Identification of rice varieties based on seed and seedling characters

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Received : Accepted : 3 April 2016 Published : 20 July 2016

ABSTRACT

In this study, an attempt was made to characterize fifteen rice cultivars using seed and plant morphological traits. Identification/discrimination of all the fifteen rice cultivars were done utilizing 58 morphological characters based on National Test Guidelines and UPOV (International Union for the Protection of New Varieties of Plants). Based on anthocyanin pigmentation of stem, nodes and internodes, stigma colour, lemma tip color, grain and kernel colour, TKM 9 variety could be identified. The absence of auricle was observed in ADT 36 variety. While, based on leaf length and breadth, TKM 9, White Ponni and Bhavani varieties were identified. The characteristic golden furrow straw colour of lemma in ADT 39 and absence of white core and belly in ADT 42, ADT 45 and ADT 46 were observed. The cluster analysis of morphological data of both qualitative and quantitative revealed the grouping of genotypes into two major clusters based on anthocyanin pigmentation. In Cluster I, pigmentation was absent contained fourteen varieties and cluster II possessed only one variety (TKM 9), which had pigmentation on stem, nodes, internodes and seed.

Key words: *Varietal characterization, rice, DUS, morphology, cluster analysis*

Rice is the most important cereal grain of the world. It is estimated that half of the world's population depends on rice as its main source of food and Asia is considered as the homeland of rice. India has the largest acreage under rice growing countries of world but ranks second in production, owing to its lower productivity. Numbers of high yielding varieties have been developed and notified in the recent past, out of which many varieties are now in seed production chain. The release of large number of rice varieties has increased the task as well as the responsibilities of seed technologists in order to ensure the quality of seed. Seed technologists must be well equipped to identify different varieties and hybrids, both at field and seed level. Varietal descriptions given by the breeders most often relate to field characters and not sufficient to identify genotypes or seed lot adequately.

The success of an improved variety in the farmers field depends upon the availability of seeds with desired genetic purity. Only high quality seeds of assured genetic purity can be expected to respond fully to all other inputs. Maintaining genetic and physical purity of seed is of utmost importance and will enable growers to exploit the full benefits of introduced improved varieties. There are 2500 rice varieties under cultivation and with several more in the offing; increasingly detailed data is required to distinguish a cultivar from another, thereby making identification an essential prerequisite for inclusion in varietal lists (Faccioli *et al.* 1995).

Methods for measuring and recording varietal characteristics, simple and rapid operations are preferred with suitable precision apparatus. It is recognized that, many of the proposed techniques and methods are inadequate to describe fully and the variation found in the cultivated varieties or the intricate growth behaviour of the rice plant in different environments.

The present investigation was undertaken at the Department of Seed Science and Technology, Agricultural College and Research Institute, Madurai, Tamil Nadu, India during the 2010-2012 with fifteen rice cultivars viz., ADT 36, ADT 37, ADT 39, ADT 42, ADT 45, ADT 46, Co 43, Co 48, Co 50, ASD 16, MDU

5, TKM 9, White Ponni, Bhavani and BPT 5204. The 58 qualitative and quantitative morphological traits based on National Test Guidelines and UPOV (International Union for the Protection of New Varieties of Plants) were recorded at different crop growth stages. The data on DUS characters were recorded on single plant basis in each of the genotypes. Observation for days to heading and maturity were recorded on plot basis.

The scores for qualitative and quantitative traits were observed as per the National Test Guidelines of DUS. The binary data score was utilized to construct the dendrogram. The genetic associations between genotypes were evaluated by calculating the Euclidian dissimilarity coefficient for pairwise comparisons based on the morphological characters. Similarity matrix was generated through SimInt programme NTSYS-pc software version 2.02 (Rohlf 1998). The similarity coefficients was estimated and dendrogram was constructed using Unweighted pair-Group Method with Arithmetic Average (UPGMA) (Mathew *et al.* 2000).

Morphological markers provide easy, rapid, and convenient means of cultivar identification and characterization, which is useful in any breeding programme.

Morphological descriptors can provide unique identification of cultivated varieties (Molina - Cano and Elena-Rossello 1978) and they reflect not only the genetic constitution of the cultivar, but also the interaction of the genotypes with the environment (G x E) within which it is expressed (Lin and Bins 1984).

Morphological descriptors have been in place since the dawn of genetics and several workers have classified the varieties based on morphological traits (Kikkawa 1912 and Graham 1913). In the current study, fifteen rice genotypes were characterized based on 58 qualitative and quantitative traits as per the National guidelines for DUS testing. The morphological trait observations were taken at different stages of growth in three replications for each genotype.

