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VARIATION IN SOME LEAF CHARACTERISTICS IN TEA (*CAMELLIA SINENSIS L.*) AND THEIR USE IN THE IDENTIFICATION OF CLONES

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Several metric and nonparametric characteristics of the leaves of twelve popular tea clones were studied in order to determine their value as an aid to describing and distinguishing between clones. It was not usually possible to recognize clones on the basis of a single characteristic but rather, a combination of characters was required. The ratio of leaf length to leaf width was found to be more useful as a differentiating characteristic than either length or width alone. The angle between leaf tip and axis was more meaningful than that between petiole and axis as an estimate of leaf pose. Other useful discriminative characters were petiole length, leaf size, ratio of apical length to basal length, internode length and girth and length of bud. Useful nonparametric characters were colour, texture and patina of leaf and pubescence of bud.

Clones which resemble one another were grouped and an ideograph was devised, summarizing the characteristics common to each group of clones and the areas of similarity and differences among them. Keys were constructed for differentiating between the clones within each group.

The more popular clones are described and their discriminative features highlighted in the appendix.

INTRODUCTION

Considerable difficulties in the identification of tea clones are often encountered and errors in identification have been known to occur. Only the very experienced, by their intuitive judgement, are able to identify clones without difficulty. It would, therefore, be useful to have a practical guide for the recognition of clones in the field.

Members of a clone have certain morphological characteristics in common and differ in several characteristics from typical members of other clones. Clones can be distinguished and identified correctly only if they possess well-marked morphological differences which facilitate their recognition in the field. Sometimes, differences may not be sufficiently distinct for clones to be recognized in the field with certainty and misidentification takes place due to resemblances between certain clones.

Since tea in the field is maintained in the vegetative state, it is necessary to choose vegetative characters for general identification purposes inspite of the relative plasticity of vegetative as compared to reproductive characteristics which makes vegetative characters generally less reliable as diagnostic criteria (Stebbins, 1967). Resort may be had to reproductive structures, as a check, where they are very distinctive. There are hardly any characteristics in tea which show discontinuous variation and on which basis individual genotypes may be separated, clearly and certainly, into

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discrete groups. Nearly all the characteristics show continuous variation, which commonly implies polygenic determination and usually requires biometric analysis.

The biometric approach seeks to measure variation in a character. Characters which have been used in the past for separating agrotypes, jats or clones were used as a guide in the choice of suitable parameters for study. Wight (1953) used two characters, patina (whether matt or glossy leaf surface) and pose (whether erect intermediate or dependent) of leaf as an agrotype index in tea. He suggested that the phenotypic groups had a genetic basis and that the contrasting characters had their origins in the two parental types designated *sinensis* and *assamica* from which most of the tea grown in Assam are derived. These and several other leaf characters such as size, colour and texture have been used to differentiate between the Assam and China jats (Visser, 1969). Richards and Sebastiampillai (1964) used size, shape, colour, texture, patina and pose of leaf, type of leaf apex and venation, length of internodes, size and pubescence of bud and some floral characters such as hairiness of ovary and stigmatic features to describe and distinguish between six different clones in Sri Lanka. Few studies on clonal variation in tea leaf characters have been reported previously. Clonal differences in leaf shape, size and area were found by Pethiyagoda and Rajendram (1965) and Krishnapillai and Pethiyagoda (1978). Mazumder and Bezbaruah (1978) reported significant differences in leaf size and density in some Tocklai released clones.

The main objectives of the present study were to measure and analyse the variation in some morphological characteristics of the leaves of twelve different clones in the belief that this would spotlight the similarities and differences between clones and would help detect a few easily recognized diagnostic or "key" characteristics for distinguishing clones. Attempts were made to determine which clones resembled one another closely enough to be confused and discriminative features in them were sought. Some of the more popular clones of Sri Lanka are described and their discriminative features highlighted in the appendix.

MATERIALS AND METHODS

Twelve tea clones popular in Sri Lanka, comprising six TRI clones and six estate selections, were chosen for investigation. Clones TRI 2023, TRI 2024, TRI 2025, TRI 2026 and TRI 2027 are related clones selected in Sri Lanka but derived from seed of a single mother tree, ASM 4/10, in Tocklai. TRI 777 was selected in Sri Lanka from seed imported from Indo-China. The six estate clones are of unknown origin; DT1, DN and CY9 were selected in the up-country estates Drayton, Diyagama and Tillicoultry, respectively. DG 39, MT/BG and MT 18, commonly known as the "Balangoda clones", were selected at Balangoda estate, in the low country.

