 — *The sources of isolates of Phomopsis theae used in a resistance trial at St Coombs, Talawakele*

Year of inoculation	Isolate	Estate	Source		Clone
			District	Elevation (ft)	
1965	LT 1	Hugoland	Udapussellawa	3500	Not known
	LT 2	Welimada Group	New Galway	3800	2024
	LT 3	Gonamotawa	Haputale	4300	Not known
	LT 5	Downside	New Galway	4000	2025
	LT 10	St Coombs	Dimbula	4500	KEN 16/3
1966	LT 15	Troup	Dimbula	4444	2024
	LT 16	Waltrim	Dimbula	4600	Not known
	LT 18	Waldemar	Udapussellawa	4500	Not known
	LT 19	Diyagama West	Dimbula	4450	DIY G
	LT 20	St Coombs	Dimbula	4500	KEN 16/3
1967	LT 23	Aislaby	Badulla	4000	2024
	LT 24	Gonakelle	Passara	4000	2024
	LT 25	Craig	Haputale	6375	2025
	LT 26	St Leonards	Udapussellawa	5000	2024
	LT 27	Craig	Haputale	6375	2023
1969	LT 30	Park	Nuwara Eliya	6200	Seedling
	LT 34	St Coombs	Dimbula	4500	TC 9
	LT 36	St Coombs	Dimbula	4500	KEN 16/3
	LT 37	St Coombs	Dimbula	4500	2024
	LT 38	Gordon	Udapussellawa	4300	NAY 3

Results

The proportion of plants that became infected was approximately the same in 1966, 1967 and 1969, while in 1965 it was significantly less (Table 2). The biggest lesions were obtained from the 1967 and 1969 inoculations, and the smallest from the 1965 inoculations.

TABLE 2 — *Results of inoculations of 20 tea clones with Phomopsis theae*

Year of inoculation	Plants infected (%)	Mean lesion length (cm)
1965	64.3	1.41
1966	97.3	5.79
1967	99.6	3.72
1969	99.2	6.21

Full results of the inoculations are summarized in Table 3. It will be noted that none of the 20 clones tested in this experiment was immune to infection. In presenting these results, clone TRI 2023 has been selected as a standard for estimating the relative resistances of the clones. This clone has consistently shown high resistance in the field in various districts as well as in extensive inoculation tests.

TABLE 3 — Mean lesion lengths (cm) on 20 tea clones after inoculation with *Phomopsis theae*

Clone	Year of inoculation			
	1965	1966	1967	1969
DT 1	1.21	5.29	3.40	4.63
2025	1.63	5.82	4.00	3.35
2016	1.94	5.80	4.54	7.74
2027	1.43	6.49	3.42	5.42
2151	1.41	7.12	3.50	5.95
25	1.33	7.11	4.63	3.44
MTBG	1.25	7.95	3.12	6.11
2024	1.30	5.99	3.22	4.00
2022	1.45	6.28	4.06	5.75
W 3	1.30	3.38	4.35	10.40
2023	1.24	3.74	2.29	2.83
740	1.35	5.54	3.51	8.11
2142	1.32	5.86	3.33	7.47
2039	1.46	6.58	3.44	6.37
2026	1.59	6.01	3.08	3.46
777	1.39	4.95	3.50	7.93
H6A1	1.29	5.82	5.13	5.24
NAY 3	1.36	6.68	3.65	7.30
E 7/27	1.41	5.62	3.97	7.86
DT 95	1.54	3.52	4.35	10.33

Figures in bold print are significantly greater than the corresponding figure for 2023 ($P < 0.05$). None of the figures was significantly less than that for 2023 in any year.

All results were subjected to analyses of variance and in Table 3, mean lesion lengths significantly greater ($P < 0.05$) than the corresponding figure for clone TRI 2023 are presented in bold print.

