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(RESEARCH ARTICLE)

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Mahalanobis's D^2 statistics of some deep-water rice cultivars of Dhemaji district, Assam for genetic divergence analysis.

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Abstract

A study has been conducted to assess the genetic divergence of ten widely cultivated indigenous deep-water rice cultivars (viz. *Panikakuwa*, *Kakuwa*, *Miabao*, *Dalbao*, *Maguribao*, *Negheribao*, *Panidhan*, *Bhubao*, *Amana* and *Happybao*), collected from different paddy growing fields of Dhemaji district, Assam. The nature and the magnitude of genetic divergence has been estimated using Mahalanobis's D^2-statistics. Highest genetic divergence has been shown by the cultivar *Negheribao*, *Dalbao*. and *Miabao* (8.09452, 7.93156 and 7.92378 respectively). Five yield attributing characters viz. length of the panicle, 1000 seeds weight, number of spikelet per panicle, panicle per plant, percentage of seed setting were studied for percentage contribution and correlation coefficient towards yield. *Dalbao* has also been found to possess several characters of ideal panicle type. *Dalbao* and *Negheribao* having superior panicle traits may be considered for inclusion in deep- water rice breeding programmes. These cultivars might be included in further hybridization programme. Highest contributing characters to grain yield were number of spikelet per panicle (66.6%) and panicle per plant (58.1%). These characters could be used as selection indices in yield improvement. The cultivar *Dalbao* shows both panicle traits of rice ideal panicle type and has also shows a good range of genetic divergence among all. Thus this cultivar shows extreme promises and hence should be considered for inclusion for deep-water rice breeding programmes and also for consumption.

Keywords: Cultivar; Correlation coefficient; D^2-statistics; Genetic divergence

1. Introduction

Deep-water rice is an important crop in flood prone areas of Assam. Rice cultivars grown in the deep-water ecosystem distinguishes itself from upland rice cultivars by its ability to survive in water depth of more than 50 cm, for at least 1 month [1]. These rice varieties have three special adaptations

- Ability to elongate with the rise of water levels.
- Develop nodal tillers and roots from the upper nodes in the water and
- The upward bending of the terminal part of the plant called 'kneeing' that keeps the reproductive parts above the water as the flood subsides.

Thus these cultivars constitute an important source of genetic variation for utilization in breeding programme of rice varieties with tolerance to flooding [2]. So, conservation and characterization of these landraces is an important step towards this direction.

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Germplasm is the determinant of success and nature of the end product in any crop improvement programme. The development of superior rice population involved the intelligent use of available genetic variability to cater the need of various farming situations of rice. Thus any wrong choice of germplasm to initiate the selection process results in the wastage of resources and labour. The knowledge of genetic variability for characters of economic importance and their heritability and genetic advance is of utmost importance in planning future breeding programme. The crosses between parents with maximum genetic divergence are generally the most responsive for genetic improvement [3]. Genetic diversity can be evaluated with morphological traits also along with DNA markers. The D2 analysis (based on multivariate analysis) developed by Mahalanobis in 1936 [4] has been found to be a potent tool in quantifying the degree of divergence in germplasm using morphological traits.

2. Materials and methods

Materials taken for present study include 10 indigenous deep water rice cultivars viz Panikakuwa, Amana, Kakuwa, Dalbao, Maguribao, Panidhan, Bhubao, Negheribao, Happybao and Miabao collected from different pockets of Dhemaji District.

Panicle traits have been studied by visual perception following SES of IRRI. [5].

2.1. Length of panicle

The average panicle length of five plants on the main culm from the base of the panicle to the top of the last spikelet excluding awns was recorded in centimeter.

2.2. Test (1000 seeds) weight

A sample of 100 well developed fresh whole seeds was collected and weighed in grams and computed to 1000 grains weight.

2.3. Spikelet's per panicle

Total number of spikelets on main panicle was counted and recorded at the time of maturity.

2.4. Percentage of seeds setting

Counted the number of well filled grains of five randomly selected panicles for each cultivar and expressed in percentage.

2.5. Panicles per plant

The total numbers of panicles per plant were recorded in five replications for each cultivar.

2.6. Genetic divergence

Genetic divergence has been determined by Mahalanobis D2 analysis with the help of computer software INDOSTAT 8.1. All statistical analysis has been done by SPSS v17.0 software.

3. Results

Regarding panicle traits, Dalbao shows highest panicle length (33.6 ±1.24), Miabao shows highest 1000 grain weight (25.26±0.101), Amana shows highest number of spikelet/panicle (367.7±6.8) and Panikakuwa shows highest percentage of seed setting (94.59±1.52). Length of the panicle has shows positive correlation with 1000 grain weight(0.517) but negative correlation with percentage of seed setting (-0.392) (Fig. 1)

