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USE OF VARIATIONS IN MORPHOLOGICAL CHARACTERISTICS FOR IDENTIFICATION OF BANGLADESH TEA CLONES

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An investigation was conducted to study several parametric and non-parametric characteristics of leaves and some non-parametric characters of the bushes of eleven tea clones released by Bangladesh Tea Research Institute in order to identify and distinguish them. The leaf parameters were length (L), width (W), leaf shape (L/W), leaf size (LXW), apical length, basal length and ratio of apical to basal length, and non-parametric parameters were patina, colour, texture, venation, apex, margin and pose of leaf. The bush characters were growth pattern, compactness, branching behaviour, density and distribution of plucking points, and flowering behaviour of bushes. There were significant differences among the parametric characters of clones. The clones also possessed some distinctly different non-parametric characteristics like leaf colour, patina, branching behaviour of bushes etc. It was not usually possible to recognize clones on the basis of single character but rather a combination of characters was required. Growth pattern of bushes, leaf patina, colour, shape and size of leaves were more useful in identification of tea clones compared to the other characters. Keys were also constructed for differentiating the clones. It would, therefore, be useful as a practical guide for the identification of the clones in the field.

INTRODUCTION

A clone is termed as vegetative progeny of an individual plant and therefore, members of a clone have the same genetic composition. Clones of different cultivars can be distinguished and identified correctly only if they possess well-marked morphological differences. However, considerable difficulties in the identification of tea clones are often encountered as there are hardly any characteristics among clones, which is discontinuous in nature (Wickramaratne, 1981). Only the very experienced persons, by their intuitive judgement, are able to identify clones without difficulty. Since tea in the field is maintained in the vegetative state, it is necessary

to choose vegetative characters for general identification purpose. Different morphological characters such as plants type, shape and size of the bush, branching habit, leaf size, leaf colour, texture etc. are used as identifying characters of a clone. It has been reported by many workers that the differences in leaf characteristics are helpful for the identification of clones released by Tocklai Experimental Station, India and Tea Research Institute of Sri Lanka (Wight, 1953; Richards and Sebastiampillai, 1964; Krishnapillai and Pethiyagoda, 1978; Mazumder and Bezbaruah, 1978; Bezbaruah and Singh, 1980; Wickramaratne, 1981).

Bangladesh Tea Research Institute (BTRI) has started clonal selection work in 1959. So far eleven outstanding clones in BT series (Bangladesh Tea Series) have been released. The general description and comparative performances in respect of yield and quality of BTRI released clones were described (Anon. 1999; Alam *et al.*, 1999). However, no biometrical analysis or systematic work for the identification of clones has been done yet. Therefore, the present investigation was undertaken to study the variations in morphological characteristics of leaves and bushes, and to construct keys, on the basis morphological variations, for the identification of BTRI released clones.

MATERIALS AND METHODS

The investigation was carried out at the Botany Division, Bangladesh Tea Research Institute (BTRI), Srimangal, Moulvibazar during August - October 1999. Eleven clones, viz. BT1, BT2, BT3, BT4, BT5, BT6, BT7, BT8, BT9, BT10 and BT11 released by BTRI, were investigated. Most of the ambient characters were measured on a numerical scale. Measurements for attributes were made on thirty mature leaves per clone collected from bushes in plucking. The characters measured were length (L), width (W), apical length (AL), basal length (BL), ratio of length to width, length x width and ratio of apical length to basal length of leaf as described by Wickramaratne (1981). The product L x W was used as an index of leaf size and the ratio L/W as an indication of shape.

The data were analyzed statistically following the ANOVA-technique and means were separated by Duncun's New Multiple Range Test (DMRT) using computer Package MSTAT.

Variations in non-parametric characters, viz. patina, texture, colour, pose, venation, apex and margin of leaf, were determined visually. The bush characters were growth pattern, compactness, branching behaviour, density and distribution of plucking points, and flowering behaviour of bushes.

