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Modified Graphical Analysis : A Technique for Germplasm Classification*

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ABSTRACT

Four exotic, four indigenous varieties of barley and 56 hybrids among them were subjected to multivariate and modified graphical analysis. Two types of analyses provided more or less similar picture as far as comparatively diverse populations were concerned. The grouping pattern was comparable to a certain degree in the two types of analyses. However, considerable differences were also observed in this respect. Probable resaons of such differences and the implications of the proposed technique have been discussed.

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INTRODUCTION

PLANT BREEDER usually deals with a large collection of germplasm. Obviously, he cannot use the entire germplasm in the hybridization programmes. Consequently, he has to classify the available germplasm into the groups containing strains, more or less with similar characteristics. He may, then, select only a few strains from different groups for crossing purpose. Classification of germplasm can be done in various ways. Most commonly used are the graphical approach (Anderson, 1957) and Mahalanobis D^2 analysis (Rao, 1952). Grouping on the basis of multivariate analysis is a sound statistical technique and accounts for quantitative measurements of the distance between biological populations. However, the analysis is quite tedious, lengthy and time consuming and may not be attempted without a computer. As such, the analysis is highly desirable and fruitful results are provided, when crosses are attempted on the basis of information, obtained from such an analysis (Bhatt, 1973).

Graphical analysis is a simple technique and requires little time. The technique has been extensively used and it has been observed that grouping in this analysis is primarily based upon two characters that are used in plotting the glyphs. Once these characters are changed, grouping pattern is also changed considerably (Jain, 1974). Jain did not observe any similarity in grouping pattern done on the basis of graphical approach and numerical approach.

In the present investigation, some modifications were made in the graphical analysis and attempt was made to correlate the grouping pattern obtained

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on the basis of modified technique with that of D^2 analysis.

MATERIALS AND METHODS

Four exotic (AB 12/59, EB 1556, PTS 57 and A 59) and four indigenous (BG 1, K 572/10, IB 226 and C 164) strains of barley were used to prepare all possible hybrids including reciprocals. Fiftysix hybrids and the parents were sown in a randomized block design with four replications. Three meter long rows were spaced 30 cm apart, distance among plants within rows being about 15 cm. Observations on five competitive plants from each plot were recorded for: plant height (cm), total tillers, ear length (cm), effective tillers, 100-grain weight (g), grain yield per ear (g), grains per ear and grain yield per plant (g).

Data were subjected to graphical (Anderson, 1957) and multivariate analysis (Rao, 1952). In this modified graphical technique, two separate graphs were prepared considering two sets of characters on X and Y-axis. Third graph was then, prepared pooling these two graphs together. Positions of the glyphs in the pooled graph were compared with the position of various genotypes in the λ_1 and λ_2 graph of D^2 analysis.

RESULTS AND DISCUSSION

Results of multivariate analysis have been published elsewhere (Chaudhary and Singh, 1975). Only the λ_1 and λ_2