Most of the chosen characters could be measured on a numerical scale. Measurements for attributes were made on twenty mature leaves and twenty flush shoots per clone, collected from bushes in plucking. Characteristics were studied as follows:

Mature leaves. The outline of each leaf was drawn on paper and the **length** (L) from leaf base to leaf apex, **width** (W) at the widest point, **basal angle** and **apical angle** were measured. The **apical and basal lengths** were determined by measuring the distance from the midpoint of a line drawn across the widest part of the leaf to the apex and base of the leaf, respectively. The product L x W was used as an index of **leaf size** and the ratio L/W as an indication of **shape.** The ratio apical length/basal length was also calculated.

Flush shoots. These had a bud and two leaves; the first leaf, nearest the bud, was designated L_1 and the lower leaf L_2 and measurements were made on both leaves. **Leaf length** (l), **width** (w), l x w and l/w ratios were determined. **Petiole length** for each leaf and **internode length** between the two leaves were recorded; the **girth** of this internode and the next were measured in mm using calipers. **Pose of leaf** was determined by two measurements of leaf angle. The first, P/A, was the angle between the petiole and the axis and the second, A/LT, the angle between the axis and the leaf tip. The **length of the terminal bud** was also measured.

Data were analysed statistically as a completely randomised design, treating the differences between and within clones as sources of variance. The coefficients of variation (cv %) within clones and the significance of differences between clones were determined.

Variation in nonparametric characters (patina, texture, colour and pubescence) was determined from notes taken in the field as well as from inspection of the samples used for the other measurements. It was fairly easy to assign the clones into classes designated glossy or dull according to patina or gloss on the mature leaf surface although difficulties may sometimes arise, especially in wet weather. Classification according to texture was more difficult as all mature leaves appeared to be tough (or leathery) and most flush leaves were soft. Clones were described as tough or soft and thick or thin, considering leaves of intermediate age. Pubescence of bud was graded as nearly glabrous, more or less glabrous, slightly pubescent or clearly pubescent. Because of the difficulty in taking objective notes on relatively small colour differences, mature leaves were described simply as green or dark green. Flush shoots were graded as yellow, yellowish green, light bright green or bright green.

RESULTS AND DISCUSSION

Tables 1 and 2 show the means of the mature leaf and flush shoot characteristics, respectively, for the twelve tea clones. Highly significant differences were found between clones for every characteristic, indicating a multi-dimensional pattern of variation. While certain clones could be classed as one type or another for a character according to the mean value for that character (with mean value followed by one letter only in inclusive groups column in Tables 1 and 2), others fell into categories common to two or more groups — that is, they were not significantly different from either group (inclusive groups contained two or more letters). Thus, one feature alone may not usually serve to distinguish between clones (since many clones may share a common feature and there is some degree of overlap) but several characters which show small but significant and detectable differences between clones may be used in combination to identify clones.

TABLE 1 — *Means of mature leaf characteristics for 12 different tea clones.*†

CLONE	*Length (L) cm*	*Width (W) cm*	*Basal angle degrees*	*Apical angle degrees*	*L/W ratio*	*L × W*	*Apical length Basal length*
TRI 2023	10.45 abc	4.45 cd	100.10 cde	42.85 ab	2.36 b	47.16 cd	1.04 b
TRI 2024	9.09 ab	3.91 b	94.55 abcd	44.35 ab	2.33 b	35.83 ab	1.00 b
TRI 2025	9.33 ab	4.97 d	104.80 de	59.00 c	1.89 a	46.76 cd	0.83 a
TRI 2026	10.94 c	4.70 d	106.85 e	44.55 ab	2.32 b	52.89 d	1.03 b
TRI 2027	9.58 abc	4.02 bc	87.20 ab	44.50 ab	2.34 b	38.73 b	0.98 b
TRI 777	10.02 abc	3.54 ab	95.45 bcd	43.85 ab	2.82 d	35.83 ab	0.96 ab
DT 1	9.02 a	3.22 a	93.55 abc	45.00 ab	2.83 d	29.25 a	1.21 c
DN	10.22 abc	3.71 ab	104.80 de	46.05 ab	2.76 cd	38.16 b	1.06 b
CY 9	10.55 bc	3.99 bc	83.15 a	44.40 ab	2.65 cd	42.18 bc	1.03 b
DG 39	9.73 abc	3.87 b	94.25 abcd	41.85 ab	2.51 bc	38.29 b	1.06 b
MT/BG	9.70 abc	3.83 b	92.15 abc	47.80 b	2.53 bc	37.45 ab	1.05 b
MT/18	10.47 abc	3.79 b	93.95 abcd	39.80 a	2.77 cd	40.12 b	1.00 b
CV %	14.53	11.89	14.34	20.3	9.91	25.48	15.4
Significance	*	*	*	*	*	*	*
LSD 5%	1.17	0.38	8.53	5.70	0.20	6.35	0.09
1%	1.52	0.50	11.21	7.49	0.26	8.35	0.13

† Letters following each value indicate inclusive groups. Any two means followed by the same letter in the same column are not significantly different at the 0.01 level according to LSD.

