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Path Analyses of Yield and Yield Related Traits of Thirty Four Diverse Tea (*Camellia* L. sp.) Genotypes

S. Babu
Botany Division, UPASI Experimental Farm, UPASI Tea Research Foundation, Tea Research institute, Nirar Dam B.P.O., Valparai-642 127, Coimbatore Dist., Tamil Nadu, India

Abstract: An association analysis was carried out to obtain and interpret information on the nature of interrelationships between yield and yield related traits. Thirty four tea genotypes were used in this study to represent the high levels of correlation of four traits that were identified as important yield determinants such as dry weight of shoot, fresh weight of shoot, number of shoots/plant and leaf breadth. The inter correlation values were found to be highly significant, hence further partition the values by path analyses was carried out to have a more accurate selection of characters for improving the yield. Among the traits studied leaf breadth, dry weight of shoot and number of shoots/plant were found to have high positive direct effect on yield/plant. Based on both the correlation and path coefficient values, it is interesting to know that dry weight of shoot is a possible consideration for the direct selection of high yielding genotype in the early generation where the yield test is not being conducted.

Key words: *Camellia sinensis,* tea, path analysis, association, correlation

INTRODUCTION

Success of any breeding programme solely depends on the extent of genetic variability present in a crop. Crop improvement for yield has been achieved through effective use of germplasm and fixing desirable character combinations. While selection for yield, the nature of gene action and their direct and indirect effects on yield in the early generations are of great value for crop improvement.

Association (Path) analysis is a statistical tool developed by Wright (1921). Knowledge on the correlation between yield and its component characters themselves can improve the efficiency of selection. Because, in a complex situation selection for an optimum advance should be based on judiciously computed index that to if any environmental influence is there. Correlation studies permit only a measure of relationship between two traits. Hence, path coefficient analysis becomes necessary as it permits separation of direct and indirect effects via other related characters by partitioning the correlation coefficients (Dewey and Lu, 1959). This will help in designing appropriate breeding procedure for evolving high yielding genotypes. Hence the present investigation was conducted. The objectives of the study were to obtain and interpret information on the genetic behaviour of different quantitative traits and nature of interrelationship between yield and yield related traits and their importance while selecting a high yielding tea genotypes by giving more importance to the directly correlated characters and leaving the least and uncorrelated traits.

MATERIALS AND METHODS

Thirty four accessions were collected from the old seedling populations available in different agro climatic zones of South India. The accessions were raised in the UPASI-Tea Research Foundation, Tea Research Institute's germplasm bank during 2002 in a randomized block design with two replications as per the recommended package of practices. The data included in the association analyses were stem girth (cm), leaf length (cm), leaf breadth (cm), drought tolerance, shoot length (cm), inter node length (cm), number of shoots/plant, fresh weight of shoot (g), dry weight of shoot (g) and yield/plant (g). Observations were recorded from five randomly selected plants in each replication during, 2005-06. The phenotypic correlation coefficient was worked out by the method suggested by Goulden (1952). The direct and indirect effects of each trait on yield/ plant were estimated as per the methods suggested by Dewey and Lu (1959).

RESULTS

The yield/plant had registered highly significant positive correlation with all the traits except stem girth. (Table 1). Among the traits dry weight of shoot followed

Table 1: Phenotypic correlation coefficient between yield and yield related components in tea

Yields components	Leaf length	Leaf breadth	Drought tolerance	Shoot length	Inter node length	No. of shoots/plant	Fresh weight of shoot	Dry weight of shoot	Yield/plant
Stem girth	0.106	0.110	0.299	0.145	0.142	-0.058	0.203	0.171	0.099
Leaf length		0.764**	0.132	0.300	0.440**	0.127	0.489**	0.484**	0.425**
Leaf breadth			0.205	0.323	0.522**	0.275	0.596**	0.613**	0.628**
Drought tolerance				0.386*	0.447**	0.320	0.301	0.285	0.403*
Shoot length					0.790**	0.246	0.554**	0.506**	0.494**
Inter node length						0.245	0.741**	0.695**	0.608**
No. of shoots/plant							0.254	0.302	0.670**
Fresh weight of shoot								0.973**	0.801**
Dry weight of shoot									0.825**

*p values ≤0.05; **p value ≤0.01

Table 2: Direct and indirect effects of yield components on yield/plant through other characters in 34 diverse tea genotypes