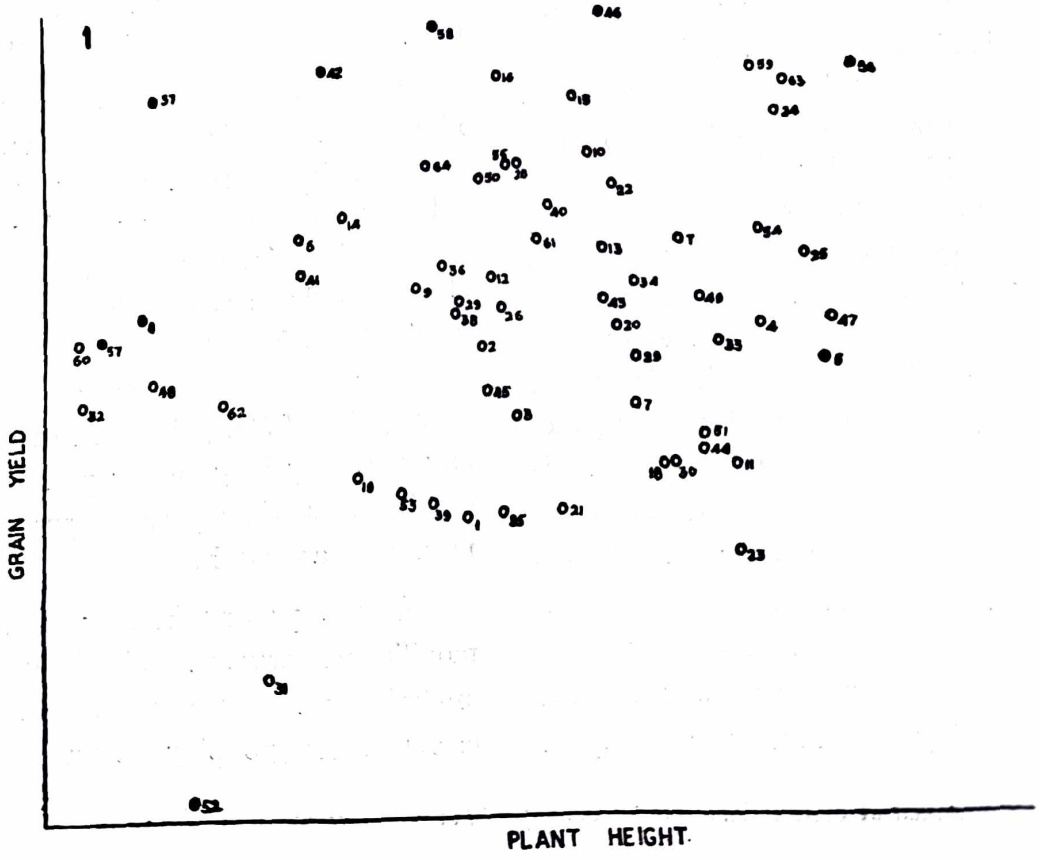

Fig. 1

graphs will be considered here. The populations 8, 10, 11, 18, 14, 42, 46, 5, 33, 27, 20, 48, 63, 56, 37, 52, 57 and 58 occupied border positions in the graph, showing comparatively more divergence among them. Following Anderson's technique scatter diagram (Fig. 1) was prepared using plant height and grain yield in plotting the glyphs. Populations shown by solid circles in this figure occupied a border position in the λ_1 and λ_2 graph and thus there was a little similarity in the two types of analysis as far as comparatively more diverse populations were concerned. Characters used in plotting this graph accounted only for 13.8 per cent of the total divergence (Fig. 1). In the second graph (Fig. 2), total tillers and grains per ear were used in plotting the glyphs. These characters accounted for 36.2 per cent of the total divergence. This time similarity of the border populations as compared to the λ_1 and λ_2 graph was of a little higher order.

The pooled graph (Fig. 3) which accounted for 50 per cent of the total divergence was quite close to λ_1–λ_2 graph as far as more diverse populations were concerned. There were about 18 populations occupying border position in the λ_1–λ_2 graph out of which 13 occupied a border position in the graphical analysis also. Thus, the two types of analysis showed about 72 per cent similarity in this respect. An attempt was also made