*** Significant at $P < 0.001$.

Only those characters most useful in identifying each clone will be elaborated upon in the text as space does not permit a detailed discussion of each character for each clone. Considering first the mature leaf characters (Table 1), leaf shape (L/W ratio) had a low coefficient of variation (9.91 per cent) and the least amount of overlap; it may, therefore, be regarded as a reliable character, most useful in grouping clones. On this character alone, TRI 2025 can quickly be singled out as it is in a class by itself (inclusive group *a* in Table 1) with a very low mean value. This clone is also markedly different from the others in apical angle and ratio of apical to basal length. This is in accord with the well-known fact that TRI 2025 is the most easily recognized of clones, identified mainly on the basis of leaf shape, thus emphasizing the validity of the present analysis. The very low L/W ratio indicates that the leaf is very wide relative to its length, resulting in a broad, somewhat rounded shape. The low apical/basal length ratio means that the widest part of the leaf tends toward the apex. The general appearance of the mature leaves of TRI 2025 can now be deduced as broad and rounded, widest toward the apex with a rather large apical angle. Following the terminology of most botanical texts, this would be described as obovate. Visual examination of bushes in the field showed that although every leaf of this clone may not fit this description, the great majority of them do. On the basis of the L/W ratio, two further groups emerge. The highest L/W ratios (inclusive group *d* in Table 1) indicate relatively long, narrow leaves (elliptical) and include the two clones TRI 777 and DT1 which are known to have many features of the China type. The lower L/W ratios (*b* in Table 1) indicate leaves which are somewhat broader than the *d* group (broadly elliptical). The TRI 202-series, with the exception of TRI 2025, fall into this category. It is pertinent to note here that this series of clones is known to be derived from the "Cambod" or "Southern" variety (*C. assamica* sp. *lasiocalyx*) which characteristically has broadly elliptical leavs (Bezbaruah and Dutta, 1977). Although the clones mentioned so far may be categorised as obovate (*a*), elliptical (*d*) or broadly elliptical (*b*) with mean values for leaf shape index highly significantly different from one another, there is still a small amount of overlap; this is illustrated in Figure 1. In such instances, the fact that a clone tends to have significantly more leaves of a certain category may aid in separating it from other clones which it resembles. For example, TRI 2024 is sometimes confused TRI 2025 or with TRI 777 because one may come across a few leaves which resemble the typical TRI 2025 leaf and others which are somewhat narrow though elliptical; however, the majority of its leaves may be described as broadly elliptical. Therefore, it is useful to consider the plant as a whole or at least an adequate sample of leaves when identifications are attempted. The Balangoda clones DG 39 and MT/BG have mean values for leaf shape index intermediate between the categories broadly elliptical and elliptical. There is some overlap with both groups and they are not significantly different from the former. MT 18, CY 9 and DN also have intermediate values and some overlap and are not significantly different from the elliptical. The two intermediate groups are not significantly different from each other.

Considering width, TRI 777, DT1 and DN have narrow leaves, TRI 2023, TRI 2025 and TRI 2026 have broad ones and the others are intermediate. Size of leaf, although very variable within a clone (cv% = 25.48), is useful for picking out the extreme types; for instance, DT1 has very small leaves and TRI 2023, TRI 2025 and TRI 2026 extra large ones. Among the TRI 202- series, TRI 2024 and TRI 2027 have significantly smaller leaves than the others of the series. Leaf length is of little use in distinguishing clones because most clones are not significantly different from one another for this attribute. For apical/basal length ratio, most of the clones had similar values with only TRI 2025 and DT1 being distinctly different.