The results confirm field observations that canker attacks are generally not very severe during the first year after planting. This is perhaps why the mean length of lesions and the percentage of successful inoculations were both lowest in 1965 (see Table 2). Furthermore, in 1965 as many as 15 clones appeared to be highly resistant, compared with only a few each in 1966, 1967 and 1969. For these reasons, it may not be far wrong if the 1965 inoculations are not taken into account in assessing the relative resistances of the 20 clones. It then becomes clear that the most outstanding clone in the trial was TRI 2023, followed by TRI 2026, which was the next best. Other clones that showed comparatively good resistance in at least one of the three years, 1966, 1967 and 1969, were TRI 2025, 2024 and 25, MTBG, W 3 and DT 95. The full implications of these observations will be discussed later.

Variation in the pathogenicity of isolates

The inoculation studies demonstrated that marked variation exists in the pathogenicity of different isolates of *P. theae*, although all the isolates tested were pathogenic (Table 4). The variation in pathogenicity was very highly significant ($P < 0.001$) in 1966, 1967 and 1969 and highly significant ($P < 0.01$) in 1965.

TABLE 4 — Mean lengths (cm) of lesions resulting from inoculation with 20 isolates of *Phomopsis theae* on 20 tea clones

Isolate	LT 2	LT 1	1965 LT 5	LT 3	LT 10
	1.34	1.34	1.37	1.49	1.50
LSD ($P < 0.05$) = 0.11 ; ($P < 0.01$) = 0.15					
Isolate	LT 20	LT 16	1966 LT 15	LT 19	LT 18
	4.67	5.08	5.41	6.83	6.87
LSD ($P < 0.05$) = 0.55 ; ($P < 0.01$) = 0.72 ; ($P < 0.001$) = 0.92					
Isolate	LT 25	LT 27	1967 LT 24	LT 26	LT 20
	2.18	2.31	2.62	2.99	8.52
LSD ($P < 0.05$) = 0.32 ; ($P < 0.01$) = 0.45 ; ($P < 0.001$) = 0.54					
Isolate	LT 34	LT 37	1969 LT 38	LT 36	LT 30
	4.04	5.85	6.18	6.43	8.42
LSD ($P < 0.05$) = 0.97 ; ($P < 0.01$) = 1.29 ; ($P < 0.001$) = 1.68					

The results also indicated that there was a very highly significant interaction ($P < 0.001$) between clones and isolates, implying that most of the clones reacted differently to the different isolates. For instance, in the 1969 inoculations, clones DT 1 and 740 were more susceptible to isolate LT 36 than LT 30, although the latter was a more virulent strain. Further, the order of susceptibility of the 20 clones was not identical in respect of any two of the 20 isolates used in this experiment.

Natural incidence of cankers in Experiment P18

At the completion of the experiment, the number of natural cankers on the 20 clones was recorded in all the four blocks and the results were examined by analysis of variance, using the transformed data (Table 5).

TABLE 5 — Natural incidence of cankers caused by *Phomopsis theae* on 20 tea clones

No. of cankers/200 plants (transformed data)				
2023	2025	2026	777	740
1.00	1.00	1.10	1.10	1.18
DT 1	2027	2151	2016	2039
1.20	1.41	1.41	1.43	1.54
2024	2022	NAY 3	25	W 3
1.57	1.60	1.71	1.90	1.91
E 7/27	2142	MTGB	DT 95	H6A1
2.04	2.71	3.23	3.59	5.04

Figures in bold print are significantly greater than the corresponding figure for 2023 ($P < 0.05$)

Trial 2—Experiment UP7, Nayabedde Estate, Bandarawela

One-year-old plants raised from 20 TRI and estate clones were planted out during the north east monsoon season of 1964 at Nayabedde Estate, Bandarawela, on a site that previously had a high incidence of *Phomopsis* cankers. There were 50 plants of each clone planted in rows, at a spacing of 4 ft by 2 ft. Each clone had on either side a row of TRI 2024, planted as a buffer. The plants were brought into bearing by bending as practised on the estate.

The resistances of these clones were assessed on field performance by recording periodically the number of deaths occurring in each clone. The final assessment was made in April 1969, before the experiment was concluded, when in addition to the number of deaths the number of cankers on each plant was also recorded. A row of TRI 2024, selected at random, was also assessed similarly to determine its relative resistance.