In taxonomical approach, the variations were observed for both the quantitative and qualitative characters *viz.*, intensity of green colour, pubescence of leaf blade surface, colour of ligules, length and width of blade, attitude of culm, time of heading, flag leaf attitude, density of lemma pubescence, stigma colour, stem length, time of maturity, stem length excluding panicle, anthocyanin coloration of nodes and internodes, colour of lemma tip, panicle characters, 1000 seed weight, seed length and width, decorticated seed length and width, shape and colour of decorticated seed and expression of white core and white belly for discrimination of the rice cultivars. Based on the leaf green colour intensity, it was light in Bhavani, White Ponni and TKM 9 and medium in ADT 36, ADT 49, ADT 42, ADT 45, ADT 46, Co 43, Co 48, Co 50, ASD 16, MDU 5 and BPT 5204 and ADT 37 alone had dark intensity. The intensity of green colour was found to be a useful trait to characterize the genotypes (Rosta 1975). However, it will not be reliable for identification of cultivars, because the intensity of green colour of many cultivars gets bleached when the plants are left in the field to dry in sun or as a result of influence of fertilizers and environmental conditions (Kooistra, 1964). Tamilkumar (2009), Eevera (2003) and Monika *et al*. (2007) used this trait to characterize the 26 cultivars in rice. Ravi (2000) while classifying 40 varieties, opined that morphological descriptors reflected not only the genetic constitution of cultivar but also interaction of genotype and environment. Based on anthocyanin pigmentation of stem, nodes and internodes, ligule colour, basal sheath colour, stigma colour, lemma tip color, grain and kernel colour, TKM 9 variety could be identified. Anthocyanin pigmentation was one of the earliest characters used to classify rice varieties as it was the most prominent character (Hector, 1930, Sethi and Sexena, 1930 and Ram and Chetty, 1934). Ravi (2000) used this trait to characterize 40 rice cultivars. Basal pigmentation was scored for its presence or absence, but intensity of purple pigmentation was not observed as it is liable to vary depending on the skill of the observer and the effect of the environment within cultivars as well as between cultivars. Varieties ADT 37, ADT 39, ADT 42, ADT 45, ADT 46, Co 43, Co 48, Co 50, White Ponni, Bhavani, TKM 9, ASD 16, MDU 5 and BPT 5204 possessed leaf auricles while it was absent in ADT 36 only. Similarly, Maheshwaran (2010) characterized ten rice cultivars and reported leaf auricles were absent in ADT 36 and TRY 2, while Co 47, Co 48, Co 49, Co 50, TRY 1, ADT 46, CR 1009, BPT 5204 had leaf auricles as opined by Singh *et al*. (2004) and Madhavilatha and Suneetha (2005). Based on leaf length and breadth, TKM 9, White Ponni and Bhavani varieties were identified. Singh *et al*. (2004), Zafar *et al*. (2004) and

Monika *et al*. (2007) also grouped 19 varieties of rice based on length and width of blade. Maheshwaran (2010) reported that 60% of the rice varieties possessed medium category and 10 % fell under longer blade length. In the present study, 66 % of the varieties had medium category and 33% of the varieties had long leaf blade. This is the important qualitative trait for varietal identification, ADT 39 was identified based on golden furrow in straw colour of lemma. Ravi (2000) used this trait for varietal identification of 40 rice varieties and reported that morphological descriptions reflect not only the genetic constitution of the cultivar, but also the interaction of the genotypes with environment (GxE) in which it was expressed. On the other hand Mehla and Satish (2008) observed that colour of lemma and palea was not useful in distinguishing rice cultivars. Siddiqui *et al*. (2007) reported that glume colour was not specific to genotypes that occurred at various elevations. The white core and white belly were absent in ADT 42, ADT 45 and ADT 46. Earlier literature quoted the presence of pearl spot (Rosta, 1975 and Vanangamudi *et al*. 1988) due to the occurrence of amylose (Singh *et al*. 2004).

Assessment of genetic variation is an essential component in genotype characterization and conservation. Continued usage of morphological data to describe cultivars indicates that these data retain popularity as descriptors till date (Pauksens 1975). In the present study, the characterization of different genotypes of rice was carried out using a wider range of simple and complex morphological traits. Morphological descriptors provide unique identification of cultivated varieties but they not only reflect the genetic constitution of the cultivar but also the environmental interaction within which it is expressed (Lin and Bins, 1984; Patterson and Weatherup 1984). The cluster analysis of morphological data, both qualitative and quantitative, revealed the grouping of genotypes into two major clusters formed based on anthocyanin pigmentation *viz.,* cluster I and cluster II. In Cluster I, pigmentation was absent and contained fourteen varieties. Cluster II possessed one variety (TKM 9) which had pigmentation on stem, nodes, internodes and seed.

Cluster I was further subdivided into A and B based on leaf auricles. A group consisted of only one genotype (ADT 36), which does not have leaf auricles against group B that auricle in possessed thirteen varieties. Based on time to maturity, B group was again subdivided into B1 and B2 with four varieties in B1 and nine in B2 wherein, Co 43 and Co 48 showed higher similarity. Among 58 qualitative and quantitative characters, Co 43 and Co 48 were similar in 54 characters.

The distribution pattern of genotypes into different clusters did not reveal any similarity between morphology and type of grain variation as genotypes chosen from same grain type was found in different clusters as well as in the same cluster. Similar results were reported in rice by earlier workers (Keshavulu 2006 and Tamilkumar 2009).

REFERENCES

Eevera T 2003. Morphological, biochemical and molecular characterization of rice varieties and hybrids. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu.

Faccioli P, Terzi V, Monetti A,Nicola J and Pecchioni N 1995. b-hordein STS markers for barley genotypes identification : comparison with RFLPS, hordein A-PAGE and morphophysiological traits. Seed Sci. & Technol., 23: 415-427.

Graham RJD 1913. Preliminary note of the classification of rice in the central provinces. Meni. Dept. Agric. India Bot. Survey, 6: 209-229.

Hector GP 1930. Agricultural and botanical classification of rices of Bengal. Agricul. J. India, 25: 151-153.

Keshavulu K 2006. Identification of microsatellite markers for distinguishing elite fine grain rice varieties and hybrids and their utilization in seed purity assessments. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore.

Kikkawa S 1912. On the classification of cultivated rice. J. College of Agric., Tokyo 3: 1-108.

Kooistra E 1964. Identification research on pulses. Proc. Int. Seed Test. Asso., 29(4): 937-947.

Lin C.S. and Bins M R 1984. The precision of cultivar trials within eastern cooperative tests. Can. J. Plant Sci., 64: 587-591.

Madhavilatha L and Suneetha Y 2005. Studies on genetic divergence in rice germplasm lines. Madras Agric. J., 92: (1-3) 12-16.