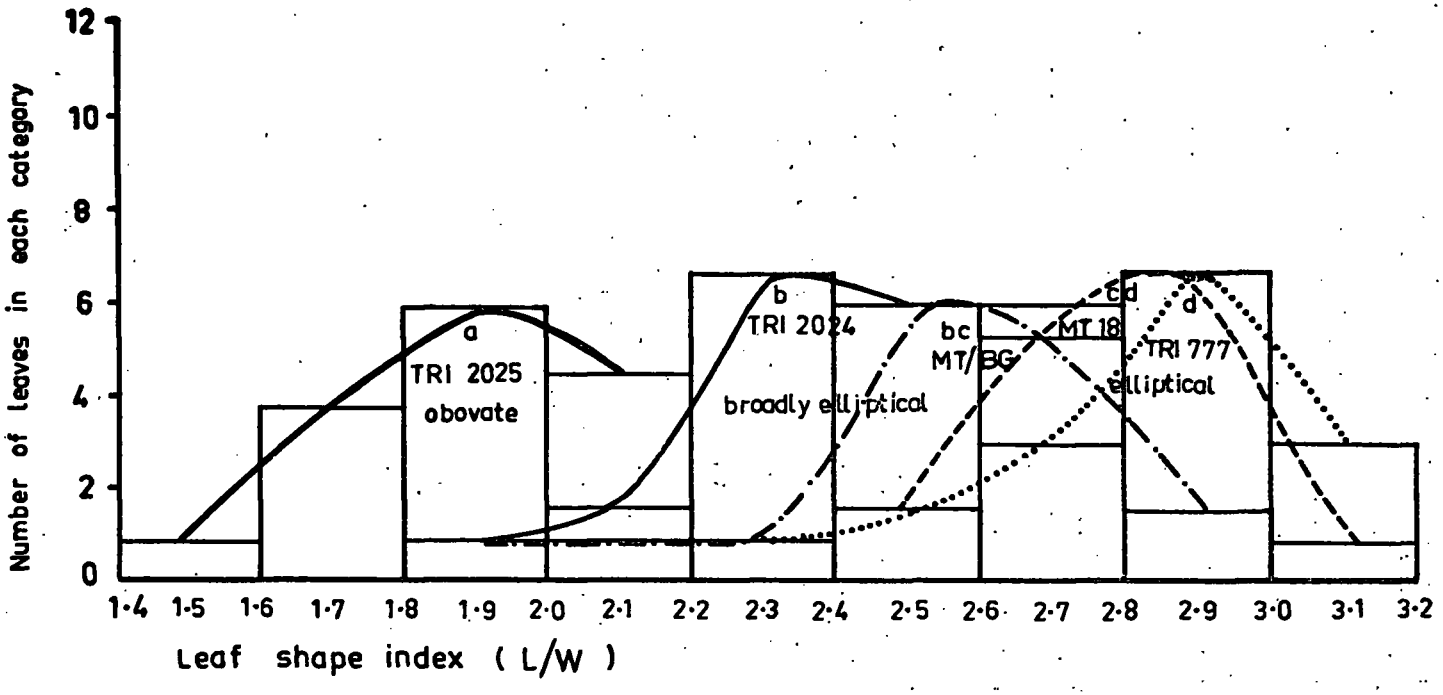

FIGURE I. Frequency distribution of leaf shape of some tea clones

TABLE 2 — *Means of flush characteristics of 12 different tea clones.*†

CLONE	*Leaf length (l) cm*		*Leaf Width (w) cm*		*l/w ratio*		*l × w*	
	L_1 ‡‡	L_2	L_1	L_2	L_1	L_2	L_1	L_2
TRI 2023	5.16 f	6.16 d	1.89 f	2.73 e	2.74 cde	2.28 b	9.77 e	17.06 c
TRI 2024	4.10 bcd	5.21 abc	1.68 e	2.35 d	2.45 b	2.29 bc	6.94 bc	12.31 ab
TRI 2025	4.15 bcde	4.97 a	1.98 f	2.68 e	2.13 a	1.85 a	8.24 d	13.51 b
TRI 2026	4.33 de	5.02 ab	1.72 e	2.22 bcd	2.53 bc	2.27 b	7.48 cd	11.32 ab
TRI 2027	4.23 cde	5.18 abc	1.66 de	2.25 cd	2.56 bcd	2.31 bc	7.06 bc	11.81 ab
TRI 777	4.38 de	5.71 cd	1.62 cde	2.21 bcd	2.73 cde	2.59 e	7.17 bcd	13.11 b
DT 1	3.84 ab	4.86 a	1.40 a	1.93 a	2.77 de	2.53 de	5.40 a	9.58 a
DN	4.48 e	5.67 bcd	1.60 bcde	2.27 cd	2.88 e	2.50 cde	7.20 cd	13.05 b
CY 9	3.92 abc	4.96 a	1.37 a	1.95 ab	2.87 e	2.54 e	5.40 a	9.73 a
DG 39	3.94 abc	4.68 a	1.52 abcd	2.07 abc	2.59 bcd	2.26 b	6.05 ab	9.86 a
MT/BG	3.74 a	4.71 a	1.46 ab	2.03 abc	2.56 bcd	2.32 bcd	5.51 a	9.69 a
MT 18	3.83 ab	4.74 a	1.47 abc	2.12 abcd	2.61 bcd	2.24 b	5.63 a	10.17 a
CV %	10.20	15.59	11.75	14.78	1.40	1.26	6.80	17.25
Significance	*	*	*	*	*	*	*	*
LSD 5%	0.26	0.50	0.12	0.20	0.17	0.16	0.85	2.14
1%	0.35	0.65	0.15	0.27	0.23	0.21	1.12	2.81

† Letters following each value indicate inclusive groups. Any two means followed by the same letter in the same column are not significantly different at the 0.01 level according to LSD.

‡‡ L_1 and L_2, the first leaf, nearest the bud, and the lower leaf respectively, on the flush shoot.