In 1968 a very high incidence of the disease was observed following the severe drought experienced during June to August, and a number of deaths due to *P. theae* was recorded. The clones worst affected were UH 9/3, 2024, NL 3/1 and 25, the number of deaths being 30, 9, 9 and 8 respectively.

Results

The results are shown in Table 6. For estimating the relative resistances of the clones in this trial, clone TRI 2024 has been selected as the standard, for two reasons: firstly TRI 2023 was not included in this trial, and secondly, this clone has been consistently found to very susceptible to the disease at Nayabedde and other estates in Uva. The figures given in Table 6 are the weighted means of the total number of cankers for each clone. In cases where no discrete cankers could be discerned on dead plants, a score of four was given per plant as previous experience has shown that deaths result only when multiple infections occur on the collar (unpublished data).

TABLE 6 — *Relative resistances of 20 clones to Phomopsis theae using clone TRI 2024 as the standard*

No. of cankers (weighted means)					
DK 1	777	K 145	DT 1	NAY 13	NAY 28/8
3.12	3.32	4.45	4.55	4.55	4.70
NAY 3	GMT 9	2046	2025	2039	NAY 27
5.64	6.06	6.11	6.24	6.82	7.50
2016	2027	2022	2151	MTBG	NL 3/1
8.20	8.59	9.00	9.10	9.25	13.23
25	2024	UH 9/3			
13.81	15.31	17.51			

The figures in bold print are significantly lesser than the corresponding figure for 2024 ($P < 0.05$). None of the figures was significantly greater than that of 2024

The results confirm the general observation that clone TRI 2024 is highly susceptible to Collar and Branch Canker Disease in Uva. A highly significant correlation ($r = 0.698$; $P < 0.001$) between the number of cankers and the number of deaths in each clone was observed in this trial.

Trial 3—Experiment UP8, Glen Devon Estate, Halgranoya

The methods used were the same as in Trial 2. The planting was carried out in December, 1965 and the experiment was concluded in May, 1969.

Disease incidence was low in this experiment, and the only deaths (3) recorded were in KEN 16/3. The resistances of the clones were again assessed on field performance.

Results

The results are summarized in Table 7, which gives the weighted means of the total number of cankers observed on each clone. For estimating the relative resistances of the different clones, again clone TRI 2024 has been used as the standard, although clone TRI 2023 was also included in this experiment.

TABLE 7 — *Relative resistances of 20 tea clones to Phomopsis theae using clone TRI 2024 as the standard*

No. of cankers (weighted means)						
2023 2.50	2027 2.50	2021 2.50	2016 2.50	1526 2.50	DT 1 2.50	777 2.70
740 2.70	2022 3.00	K 145 3.22	GD 5/110 3.22	2026 3.22	DK 1 3.32	2142 3.58
GD 3/113 3.66	2046 4.24	2039 4.34	2151 4.64	DT 95 5.04	2024 6.33	KEN 16/3 6.96

Figures in bold print are significantly lesser than the corresponding figure for 2024 ($P < 0.05$). None of the figures was significantly greater than that for 2024

The results proved again that 2024 is a highly susceptible clone, although the most susceptible clone in this trial was KEN 16/3. Clone 2023 proved to be highly resistant and so were a few others like 1526, 2016, 2021, 2025 and DT 1.

Field observations

(a) St Leonards Estate, Halgranoya

In January, 1969 a high incidence of *Phomopsis* cankers was reported to have occurred in the multiplication plots at St Leonards Estate. In one block of 19 clones, the incidence of cankers appeared to be very high on a few clones. To obtain an estimate of the relative resistances of these 19 clones, about 200 plants of each clone were selected at random and the number of cankers on these plants recorded. The plants were approximately 4 years old from planting when the outbreak occurred. The results are shown in Table 8.