RESULTS AND DISCUSSION

There were statistically significant differences among the clones for every parametric characteristic measured in the leaf (Table 1). BT1 produced the longest leaf (16.78 cm) and BT6 had the shortest (11.32 cm) while BT10 produced the widest leaf (7.18 cm) and BT9 the narrowest (4.49 cm). The variations in different clones might be due to the genetic make up of the clones. Majority of the clones had similar values for L/W ratio. The leaves of BT9 had the highest L/W ratio (2.88) and BT10 and BT6 possessed lower values (2.22 and 2.27 respectively) (Table 1). The highest L/W ratio (a) indicates that the leaf is long and narrow with an elliptic shape and the lowest L/W ratio (d) indicates that the leaf is wide relative to its length with a lanceolate shape. Leaves having lower L/W ratios (b) indicate that they are somewhat broader than the group a and are obovate in shape includes BT1, BT2, BT3, BT4, BT7 and BT11. On the basis of the L/W ratio of leaves the clones would be grouped into three distinct groups – elliptic, lanceolate and obovate. Results revealed that leaf length, leaf width and leaf shape (L/W) could be used as a useful and reliable character in identification and grouping of clones. However, it was reported that the leaf length was found to be of less importance in distinguishing some Sri Lankan tea clones (Wickramaratne, 1981). Size of leaf (LXW) although very variable within a clone, is also useful for picking out the extreme types. However, there were significant differences among the clones in leaf size. BT1 and BT10 possessed the larger leaves (109.29 and 114.64 cm^2 respectively) and BT6 and BT8 had the smaller (54.93 and 55.65 cm^2 respectively). The apical/basal length ratio indicates whether the wider part of the leaf tends toward the apex or the base. For apical/basal length ratio, most of the clones had similar values with only BT4 and BT7 being distinctly different (Table 1). Visual examination of bushes in the field showed that although every leaf of the clone may not fit with these descriptions, the great majority of them did. Therefore, it is useful to consider a plant as a whole or at least an adequate sample of leaves when identifications are attempted. The clones also possessed some distinctly different non-parametric characters viz. growth pattern, compactness, branching behaviour, density and distribution of plucking points, and flowering behaviour of bushes and patina, colour, texture, venation, apex, margin and pose of leaf (Table 2). Wickramaratne (1981) also reported similar findings for Sri Lankan tea clones. The clones would be separated into four distinctly different agro-type – Hybrid II, Hybrid III, Monipuri and Light leaved Assam on the basis of the non-parametric characteristics of leaves and bushes. This result confirms the grouping of BT clones into four broad categories as was done by Anon. (1999) and Alam *et al.* (1999).

It could be concluded that one feature alone may not usually serve to distinguish between clones but several characters which show small but significant and detectable differences between clones, may be used in combination to identify clones.

On the basis of leaf patina BT clones may conveniently be separated into two groups – the clones having foliage dull in appearance (A) and the clones having foliage glossy in appearance (B). To differentiate between the clones within each group keys may be constructed using the information presented in table 1 and 2.

Group A: The clones having foliage dull in appearance, leaf texture thin and soft

1. a. Typically plagiotropic, very compact bush and profusely branched, plucking points fairly dense and evenly distributed, shorter internode in twigs, semi-dark green foliage, horizontal leaf, prominent long apex, larger in size, margin deeply serrated but may not be uniform throughout, blade wavy, slightly embossed between veins, early and highly floriferous, small flower – BT1.
   b. Other than plagiotropic, intermediate size – 2
2. a. Plagio-orthotropic, compact bush, high plucking density, light green foliage, semi-erect leaf, shape obovate, concave upwards (boat shaped), apex not prominent, highly floriferous – BT3.
   b. Ortho-plagiotropic, bush fairly compact, very light green foliage, leaf apex prominent, shape lanceolate, leaf margin uniformly dentate and no waviness of leaf blade, pose erect to semi-erect, poorly floriferous – BT6.