*** Significant at $P < 0.001$.

TABLE 2 (*Cont'd*)

CLONE	*Leaf pose (P/A) degrees* L_1	L_2	*Leaf pose (A/LT) degrees* L_1	L_2	*Internode length cm.*
TRI 2023	21.00 bcde	24.85 ab	60.65 d	66.00 e	1.29 a
TRI 2024	23.30 de	31.35 c	39.75 ab	45.55 ab	1.94 d
TRI 2025	26.25 e	37.10 d	50.05 c	52.35 bcd	1.71 bcd
TRI 2026	22.05 cde	30.45 c	51.70 cd	56.15 cd	1.65 bcd
TRI 2027	20.09 bcd	27.20 abc	48.50 bc	48.10 bc	1.36 ab
TRI 777	23.20 de	26.95 abc	36.75 a	44.25 ab	1.90 d
DT 1	20.80 bcd	22.35 a	38.25 a	35.15 a	1.86 d
DN	14.30 a	25.20 ab	30.40 a	37.55 a	1.77 cd
CY 9	16.50 ab	24.55 ab	36.15 a	37.15 a	2.57 e
DG 39	20.35 bcd	23.30 ab	55.75 cd	52.90 bcd	1.49 abc
MT/BG	18.30 abcd	26.90 abc	53.05 cd	56.80 cd	1.38 ab
MT 18	17.70 abc	27.65 bc	48.85 bc	59.90 d	1.44 abc
CV %	32.60	22.13	25.61	24.38	25.41
*** Significance	*	*	*	*	*
LSD 5%	4.12	3.75	7.28	7.45	0.27
1%	5.41	4.93	9.56	9.80	0.35

TABLE 2 (*Cont'd*)

CLONE	Petiole length cm		Girth mm		Bud length cm
	L_1	L_2	L_1	L_2	
TRI 2023	0.36 f	0.34 d	1.56 d	1.75 cd	3.34 e
TRI 2024	0.38 ef	0.34 d	1.45 cd	1.66 cd	2.73 ab
TRI 2025	0.30 cde	0.33 d	1.43 cd	1.76 cd	2.91 bcd
TRI 2026	0.36 f	0.34 d	1.56 d	1.80 d	3.03 d
TRI 2027	0.31 de	0.32 cd	1.59 d	1.78 d	2.94 bcd
TRI 777	0.41 g	0.41 e	1.50 d	1.76 cd	2.80 abcd
DT 1	0.27 cd	0.27 bc	1.23 ab	1.62 bcd	2.72 ab
DN	0.30 cde	0.31 cd	1.23 ab	1.58 bc	3.02 cd
CY 9	0.26 bc	0.29 cd	1.09 a	1.44 ab	2.77 abc
DG 39	0.22 ab	0.20 a	1.29 bc	1.45 ab	2.71 ab
MT/BG	0.19 a	0.20 a	1.11 a	1.36 a	2.64 a
MT/18	0.20 a	0.22 ab	1.07 a	1.27 a	2.71 ab
CV %	17.31	20.00	15.98	14.30	10.72
*** Significance	*	*	*	*	*
LSD 5%	0.03	0.04	0.13	0.14	0.19
1%	0.04	0.05	0.17	0.19	0.25

Concerning flush shoot characteristics, variation in shape of flush leaves was similar to that for mature leaves with TRI 2025 somewhat rounded, the other TRI 202- series clones broadly elliptical, the Balangoda clones intermediate and the others elliptical. As regards leaf pose, the angle between the axis and leaf tip, A/LT, was found to be much more useful as a diagnostic character than the angle between petiole and axis, P/A. Although P/A is more often used for the estimation of leaf pose, A/LT is considered here to be more meaningful because it is possible for two leaves which have different poses of lamina, for example erect and pendent, to have similar P/A values but they would have significantly different A/LT values. The clones TRI 777, DT1, DN and CY9 has low A/LT values indicating erect leaves and TRI 2024 also fell into this category. These five clones also had generally longer internodes than the other clones. TRI 2023 had very high A/LT values indicating a pendent leaf pose and it had short internodes while the other TRI 202- series clones and the Balangoda clones were pendent or intermediate in pose with internodes which were rather short or of intermediate length.

On the basis of prior knowledge, the twelve clones investigated here may conveniently be separated into three groups the TRI 202- series, the Balangoda clones and the remainder. The present study shows that the four clones which make up the remainder all have long, narrow (elliptical) leaves which are erect in pose and have long internodes. Narrow erect leaves are characteristics of the China variety (Bezbaruah and Dutta, 1977) and these clones with morphological characteristics of this variety may perhaps be classed as "China hybrids". The members of each group have several features in common which differentiate them from other groups and this is depicted in the form of an ideograph in Figure 2. Each circle encloses the characteristics of a group of clones. The region where two circles overlap contains the characters common to these two groups of clones. In the central region are some characters investigated here which are common features of all three groups. In the outer parts of the circles, which do not overlap, are the special attributes found in one group only.