TABLE 8 — *Relative resistances of 19 tea clones to Phomopsis theae at St Leonards Estate, Halgranoya*

No. of cankers per 100 plants				
WAL 26 0	LD 512 0	GOR 7/4 0	ESK 9/5 1.0	GOR 7/6 1.0
SL 2/1 1.0	BETJAN 1.4	LD 999 2.0	ESK 6/11 2.0	SL 3/112 3.0
LD 470 3.0	SL 10/183 4.0	K 145 6.0	2025 10.5	TK 66 20.9
LD 25 40.0	K 150 51.9	LD 502 58.5	2024 60.2	

It is interesting to note that 2024 again proved highly susceptible, while some clones like WAL 26, LD 512 and GOR 7/4 showed high resistance. Clones TK 66, LD 25, K 150 and LD 502 were highly susceptible.

(b) *Craig Estate, Bandarawela*

Following a serious outbreak of Collar and Branch Canker Disease in the new clearings at Craig Estate in 1966, a survey was conducted on the incidence of the disease in the clearings planted in 1963 and 1964. The number of deaths due to *P. theae* was recorded in each clonal block and the results are shown in Table 9.

TABLE 9 — *Incidence of Collar and Branch Canker Disease in the new clearings at Craig Estate, Bandarawela*

	Clone	No. of plants examined	No. of dead plants	Deaths (%)
1963 Clearing				
	2023	3456	4	0.1
	2026	200	2	1.0
	2025	500	46	9.2
1964 Clearing				
	2026	487	1	0.2
	2022	515	8	1.6
	2025	2015	48	2.4
	2021	494	13	2.6
	NAY 3	1126	93	8.3

An interesting feature of these observations was the high resistance of 2023 and 2026 and the relatively poor performances by NAY 3 and 2025.

(c) *St Coombs, Talawakele*

The relative resistances of 31 clones and a seedling progeny planted in the Experiment VP1 (1961) at St Coombs were estimated in November, 1966, after the plants received their first prune. In this experiment, the various clones and the seedling progeny are planted in randomized, replicated plots consisting of 36 plants each. Approximately 144 plants were examined in each clone and the number of cankers on the pruned plants recorded (Table 10). For estimating the resistances of the clones, clone 2023 has been again used as the standard.

TABLE 10 — *Relative resistances of 31 tea clones and a seedling progeny to Phomopsis theae at St Coombs, Talawakele*

Mean No. of cankers (transformed data)					
2023	1.00	N	1.21	NL 4/2	1.79
2151	1.00	CR 4	1.25	MTBG	1.83
777	1.00	2026	1.35	GMT 9	1.88
CV4B1	1.00	2024	1.36	MT 18	2.46
EN 31	1.00	K 150	1.41	UH 9/3	3.42
CV5B1	1.10	T 5/135	1.47	PO 26	3.84
CY 9	1.10	KEN 15/7	1.54	KEN	4.40
TK 48	1.10	PA 22	1.55	NL 3/1	4.97
QT 1/5	1.18	Seedling	1.57		
2025	1.21	T 5/3	1.65		
2027	1.21	K 136	1.74		
DT 1	1.21	DG 39	1.75		

Figures in bold print are significantly greater than the corresponding figures for 2023 ($P < 0.05$)

The incidence of the disease in this experiment was low and only deaths recorded were in clones KEN 16/3 and NL 3/1. It should be noted that these two clones were also the most susceptible on the basis of canker incidence.

(d) *Other observations*

Further observations at St Coombs and elsewhere have shown that the following clones are of low resistance :

DG 3, DG 39, MT 16, MT 18, Kandapola 9, QT 3/3, St John's Hill 76, DK 8, TC 9, Park 1 and Welimada 1/1.

Clone DG 7 has shown high resistance to the disease in two estates where its performance has been observed.

Discussion

The results of the experiments and observations carried out at St Coombs and elsewhere are summarized in Table 11, where the clones are divided into three resistance groups, based on their average performance. In this Table, there are two categories, A and B; in Category A are included clones on which sufficient data are available to obtain a reasonably good estimate of their resistances, and Category B includes clones with insufficient data for a reliable estimate of their resistances. It is likely that the positions of some of the clones listed in Category B may change in respect of the three groups, when more information on their resistances becomes available.