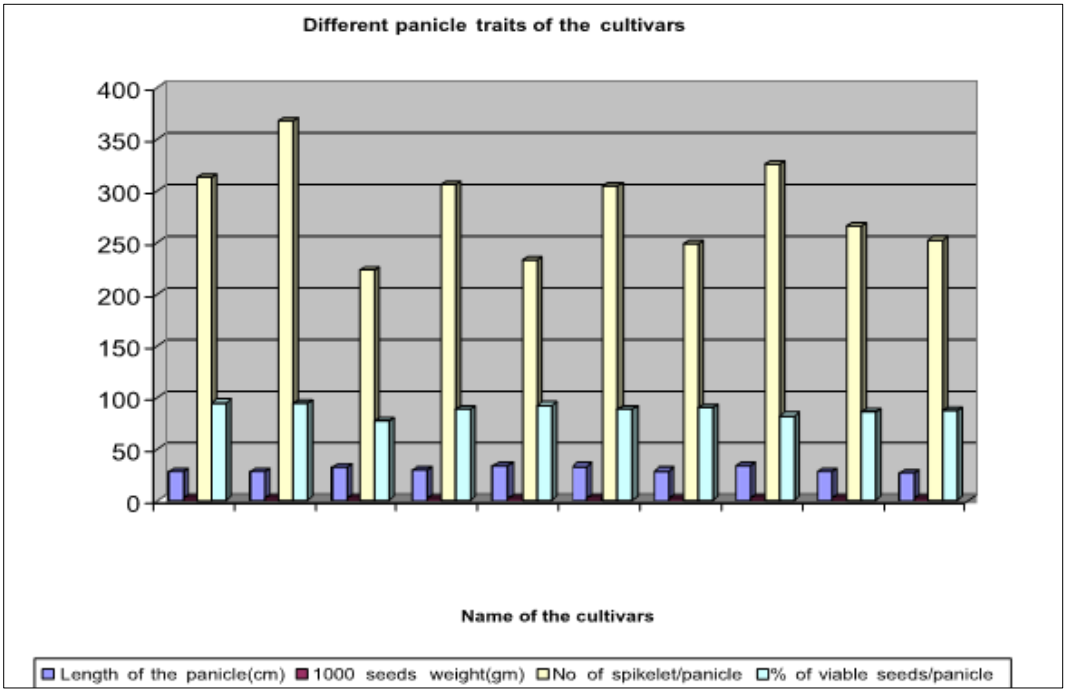

Figure 1 Different panicle traits of the evaluated cultivars

Table 1 Percentage contribution of panicle traits to grain yield

Panicle traits	**Contribution of the traits to grain yield (%)**
Length of the panicle	-94.9
1000 seed weight	49.7
No. of spikelet per panicle	66.6
Percentage of seed setting	-53.1
Panicle per plant	58.1

Number of spikelet per panicle has shows highest contribution (66.6%) towards grain yield, whereaslength of the panicle and percentage of seed setting shows negative contribution to grain yield.(Table-1)

Table 2 Mahalanobis Distance of the cultivars

Extreme values				
			Name of the cultivars	**Values**
Mahalanobis Distance	Highest	1	Negheribao	8.09452
		2	Dalbao	7.93158
		3	Miabao	7.92378
		4	Happybao	7.75369
		5	Panidhan	7.61678
	Lowest	1	Kokuwabao	5.34567

		2	Maguribao	6.20391
		3	Panikokuwa	6.69847
		4	Bhubao	7.12241
		5	Amana	7.30920

Negheribao and Dalbao has shows highest genetic divergence whereas Kakuwa and Maguribaohasshows lowest genetic divergence.(Table -2)

Table 3 Correlation coefficient of the panicle traits

	Lengthof panicle	**Panicleper plant**	**Viable seeds perplant**	**1000 seeds weight**	**Spikeletper panicle**
Length of panicle	1.000				
Panicleper plant	-0.112	1.000			
Viableseedsperplant	0.292	-0.166	1.000		
1000seedsweight	-0.234	0.292	-0.198	1.000	
Spikeletper panicle	-0.546	0.128	-0.388	0.119	1.000

Length of the panicle shows moderately negative correlation with spikelet per panicle. The other characters under consideration have shows no strong correlation with each other.

4. Discussion

In respect of panicle traits, all experimented cultivars have shows some panicle characters of rice ideal panicle type [6], such as panicle length (>17 cm) and grains/Panicle (160 grains/panicle).Dalbao, Amanabao, and Panikakuwa also shows seed setting rate of ideal rice panicle type (>90%) whereas Miabao has shows 1000 grain weight of ideal panicle type (>25 gm/ panicle). Length of the panicle shows moderately negative correlation with spikelet per panicle. The other characters under consideration have shows no strong correlation with each other. On the contrary Prasad et al. (2017) [7] and Kumar et al. (2022) [8] found positive correlation for panicle per plant with grain yield.

Assessment of genetic divergence is important in plant breeding if there is no improvement by selection. For adoption to different ecological areas, the rice cultivars ought to differ for many characteristics. These landraces plays an important role in the local food security [9]. Negheribao, Dalbao and Miabao have shows highest genetic divergence (8.09452, 7.93156 and 7.92378 respectively). These cultivars might be included in further hybridization programme. Highest contributing characters to grain yield were number of spikelet per panicle (66.6%) and panicle per plant (58.1%). These characters could be used as selection indices in yield improvement.

From the present preliminary study we can concluded that the cultivar Dalbao shows panicle traits of rice ideal panicle type. It has also shows a good range of genetic divergence among all. Thus this cultivar shows extreme promises and hence should be considered for inclusion for deep-water rice breeding programmes and also for consumption.

5. Conclusion

Present study summarizes that *Negheribao* and *Dalbao* with high genetic divergence and desirable and superior panicle traits may be considered for inclusion in deep-water rice breeding programmes. The characters number of spikelet per panicle (66.6%) and panicle per plant (58.1%) shows highest contribution to grain yield and thus these characters could be used as selection indices in yield improvement programmes of deep water rice. Rice cultivators of lowland rice fields may choose the cultivar *Dalbao* which shows both panicle traits of rice ideal panicle type and has also shows a good range of genetic divergence indicating extreme promises.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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