Figure 2 shows that the Balangoda clones may be separated out, as a group, from the others investigated here on the basis of petiole length, internode length, girth, leaf pose and some nonparametric characters such as leaf patina, texture and pubescence of bud. The circle representing the Balangoda group of clones in this figure has the attribute "short petioles" in the area outside the regions of overlap, indicating that this is a special feature peculiar to these clones. As a result of the extremely short petioles, the leaf bases more or less graze the axis of the flush shoot. Notwithstanding the small magnitude of the difference in petiole length, these clones are, therefore, visibly different from others with longer petioles, and it is not necessary to make measurements to recognize this group. Consequently, this feature is of considerable practical importance in recognizing this group of clones. The Balangoda clones may be distinguished from the TRI 202- series on the basis of several nonparametric characters (Table 3). For example, in the Balangoda clones the leaves are dull and leathery and the buds clearly pubescent while the TRI 202- series clones have glossy, soft leaves and nearly glabrous to slightly pubescent buds. Further, the Balangoda clones are significantly smaller in girth than the TRI 202- series (figure 2 and Table 2). However, these characters are not specific to the Balangoda clones but are found in some of the China hybrids as well. Nevertheless, the Balangoda clones and the China hybrids may be told apart on the basis of leaf pose since the latter are erect and the former pendent or intermediate (Figure 2 and Table 2).

The elimination of the Balangoda clones as a group leaves the TRI 202- series and the China hybrids. As shown earlier, these two groups may be distinguished on the basis of leaf shape; the TRI 202- series have leaves which are obovate

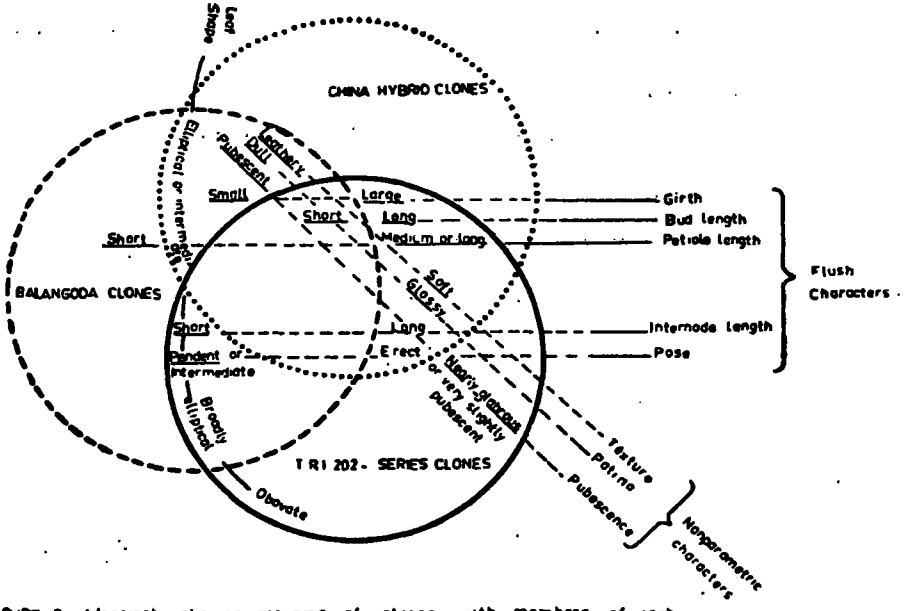

FIGURE 2. Ideograph showing grouping of clones with members of each group having several features in common which differentiate them from other groups.—T R I 202 — series clones ; ..... china hybrid clones ; Balangoda clones

TABLE 3 — *Variation in nonparametric characters of tea clones.*

CLONE	*Patina*	*Texture*	*Colour*		*Pubescence of bud*
			Mature leaves	*Flush shoots*	
TRI 2023	Glossy	Thin and soft	Green	Yellowish green	Nearly glabrous - sparsely pubescent in midrib region only.
TRI 2024	Glossy	Fairly thick and soft	Green	Yellowish green	More or less glabrous - Slight pubescence on midrib and near veins.
TRI 2025	Glossy	Thick and soft	Green	Bright green	As TRI 2024.
TRI 2026	Glossy	Fairly thick and soft	Green	Yellowish green	Slight pubescence over entire surface.
TRI 2027	Glossy	Fairly thick and soft	Green	Yellowsih green	As TRI 2023.
TRI 777	Dull	Thick and somewhat leathery	Green	Bright Green	Clearly pubescent
DT 1	Dull	Thick and tough	Green	Yellow	Clearly pubescent
DN	Glossy	Thick and rather soft	Dark green	Bright light green	Clearly pubescent
CY 9	Glossy	Thick and leathery	Dark green	Yellowish green	Clearly pubescent
DG 39	Dull	Fairly thick and somewhat leathery	Dark green	Yellowish green	Clearly pubescent
MT/BG	Dull	Fairly thick and somewhat leathery	Green	Yellowish green	Clearly pubescent
MT 18	Dull	Fairly thick and somewhat leathery	Dark green	Yellowish green	Clearly pubescent