"High resistance" clones

A striking feature of this study has been the outstanding resistance exhibited by clone 2023. It has shown exceptionally high resistance in all tests; not one clone has shown significantly greater resistance than 2023 even occasionally. The next best clone was 2026, although it did not perform well in two of the inoculation tests at St Coombs. The behaviour of clones 777 and DT 1, which follow next in order of resistance, seems to be somewhat similar to 2026. Clone K 145 was unfortunately omitted from the inoculation tests at St Coombs but its good performances at the Nayabedde and Glen Devon trials and the moderately good performance at St Leonards justify its inclusion amongst the "High resistance" clones. Clone 2025 has shown good resistance in many of the tests described and also on many estates where this clone has been planted extensively. Its "higher resistance" classification, therefore, is based on the overall performance, omitting its somewhat poor performances at Craig and St Leonards.

"Intermediate resistance" clones

This group includes the following six clones : 25, 740, 2016, 2022, MTBG and W 3. Of these, clones 740, 2016 and 2022 have fared poorly in the inoculation tests, while their behaviour in the observation trials has been good. On the other hand, clones 25, MTBG and W 3 have performed inconsistently in both the inoculation tests and the observation trials. In view of the variable behaviour of these clones, they are regarded as forming a group of intermediate resistance.

“Low resistance” clones

The clones listed in this group have, with the exception of 2024, exhibited very low resistances in nearly all the tests conducted, and invariably all of them have also done badly on estates. Clones 2027 and 2039 are listed in this group in spite of their good performance in two of the tests, because they have fared badly on some estates.

TABLE 11 — Summary of resistances of tea clones to Collar and Branch Canker Disease (Phomopsis theae)

Category A — List of clones with sufficient data for a reliable estimate of their resistances

Group 1 (High Resistance)	Group 2 (Intermediate Resistance)	Group 3 (Low Resistance)
TRI 777	TRI 25	TRI 2024
2023	740	2027
2025	2016	2035
2026	2022	2142
Drayton 1	Balangoda MTBG	2151
Kirkoswald 145	Wootton 3	Drayton 95
		Helbodde H6A1
		Kenilworth 16/3
		Nayabedde 3
		Neluwa 3/1
		Somerset E/727
		Uva Highlands 9/3

Category B — Tentative classification of clones with insufficient data for an accurate estimation of their resistances

Group 1 (High Resistance)	Group 2 (Intermediate Resistance)	Group 3 (Low Resistance)
TRI 1524	TRI 2046	Balangoda DG 3
2021	Dambatenne 1408	Balangoda DG 39
2045	Eskdale 6/11	Balangoda MT 16
Balangoda DG 7	Gonamotawa 9	Balangoda MT 18
Cannavarella CV4/B1	Kirkoswald 150	Diyanilakele 8
Cannavarella CV5/B1	Liddesdale 470	Glen Devon 3/113
Craig 4	Liddesdale 999	Kandapola 9
Diyagama West N	St Leonards Betjan	Park 1
Diyanilakele 1	St Leonards 3/112	Liddesdale 25
Diyanilakele 17	st Leonards 10/483	Liddesdale 502
Endane 31		Poronuwa 26
Eskdale 9/5		Queenstown 3/3
Glen Devon 5/110		St John's Hill 76
Gordon 7/4		Talankande 66
Gordon 7/6		Tilicoultry 9
Kenilworth 15/7		Welimada 1/1
Kirkoswald 136		
Liddesdale 99		
Liddesdale 512		
Nayabedde 13		
Nayabedde 27		
Nayabedde 28/8		
Neluwa 4/2		
Passara 22		
Queenstown 1/5		
Tangakelle CY 9		
St Leonards 2/1		
Talankande 48		
Thotulagalla 5/3		
Thotulagalla 5/135		
Waltrim 26		

