

Characterization of Local Rice Varieties of Assam using Morphological Markers

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Morphological traits are traditionally the experimental tool of "Genecologists" for the study of populations and a considerable body of experimental data available today on the nature and intensity of modifications induced influenced by various environmental factors is generated by such tools [1]. In a large germplasm collection, morphological markers provide easy, rapid and convenient means of cultivar identification and characterization, which can be a useful tool in any breeding programme. A protectable novel variety must be distinct, uniform and stable. To protect a new variety, UPOV (International Union for Protection of New Varieties of Plants) suggests a set of morphological traits for DUS testing. National guideline [2] also suggests a set of characters in this context. These morphological characters have been chosen mainly because they are easily evaluated and have high heritabilities. Keeping all these in mind, the present investigation had been undertaken to characterize and identify the key diagnostic characters of eleven rice varieties indigenous to Assam.

The plant materials consisted of nucleus seeds of 11 rice varieties of Assam. The field experiment was conducted during *Sali* season of 2002-2003 in Instructional cum Research Farm of Assam Agricultural University, Jorhat, Assam, India. The field experiment was laid out in Randomized Block Design with three replications. Observations for morphological characters were

recorded as per International Union for Protection of New Plant Varieties (UPOV) guidelines [3] and National guidelines [2].

The data were statistically analyzed following the method suggested by Gomez and Gomez [4].

The average Euclidean distance is dissimilarity coefficient [5]; that is larger the value the greater distance between the pairs of accessories, which was calculated for morphological traits and Unweighted Pair group (UPGMA) methodology was used for dendrogram construction.

Principal component analysis was carried out following method described by Sneath and Sokal [5]. This analysis helps in elucidating the proportions of relative contribution of various characters to the total variance of a population. The statistical computations for Principal Component Analysis were performed using a statistical software package "SPSS for MS Windows Release 7.5".

The morphological characters are presented schematically in the flow diagram (Fig. 1). Among the leaf characters basal leaf sheath colour, leaf colour, penultimate leaf pubescence, flag leaf attitude of blade and leaf length exhibited distinguishable differences among the varieties. Basal leaf sheath colour was purple in one variety (Rangilee), whereas others were

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green. Patra [6] reported purple basal leaf sheath colour in 22 accessions among the rice varieties of Orissa. Statistically significant difference was observed for leaf length. Among the panicle characters colour of stigma, density of pubescence of lemma, colour of tip of lemma, panicle length, panicle curvature of main axis, panicle type and awning were considered to be some distinguishing characters. Awn was present in only one variety (Rangilee). Lathra [7] reported presence of awn in 2 genotypes out of 20 rice genotypes evaluated for presence of awn. Most of the varieties (9 varieties) were with whitish stigma colour. Chaudhury and Sahai [8] found high variability for stigma colour while evaluating 1270 Cambodian rice germplasm. Among the plant characters plant habit, stem length, stem thickness, internode colour, node anthocyanin colour, ligule colour, auricle colour, days to 50 per cent heading and time of maturity constituted some distinguishable characters. Plant habit was spreading in only one variety (Rongadoria) and others were compact. Kumar *et al.* [9] found 4 types of plant habit *viz.*, erect, semierect, semi-spreading and spreading, while studying the rice varieties of Raipur. Statistically significant difference was observed for stem length and stem thickness. Auricle colour was found to be different in Bishnuprasad (pale yellow) and Jyotiprasad (pale green), whereas most of the characters were in common for these two varieties. Based on days to 50 per cent heading and time of maturity the varieties were grouped into two i.e. early and medium group. Patra [6] found extra early, early and medium duration varieties while studying the varieties of Orissa. Among the grain characters grain colour, grain length, decorticated grain width, decorticated grain shape, decorticated grain colour, grain L/B ratio, grain type and thousand grain weight constituted some distinguishing characters. Most of the varieties [8] were straw and only one variety (Rongadoria) was red. Chaudhury and Sahai [8] also found straw as the most frequent grain colour, while studying 1270 Cambodian rice germplasm. Decorticated grain colours were white (10 varieties) and red (1 variety). Chauhan and Nanda [10] also reported red and creamy white to white rice grains among the rice varieties of Kerala and

Tamil Nadu. Statistically significant difference was observed for grain length; decorticated grain length and width, grain L/B ratio and thousand grain weight.

The dendrogram in figure 1 shows the relationship among the varieties for these traits. Except for clusters III, IV and V, other varieties cluster into two main groups. If the morphological characters of the three varieties, which were out grouped from rest of the varieties, were compared then it was observed that they showed some unique morphological characters which might be the reason of such a separate identity.

In the present study using 35 morphological characters, three principal components accounting 96.11 per cent of total variation among the 11 rice varieties were extracted (Table I). This study reveals the minimum diagnostic characters contributing maximum variation among the varieties which will facilitate easy and quick identification of the varieties, in the variety identification programme.