Group B: The clones having foliage glossy in appearance

1. a. Plagiotropic, compact bush with good branching habit – 2
   b. Other than plagiotropic – 3
2. a. Very dark green foliage, fair growth and quite hardy, flushes tend semi -horizontal, short leaf apex, serration uniform, size smaller, texture thick and quite soft, venation fairly prominent and parallel— BT 4.
   b. Light green foliage, fairly dense plucking points with thick and soft plucking shoots, leaf apex prominent, long, size larger, shape lanceolate, serrated margin, lamina deeply embossed between veins, horizontal leaf pose—BT10
3. a. Plagio-orthotropic, leaf size medium, lamina moderately embossed between veins,texture fairly thick and quite soft, dark green in colour— 4
   b. Ortho-plagiotropic — 5

4. a. Pointed leaf apex, light serration, pose semi-erect, compact bush, very good branching, dense plucking points — BT8.
   b. Leaf apex slightly pointed, uniformly serrated margin, pose erect, good girth, appreciable branching habit, evenly distributed plucking points – BT11
5. a. Dark green foliage, compact bush, fairly dense plucking points, leaf apex less prominent, texture fairly thick and quite soft, serration prominent and uniform, size medium to large, pose semi-erect, moderately floriferous with large flowers – BT7
   b. Semi-dark green – 6
6. a. Leaf lamina deeply embossed between veins, pointed apex, serration uniform, elongate leaf, medium size, elliptic shape, pose semi-erect, texture thin and soft, good branching, plucking table compact with medium evenly distributed plucking points – BT9
   b. Leaf lamina moderately embossed or plain – 7
7. a. Leaf blade wavy, texture thin and soft, prominent long apex, serration plucking density, moderate flowering habit, flower size large – BT5
   b. Leaf blade not wavy, texture fairly thick and soft, apex less prominent, serration uniform, size intermediate to small, lamina of considerably equal width in mid region, pose semi-erect, comparatively loose frame, not densely branched but effective branches with very good uniform flushing behaviour, moderately floriferous – BT2

The vegetative parameters used here are probably very plastic and likely to be greatly affected by changes in environmental factors. Therefore, repeating this study at different locations and during different season may help in better identification of discriminative characters for distinguishing clones.

REFERENCES

Alam A F M B , Dutta M J and Haque S K L 1999 Provisional Release of Clone BT11. Circular No.105. pp.1-4, Bangladesh Tea Research Institute, Srimangal – 3210, Moulvibazar.

Anon1999 Plant Improvement. *In*: Brief Notes on Tea Culture for the BTRI Annual Course. pp.5-11 Bangladesh Tea Research Institute, Srimangal – 3210, Moulvibazar.

Bezbaruah H P and Singh I D1980 Characteristics of Tocklai released planting Materials. Two and a Bud 27(1), 6-8.

Krishnapillai S. and Pethiyagoda U 1978 Efficiency of uptake and utilization of nitrogen by young tea plants (*Camellia sinensis* L.) in sand culture. Tropical. Agriculture (Trinidad) 55(4), 351-358.

Mazumder C S and Bazbaruah H P 1978 On the nature of selection is in tea leaves: 1. Size and distribution pattern in some Tocklai released clones. Two and a Bud 25(2), 95-97

Richards A V and Sebastiampillai A R 1964 A note on the identification of some T.R.I. clones. Tea Quarterly 35(2), 168.

Wickramaratne M RT 1981 Variation in some leaf characteristics in tea (*Camellia sinensis* L.) and their use in the identification of clones. Tea Quarterly 50(4),183-198.

Wight W 1953 Tocklai Experimental Station Annual Report- 1953, 34-43.

Table 1: Variation in parametric characteristics of leaves of different tea clones