The peculiar behaviour of clone 2024 merits examination. This clone has been consistently found to be highly susceptible to Collar and Branch Canker in the North East Monsoon Zone (Uva, Udapussellawa and Nuwara Eliya) and hence selected as the standard to estimate the resistances of the other clones, as has been noted earlier. In Dimbula, however, its performance on estates has been reasonably good and this is supported by the results of the observation trials at St Coombs. Furthermore, it has also shown high resistance in one of the inoculation tests at St Coombs. There are possibly two explanations for these apparently conflicting observations. Drought conditions in the N.E. Monsoon Zone are generally more severe and of longer duration than at Dimbula and it is possible that under extreme conditions the resistance of 2024 declines rapidly, rendering it highly susceptible to the disease (see Shanmuganathan & Rodrigo 1967). It is also likely that strains of *P. theae* prevalent in Uva are generally more virulent or more pathogenic to 2024 than are those at Dimbula, although a detailed examination of the pathogenicities of the 20 isolates used in this study does not reveal such a trend. But with only 12 and 8 strains in each group, it is doubtful whether much significance can be attached to this. It must be mentioned, however, that the two most virulent isolates used in the inoculation tests, viz LT 23 and LT 30 (see Tables 1 and 4), came from the N. E. Monsoon Zone. In this context, one should also draw attention to the highly significant interaction seen between clones and isolates in the inoculation studies.

This work has demonstrated clearly the existence of marked variation in the degree of pathogenicity of different isolates of *P. theae*. Also some clones, normally highly resistant, were severely attacked by particular isolates under certain conditions. There are thus indications of the existence of natural biotypes of *P. theae*.

Other interesting features in this study were : (a) all the isolates used in the inoculations were pathogenic, (b) none of the 20 clones inoculated was immune to infection, (c) the high correlation observed between the number of cankers and the number of deaths occurring in a clone (Nayabedde Trial), and (d) the close parallel observed between experimental results and field observations carried out on different estates.

In view of the tentative nature of the results presented under Category B (Table 11), detailed discussion of the clones listed in the three groups is not possible. It is proposed to re-examine the classification of the clones in this category when more information is available on their resistances. Meanwhile, an explanation concerning the resistance of clone GMT 9 is necessary. It may be seen that this clone is listed amongst the "intermediate resistance" types, although it had shown high resistance in the two observation trials in which its resistance was estimated. This is due to its poor performance in new clearings on some estates.

For estates intending to make use of the clonal groupings given in this paper for practical purposes, the following points are recommended.

*It is suggested that clones listed in Group 3 (Category A) should not be planted on estates in the Uva, Udapussellawa, Kandapola and other areas, where serious outbreaks of the disease have occurred. Clones listed in Group 2 may be planted on a limited scale in these areas without much risk of damage, but it is best if these clones are also avoided. For Dimbula and Dickoya districts it is adequate if clones listed in Group 3 are left out, as the risk of damage here is not as great as it is in Uva. An exception here should be Clone 2024. This clone has shown promising resistance to the disease in Dimbula and as such we do not wish to discourage the planting of this good clone in this area on account of its extreme susceptibility to *P. theae* in the N.E. Monsoon Zone.*

With regard to clones in Category B, we recommend that clones in Group 3 be omitted altogether in the N.E. Monsoon Zone, and only limited acreages be planted in Dimbula, Dickoya and elsewhere. Clones in Groups 1 and 2 may be planted in both Zones. It is relevant to mention here that the low resistance exhibited by some of the clones in Group 3 such as GD 3/113, TC 9, MT 16, MT 18 and DG 3 has been corroborated by field observations in a number of clearings on several estates.

Acknowledgements

I wish to thank Messrs W. R. F. Rodrigo, S. R. A. Fernando and R. N. Boparat-
chy for technical assistance and Messrs P. Kanapathipillai and T. V. Saravanapavan
for the statistical analyses. Thanks are also due to the Superintendents of Nayabedde,
Glen Devon, St Leonards and Craig estates for providing sites for experiments and
for their co-operation.

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