or broadly elliptical while the leaves of the China hybrids. are relatively narrow (elliptical or tending toward elliptical). In addition, the China hybrids have clearly pubescent buds while those of the TRI 202- series clones are nearly glabrous to only slightly pubescent. This information may be obtained at a glance, from Figure 2, as it is contained within the circles representing the TRI 202- series and the China hybrids, outside the region where they overlap each other. Thus, the ideograph in Figure 2 neatly summarizes the characteristics common to each of the three groups of clones and the areas of similarity and differences among them.

Having broadly classified the twelve clones into three groups, it now remains to differentiate between the clones within each group and keys may be constructed for this purpose using the information presented in Tables 1 to 3. While the general features of each group refer to each group in relation to the other two groups, in the construction of the keys comparisons are made within each group only and should not be considered relative to clones in the other two groups.

The clones of the China hybrid group are the most readily distinguishable from one another and will be dealt with first.

General features of the China hybrid clones

Leaf shape elliptical or tending toward elliptical, leaves erect with long internodes, buds clearly pubescent.

1. (1a) Flush leaves generally small or very small, being both short and narrow. Flush yellow or yellowish green, contrasting sharply with mature leaves which are green or dark green. Leaf surface wrinkled ——2

   (1b) Flush leaves generally larger in both dimensions. Flush bright green or light bright green with green or dark green mature leaves. Leaf surface generally smooth ——3

2. (2a) Mature leaves and flush extra small, flush leaves thick and distinctly yellow, leaf surface dull, mature leaves tend to be widest just below the middle of the leaf, buds short —— DT1

   (2b) Mature leaves relatively large, glossy, dark green with wrinkles on surface deeply etched giving a corrugated appearance —— CY9

3. (3a) Leaves dull and leathery with relatively long, slightly curved petioles. Leaves may sometimes tend to be broadest toward the apex. Flowers distinctive as they are small with trifid stigma adpressed at right angles to style which is nearly always notched somewhere along its length —— TRI 777

   (3b) Leaves glossy and rather soft. Mature leaves usually sharply folded along midrib (v-shaped jat), flush leaves flat and upfolded like hands in greeting, buds rather long. Flowers large, stigma usually tetrafid, sometimes trifid or pentafid, stigmatic branches long or rarely globular, style thick and straight —— DN

General features of the TRI 202- series clones

Leaf shape broadly elliptical or obovate, leaves soft and glossy, flush shoot axis relatively thick (large girth). Buds nearly or more or less glabrous with very slight

pubescence in the region of midrib and veins or less often slight pubescence over the entire surface.

1. (1a) Leaves large, broad and somewhat rounded, widest part toward apex with large apical angle, obovate, flush leaves thick and somewhat rounded, bright green —— TRI 2025

   (1b) Leaves broadly elliptical, flush leaves yellowish green —— 2

2. (2a) Leaves larger in both dimensions —— 3

   (2b) Leaves smaller in both dimensions —— 4

3. (3a) Flush leaves large, extra long, wide and thin, often with pinkish tinge; pendent with short internodes. Buds long and nearly glabrous with a very few hairs in region of midrib only —— TRI 2023

   (3b) Buds slightly pubescent over entire surface, flush leaves fairly thick, pendent or intermediate in pose with longer internodes —— TRI 2026

4. (4a) Flush leaves erect with long internodes, flowers very specific as ovary is completely hairless —— TRI 2024

   (4b) Flush leaves intermediate in pose, may sometimes be erect, internodes short. Ovary wall hairy —— TRI 2027

General features of the Balangoda clones

Petioles extremely short as a result of which leaf bases more or less graze the axis of flush shoot which is of small girth. Leaves dull and leathery, green or dark green with small yellowish-green flush, pendent or intermediate in pose with rather short internodes. Buds short and pubescent.

The differences amongst the three clones DG 39, MT/BG and MT 18 were not significant for any of the characters investigated here and it is not possible to differentiate between them using any of these characters.

The combinations of characters used in the identification process are, to a considerable extent, dependent on the genotypes subjected to investigation. However, the value of the technique is confirmed by the fact that it was possible to differentiate between nine of the most popular clones of Sri Lanka, several of which are closely related and possess many affinities. Although measurements and analysis are required to detect those characters which are significantly different in different clones, thus forming useful diagnostic criteria, once the useful discriminative characters are established, measurements need not be made but the clones may usually be categorised according to these attributes by visual observations alone. As regards the Balangoda clones, it may be necessary to extend this study by subjecting more characters to measurement and analysis and perhaps carry this out in the low country where these clones are planted extensively.