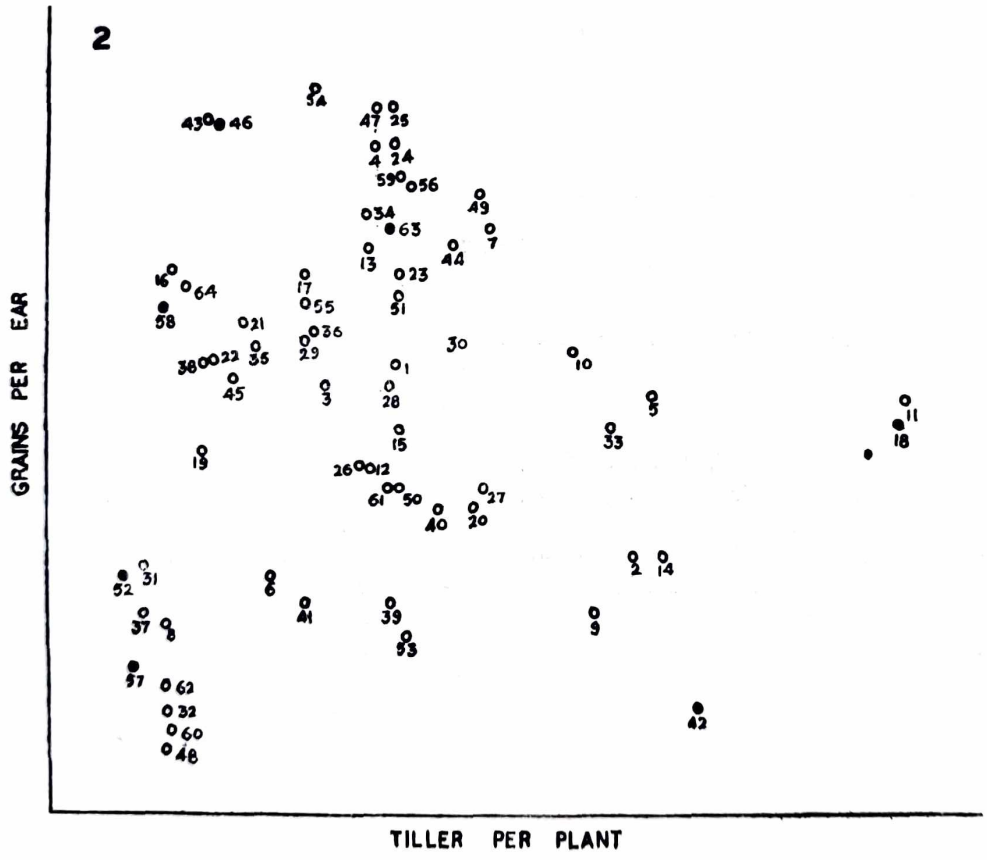

Fig. 2

to group the populations and compare them with the clustering pattern in D^2 analysis. The results are tabulated (Table 1).

Following points were evident from this comparison:

1. Group I of modified graphical analysis consisted varieties from three different groups (I, II and V) based on D^2 analysis. However, these groups were quite close.