The first principal component exhibiting 6.27 per cent of the total variation was mainly linked to grain and plant characters and also with few leaf and panicle characters. Among the grain characters grain length and decorticated grain shape, among the plant characters, stem length, days to 50 per cent heading and time of maturity, among the panicle characters panicle length and panicle number per plant and among the leaf characters only leaf length showed maximum variation. Hence these characters can be successfully employed as useful diagnostic characters for the varieties under study.

Characters associated with second principal component were grain colour, decorticated grain colour, stem length and tip colour of lemma contribute considerably towards the total variation and hence particular emphasis should be given to these characters for morphological characterization of these 11 rice varieties.

The third component was linked with the lone character days to 50 per cent heading contributing 9.51 per cent of total variation.

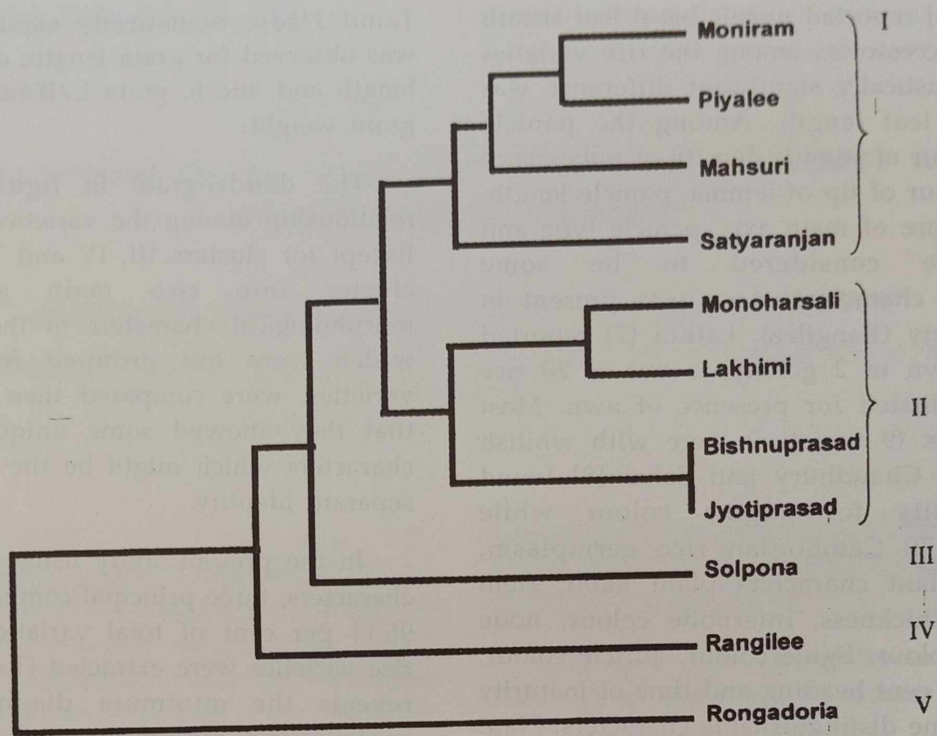


Fig. 1. Dendrogram of rice varieties based on morphological characters

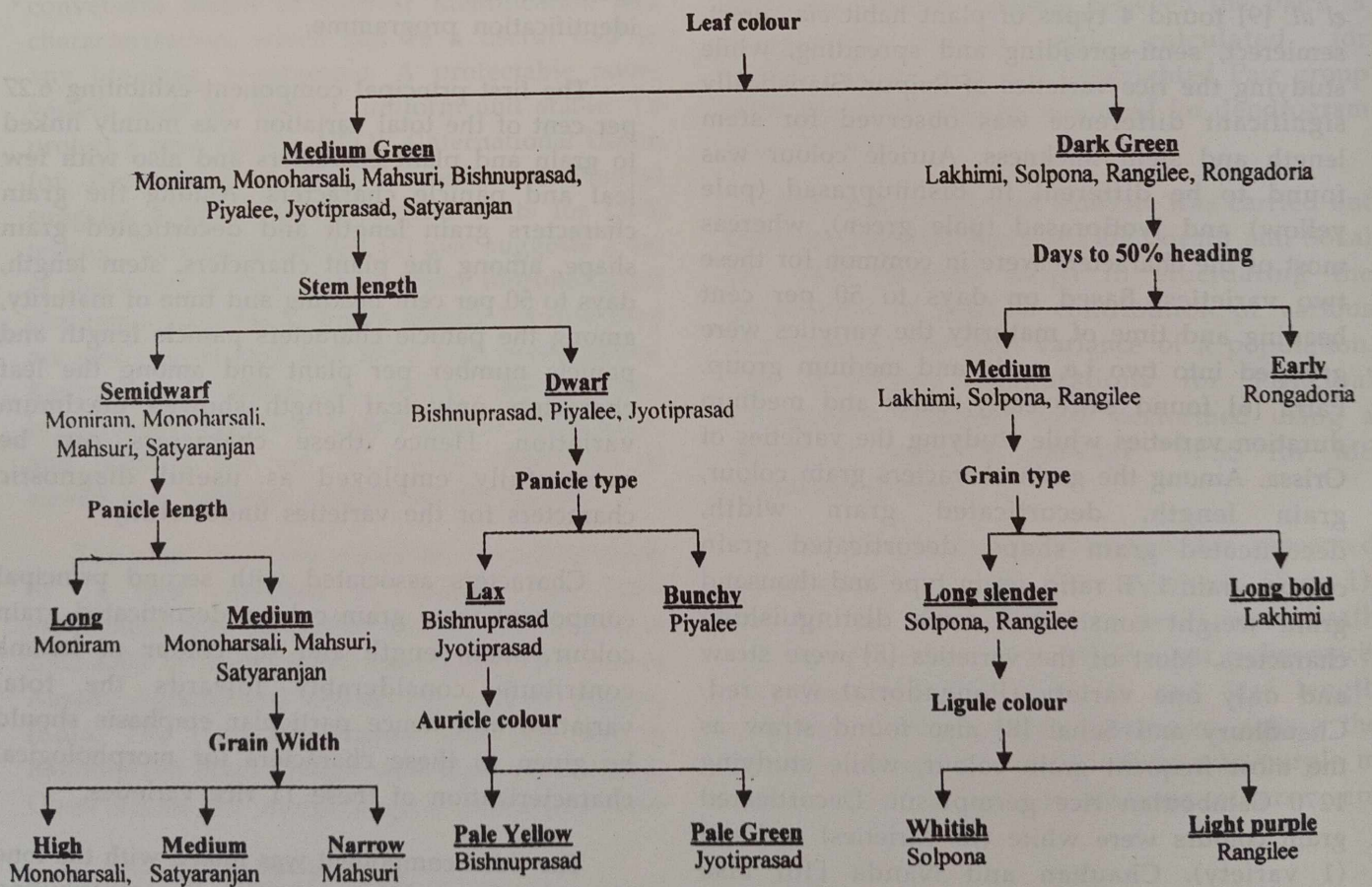


Fig. 2. Flow diagram of some morphological parameters

Table 1. Matrix of eigenvectors and values of the principal components for 34 morphological characters of rice

Characters	Principal components		
	C ₁	C ₂	C ₃
Auricle colour	-1.583	0.498	0.063
Awning	0.135	0.115	0.051
Basal leaf sheath colour	0.405	0.346	0.153
Colour of stigma	-0.297	-0.091	-0.129
Decorticated grain colour	-0.684	0.911	0.450
Decorticated grain width	-0.074	0.018	0.030
Decorticated grain length	0.352	0.046	-0.039
Decorticated grain shape	0.614	-0.29	-0.446
Density of pubescence of lemma	0.132	-0.151	0.088
Flag leaf attitude of blade (late)	-0.075	0.311	0.093