It must be reiterated that many of the vegetative characters used here (e.g. flush size, internode length, colour of leaves) are probably very plastic and likely to be greatly affected by changes in habitat (sun or shade), location (up country or low country) or season (drought or monsoon period). As such, this study is only a first step toward identification and it may be worthwhile repeating this study at different

locations and during different periods of the year in order to detect those characters which are most stable and therefore of greatest use as diagnostic criteria. The present study was carried out at St Coombs during the period March to June, 1981.

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APPENDIX

The recognition of some tea clones in the field

Brief descriptions are given to aid those working with tea in the field to recognize the principal clones of Sri Lanka. These are not detailed botanical descriptions but concise descriptions of the general appearance of each clone when grown at St Coombs, as may be observed by an average person. The outstanding features of each clone are given and in some instances finer points are included to help resolve doubtful identities.

TRI 2023 : Leaves large, glossy and broadly elliptical. Flush leaves yellowish green, sometimes with pinkish tinge, thin, long and pendent with short internodes. Flush shoots thick (large girth), buds long and nearly glabrous (sparsely pubescent in midrib region only).

Often confused with TRI 2026 but chief discriminative features are pubescence and length of bud and flush size. Additionally, scrutinizing the undersurface of leaves shows no pubescence on flush leaves of TRI 2023 but pubescence is present in TRI 2026 and flowers of TRI 2026 are often larger than those of TRI 2023.

TRI 2024 : Leaves glossy and broadly elliptical but intermediate in size. Flush leaves yellowish green, sometimes with pinkish tinge, erect with long internodes. Flush shoots thick (large girth) with short, more or less glabrous buds. Flowers distinctive as ovary is entirely hairless.

May be confused with TRI 2027 which it resembles closely. Chief discriminative features are the flower and flush characters.

TRI 2025 : Large, broad, obovate leaves, glossy but with crumpled, twisted and bumpy appearance, margins slightly upturned to give slight cup-like form. Flush leaves bright green, thick, wide and rounded. Flush shoots thick (large girth). Buds more or less glabrous.

TRI 2026 : Leaves large, glossy and broadly elliptical with rather bumpy surface. Flush yellowish green, fairly thick, intermediate in size, pendent or intermediate in pose with internodes of intermediate length. Flush shoots thick (large girth). Buds slightly pubescent with very fine hairs over the entire surface. Slight pubescence on under-surface of flush leaves also. Flowers relatively large.

Often confused with TRI 2023. Chief discriminative features are pubescence and flower size.

TRI 2027 : Leaves glossy and broadly elliptical, intermediate in size. Flush leaves yellowish green but less yellow than TRI 2024, erect or intermediate in pose with short internodes. Flush shoots thick (large girth), buds nearly glabrous. Flowers relatively small, ovary wall hairy.

May be confused with TRI 2024. Chief discriminative features are flower and flush characters.

TRI 777 : Leaves dull and leathery, elliptical, of intermediate size with smooth surface. Flush leaves fairly large, bright green and do not contrast greatly with mature leaves, erect but less so than the other China hybrid clones. Petioles relatively long and slightly curved. Buds pubescent. Flower distinctive, small in size with stigma adpressed and flattened at right angles to style which is often notched somewhere along its length.

DT 1 : Leaves small, dull and leathery, elliptical with wrinkled surface. Flush leaves very small, thick, wrinkled and erect, yellow, contrasting sharply with mature leaves which are green in colour. Buds short and pubescent. Flowers rather large, stamens much more numerous than in other clones and crowded round style with the anthers submerging the small inconspicuous trifid stigma.

DN : Leaves dark green, soft with smooth, glossy surface. Mature leaves sharply creased along midrib to give v-shaped appearance. Flush leaves bright light green, flat (no v-shape), conspicuous because they are very erect with long internodes and are upfolded toward each other like hands in greeting. Buds rather long and pubescent. Flowers large, floral characters very variable. Style thick and straight, divided about halfway along its length to give 3, 4 or 5 stigmatic branches. Occasionally the style continues undivided to the top where there are globular stigmatic heads, usually 5 in number. Stamens spread out around the style.

CY 9 : Leaves large, dark green, leathery with glossy wrinkled surface, deeply etched to give corrugated appearance. Serrations on leaf margins very clear. Mature leaves flat (no v-shape as in DN) but flush leaves are sometimes creased along midrib giving v-shape. Flush leaves yellowish green, erect with very long internodes. Buds pubescent. Flowers large, style frequently notched bearing long, curving, often twisted stigmatic branches which are nearly always three in number.

Balangoda clones: There were no striking differences among the three Balangoda clones DG 39, MT/BG and MT 18 when grown at St Coombs. A general description applicable to all is given in the text. Floral characters were also similar for all three clones. Stigma at slightly lower level than anthers, ovary hairy, stigmatic branches usually three, very rarely two.