Clones	Leaf length (cm)	Leaf width (cm)	Length: Width ratio	Leaf size (LXW)	Apical length (cm)	Basal length (cm)	A.L: B.L ratio
BT1	16.78 a	6.44 b	2.61 b	109.29a	8.21 a	8.57 a	0.97 c
BT2	13.92 d	5.27 de	2.67 b	73.53 c	6.76 c	7.15 cd	0.96 c
BT3	15.29 b	6.09 c	2.51 b	93.40 b	7.56 b	7.73 b	0.98 c
BT4	12.76 e	5.41 d	2.58 b	69.21 c	6.03 d	6.73 de	0.90 c
BT5	14.48 cd	6.21 bc	2.34 cd	90.25 b	7.08 c	7.40 bc	0.93 c
BT6	11.32 f	5.03 e	2.27 d	54.93 d	5.50 e	5.82 f	0.96 c
BT7	14.89 c	5.99 c	2.54 b	90.80 b	8.05 a	6.84 de	1.23 a
BT8	11.71 f	4.72 f	2.49 bc	55.65 d	6.10 d	5.60 f	1.13 b
BT9	13.01 e	4.49 f	2.88 a	58.86 d	6.63 c	6.38 e	1.06 b
BT10	15.90 b	7.18a	2.22 d	114.64 a	8.32 a	7.58 bc	1.11 b
BT11	13.68 de	5.29 de	2.59 b	72.31 c	7.19 bc	6.49 e	1.11 b
LSD 1%	0.7945	0.2964	0.1628	25.4319	0.4695	0.4986	0.0705

• In a column, means having same letters are not significantly different at 1% level.

Table 2: Variation in non-parametric characteristics of different tea clones

Clones	Growth habit	Leaf			
		Patina	Texture	Colour	Apex, margin, venation, pose etc.
BT1	Typically plagiotropic, very compact bush and profusely branched, plucking points fairly dense and evenly distributed, shorter internode in twig, early and highly floriferous, hybrid II.	Dull	Thin and soft	Semi-dark green	Prominent long apex, margin deeply serrated, blade wavy, slightly embossed and horizontal.
BT2	Ortho-plagiotropic, not densely branched, comparatively loose frame but effective branches, very well and uniform flushing behaviour, moderately floriferous, hybrid II.	Quite Glossy	Fairly thick and soft	Semi-dark green	Apex less pointed, lamina considerably equal width in mid region, serration uniform, semi-erect.
BT3	Plagio-orthotropic, compact habit, high plucking density, highly floriferous, hybrid III.	Dull	Thin and soft	Light green	Apex not prominent, obovate, boat shaped, semi-erect.
BT4	Plagiotropic, compact bush, Manipuri-China hybrid, good branching, fair growth and quite hardy.	Very Glossy	Thick and quite soft	Very dark green	Short apex, serration uniform, venation fairly prominent and parallel, semi-horizontal.
BT5	Ortho-plagiotropic, fair plucking density, moderately flowering habit, hybrid III.	Quite Glossy	Thin and soft	Semi dark green	Prominent long apex, serration uniform but dents blantish, blade wavy, moderately embossed, erect.
BT6	Ortho-plagiotropic, bush fairly compact, poorly floriferous, hybrid III.	Dull	Thin and soft	Very light green	Apex prominent, leaf margin uniformly dentate and no waviness of leaf blade, erect to semi-erect.
BT7	Ortho-plagiotropic, compact bush, fairly dense plucking points, Manipuri habit prominent, moderately floriferous.	Fairly Glossy	Fairly thick and quite soft	Dark green	Apex less prominent, serration prominent and uniform, semi-erect
BT8	Plogio-orthotropic, compact bush, very good branching dense plucking points, Manipuri-Assam hybrid.	Glossy	Fairly thick and quite soft	Dark green	Prominent apex, light serration, lamina moderately embossed, semi-erect.
BT9	Ortho-plagiotropic, good branching, plucking table compact, evenly distributed plucking points, hybrid II.	Glossy	Thin and soft	Semi-dark green	Pointed apex, serration uniform, lamina deeply embossed, semi-erect.
BT10	Plagiotropic, compact bush with good branching habits, fairly dense plucking points, thick and soft plucking shoot, light-leaved Assam.	Glossy	Thick and soft	Light green	Prominent long apex, serrated margin, lamina deeply embossed, horizontal.
BT11	Plagio-orthotropic, good girth, appreciable branching habit but without undesirable branches, medium sized plucking points, hybrid-III.	Glossy	Fairly thick and quite soft	Dark green	Apex slightly pointed, uniformly serrated margin, lamina moderately embossed, erect.