Yields components	Stem girth	Leaf length	Leaf breadth	Drought tolerance	Shoot length	Inter node length	No. of shoots/plant	Fresh weight of shoot	Dry weight of shoot	Phenotypic correlation
Stem girth	**-0.038**	-0.191	0.229	0.024	0.002	0.017	-0.015	-0.034	0.117	0.099
Leaf length	-0.008	**-0.850**	1.028	0.030	0.006	0.050	0.048	-0.099	0.360	0.425**
Leaf breadth	-0.008	-0.808	**1.081**	0.032	0.006	0.050	0.099	-0.112	0.409	0.628**
Drought tolerance	-0.012	-0.336	0.459	**0.075**	0.007	0.044	0.125	-0.060	0.218	0.403*
Shoot length	-0.007	-0.375	0.506	0.040	**0.014**	0.070	0.065	-0.092	0.307	0.494**
Inter node length	-0.008	-0.519	0.667	0.041	0.012	**0.081**	0.074	-0.121	0.416	0.608**
No. of shoots/plant	0.002	-0.164	0.430	0.038	0.003	0.024	**0.250**	-0.041	0.188	0.670**
Fresh weight of shoot	-0.008	-0.552	0.787	0.030	0.008	0.064	0.068	**-0.153**	0.560	0.801**
Dry weight of shoot	-0.007	-0.539	0.779	0.029	0.007	0.060	0.083	-0.151	**0.568**	0.825**

Bold are direct effect; Residual effect-0.199; * significant at the rate of 0.05; ** significant at the rate of 0.01

by fresh weight of shoot, number of shoots/plant, leaf breadth and inter node length registered very high positive correlation (Table 1).

The inter correlation among the traits shows the nature and extent of relationship with each other, which help in the breeding programme for simultaneous improvement of different traits along with yield/plant. In the present study fresh weight of shoot and dry weight of shoot recorded highly positive correlation with leaf length, leaf breadth, shoot length and inter node length. Whereas the inter node length had registered positively high correlation with all the traits except stem girth. Since the inter correlation values were highly significant, it would be better to further partition the values by path analyses to have a more accurate selection of characters for improving the yield.

The results inferred that leaf breadth, dry weight of shoot and number of shoots/plant had registered very high direct effect. Whereas, stem girth, leaf length and fresh weight of shoot recorded negative direct effect with yield/plant. The estimates of indirect path coefficient effect among the traits revealed that the dry weight of shoot alone registered positively high indirect values with all the traits studied (Table 2).

DISCUSSION

The results of correlation coefficient among different traits with yield/plant gives an idea about the direct influence of dry weight of shoot and fresh weight of shoot on the expression of yield/plant. Satyanarayana and Sharma (1981) in their study also noted the correlation of these traits with yield. As noticed by Sharma and Ranganathan (1986) and Nyirenda and Ridpath (1980) from their study, the number of shoots/plant had registered highly significant correlation with yield/plant in this experiment also. Apart from these traits leaf length and leaf breadth also expressed their importance in selection of high yielding genotypes by keeping these traits as one of the selection criteria. This was in accordance with the results of Sharma and Ranganathan (1986).

As the simple correlation and inter correlation values of all the traits showed significance and does not produce the true contribution of the characters towards the yield. Hence these genotypic correlations were partitioned into direct and indirect effects throughout path coefficient analysis. Based on the path analysis, some of the characters registered highly positive correlation were not recorded high direct and indirect path values showed the environmental influence? The highest positive direct effect of leaf breadth, dry weight of shoot and number of shoot/plant revealed the importance of these traits while selecting new genotypes for yield. Among these traits the dry weight of shoot had alone registered highly positive indirect effects with all the traits showed its high influence towards selection of high yielding tea clones.

In summary, our correlation and path coefficient results suggest that a plant type for high yield should have high dry and fresh weight of shoot along with an eventual more number of shoots/plant and high leaf breadth. Among these traits mentioned, dry weight of shoot is a possible consideration for the direct selection

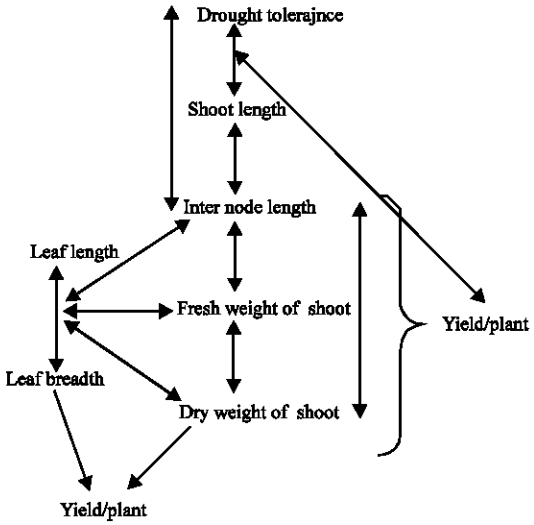

Fig. 1: Significant correlation coefficients (double-arrow headed lines) and path coefficient (single-arrow headed lines) for the path analyses of yield and yield related traits

of high yielding genotype based on the high correlation and path (direct and indirect effects) coefficient values (Fig. 1). Whereas fresh weight of shoot, leaf breadth and number of shoots/plant was considered to be an indirect selection of yield/plant during segregating generations when yield tests are not being considered because, it can be easily estimated even in young seedling stage itself (Sebastiampillai and Solomon, 1976).

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