Flag leaf attitude of blade (early)	-0.140	0.165	0.068
Grain colour	-0.260	0.661	0.013
Grain length	0.523	-0.141	0.012
Grain type	-0.611	0.419	0.271
Grain width	-0.034	-0.024	0.036
Days to 50% heading	15.292	-6.248	2.435
Internode colour	-0.137	0.182	0.090
Grain L/B ratio	0.226	-0.052	-0.043
Leaf breadth	-0.028	-0.044	-0.068
Leaf colour	0.100	0.363	0.148
Leaf length	3.156	0.152	0.167
Leaf pubescence	-0.170	0.001	-0.371
Ligule colour	0.135	0.115	0.051
Time of maturity	5.413	-1.802	-7.363
Node anthocyanin colour	-0.055	0.279	0.095
Panicle curvature	-0.409	-0.063	0.081
Panicle type	-0.088	-0.150	0.196
Panicle length	0.676	0.042	0.248
Panicle number/plant	3.526	-0.862	0.133
Plant habit	-0.137	0.182	0.090
Stem length	11.838	9.217	0.242
Stem thickness	0.417	-0.070	0.153
Tip colour of lemma	0.326	0.821	-0.847
Thousand grain weight	-0.346	-1.136	0.287
Total variance	431.355	132.358	61.912
% total contribution	66.267	20.334	9.511
Cumulative %	66.267	86.601	96.112

Table 2. Minimum diagnostic characters for morphological characterization of 11 rice varieties

Grain characters

Grain colour

Grain length

Decorticated grain colour*

Decorticated grain shape*

Leaf characters

Leaf length

Panicle characters

Panicle length*

Panicle number per plant

Tip colour of lemma*

Plant characters

Stem length*

Days to 50% heading*

Time of maturity

* = Essential character in National guideline

Based on the results of principal component analysis, 11 characters were finally selected among the initial 35 morphological characters for correct and easy characterization and evaluation of these 11 rice varieties. The list of minimum characters included both quantitative and qualitative characters and is presented in Table 2.

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