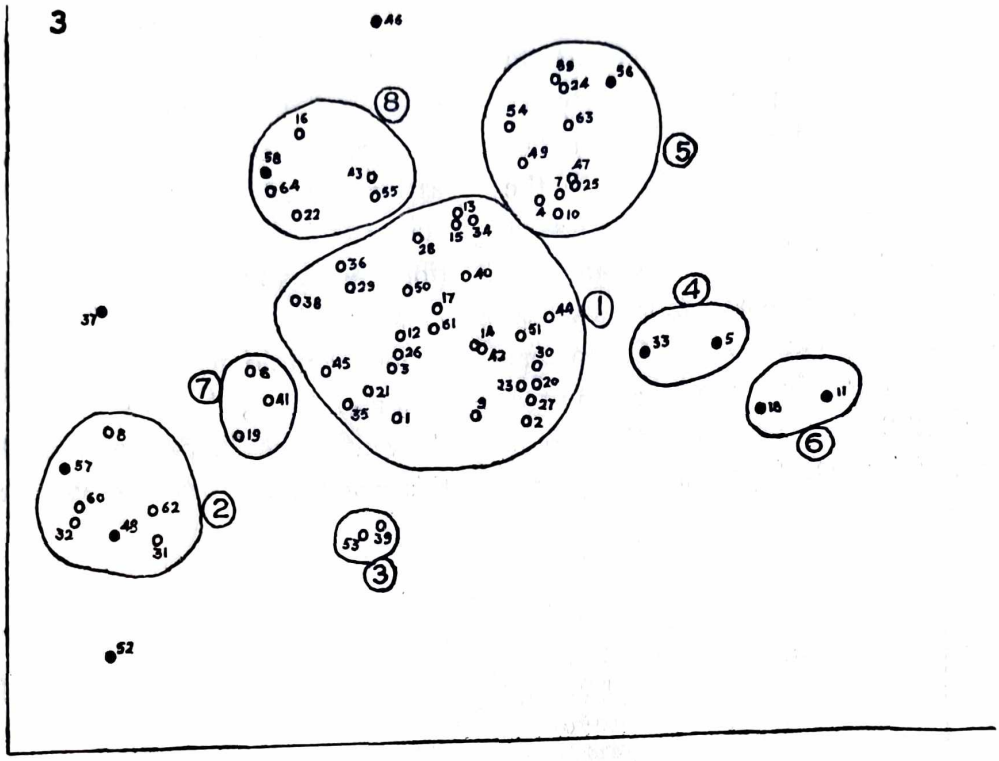

Fig. 3

TABLE 1

Grouping in D^2 and modified graphical methods.

D^2 analysis	*Modified graphical analysis*
Group I and II: 3, 4, 6, 12, 15, 17, 19, 21, 23, 24, 25, 26, 28, 30, 31, 35, 38, 41, 45, 46, 47, 50, 51, 52, 54, 55, 56, 59 and 63.	*Group I:* 1, 2, 3, 9, 12, 13, 14, 15, 17, 20, 21, 23, 26, 27, 28, 29, 30, 34, 35, 36, 38, 40, 42, 44, 45, 50, 51 and 61.
Group III: 8, 16, 22, 32, 37, 43, 44, 57, 58, 60 and 64.	*Group II:* 8, 31, 32, 48, 57, 60 and 62.
Group IV: 20, 27, 39, 40, 48, 53, 61 and 62.	*Group III:* 39 and 53.
Group V: 1, 13, 29, 34 and 36.	*Group IV:* All are in group I.
Group VI: 2, 9, 14 and 42.	*Group IV:* 5 and 33.
Group VII: 5 and 33.	*Group V:* 7, 10, 24, 25, 40, 47, 49, 56, 59 and 63.
Group VIII and X: 7, 49 and 10.	*Group VI:* 11 and 18.
Group IX: 11 and 18.	*Group VII:* 6, 19 and 41.
	Group VIII: 16, 22, 43, 55, 58 and 64.
	Group IX: 37.
	Group X: 46.
	Group XI: 52.

2. The varieties 11 and 18, 5 and 33, 7, 10 and 49 and 3, 9, 14 and 42 tend to remain together in both types of analysis.

3. Groups in graphical analysis were more because of single variety clusters.

There were considerable differences also in the two types of analyses with respect to grouping pattern (Table 1). These differences could be due to:

1. Graph in the modified analysis accounted for 50 per cent divergence while in case of D^2 analysis this accounts for more divergence.

2. In the modified analysis, observed mean values have been used in plotting the glyphs while in D^2 analysis correlations have already been removed.

3. In D^2 analysis, negative and positive deviations, all become positive because of D^2 being a quadratic value. On the other hand, in the present technique, average deviations cancel out negative and positive effects.

4. Arbitrary nature of the method of grouping in both the analyses.

Bearing of the informations obtained from the present study on germplasm classification and its comparison with the other techniques can be briefly considered. D^2 analysis, though useful, is very tedious, lengthy and time consuming. Usually this analysis can not be performed without a computer. In metroglyph analysis, grouping pattern is based almost entirely on the two characters that are used in plotting the glyphs. Therefore, divergence shown by any two genotypes is not generalized. Present technique, an extension of metroglyph analysis, provided a picture of grouping pattern that was quite comparable to the grouping pattern based on multivariate analysis. The technique is valid for identifying the comparatively diverse populations. Thus, considering the similarities in grouping pattern of the present technique with the D^2 analysis and the problems of the later, the present technique appears to be quite feasible and therefore can be applied in the germplasm classification.

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