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Phenotypic Diversity of Farmers' Variety Of Rice (*Oryza Sativa* L.) in Madhya Pradesh

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ABSTRACT
Richness in the genetic pool can be maintained only by conserving the landraces. From this standpoint of their importance in biodiversity the present study was designed to identify and differentiate farmers' variety by morphological markers so as to protect the rice genetic resource of Madhya Pradesh. 261 farmers' variety of rice were collected from 14 rice-growing district of Madhya Pradesh and were investigated for 21 qualitative traits. Most of the traits were polymorphic except coleoptile colour, presence of leaf collar, presence of leaf ligule, shape of ligule and presence of male sterility. This investigation will be helpful for breeders, scientists and researchers for recognition, reclamation and preservation of useful qualities for crop improvement and furthermore to look for assurance under Protection of Plant Varieties and Farmer's Rights Act.
Key words : Farmers' variety, Landraces, *Oryza sativa*, Rice, Morphological character, Qualitative traits

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INTRODUCTION

Agriculture in Madhya Pradesh during the early 1900s, was mainly based on cultivation of traditional cultivars, now, the genetically diverse traditional crop varieties (or landraces) that were once grown by the farmers of Madhya Pradesh have been largely replaced by fewer genetically uniform commercially bred cultivars, which now dominate agricultural production. The domesticated rice differs from its wild progenitor in large arrays of morphological and physiological traits. The cultivated ones may support mechanical harvesting and give high yield but could not compete with the wild ones in terms of pest and disease tolerance and nutrient content. Green revolution has considerably improved production of food grains in our country and its role in achieving status of self sufficiency in food grain is beyond any doubt [16]. But high yielding varieties, which are the back bone of green revolution, have indirectly stimulated erosion of landraces and wild varieties of rice [3]. Presently more than 90% of rice cultivation is being done using high yielding variety only. Obviously landraces are disappearing fast [2, 5, 7]. Importance of landraces can never be denied in agriculture system, because improvement in existing variety depends upon desirable genes which are possibly present in landraces and wild varieties only [13, 5]. Landraces offer a valuable gene pool for future breeding program [9, 12]. Resource poor farmers who were once considered as the main guardian of traditional variety of rice are also desirous in high production rather than genetic diversity therefore efforts have been made for *Ex-Situ* conservation of rice landraces of Madhya Pradesh and its characterization at morphological level.

MATERIAL AND METHOD

261 farmers' variety of rice were collected from fourteen districts of Madhya Pradesh having varied rice-growing ecosystems with the objective to characterize the genetic components underlying the differences between cultigens. The study was conducted on the site of Seed Breeding Farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. The average rainfall and temperature during the experimental season (June to November) was 124.32 mm 27.1^{o}C respectively and the soil type is black soil. The experiment was laid

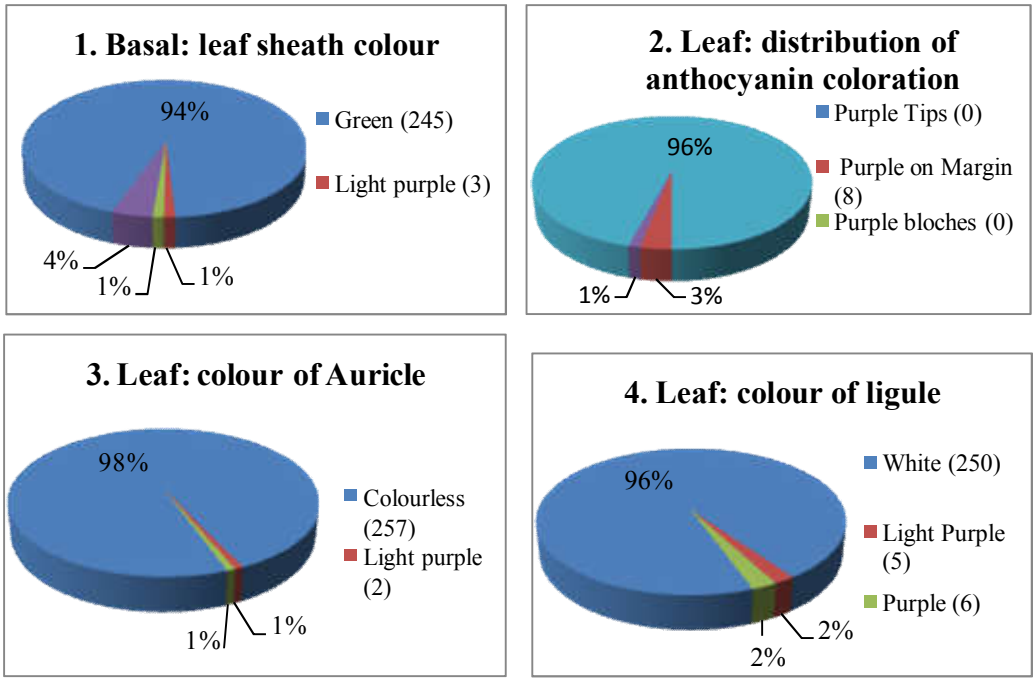
out in Randomize Complete Block Design having three replications. Each entry was sown in a plot comprising of four rows having three meter length at spacing of 20 cm between rows and 15 cm between plants. The recommended agronomical practices were followed to raise good crop in the season. Observations were recorded based on the rice descriptors given by Directorate of Rice Research [8]. Qualitative traits along with its descriptors and stage of observation have been depicted in Table 1. Data has been collected from two consecutive *Kharif* season, 2017 and 2018.

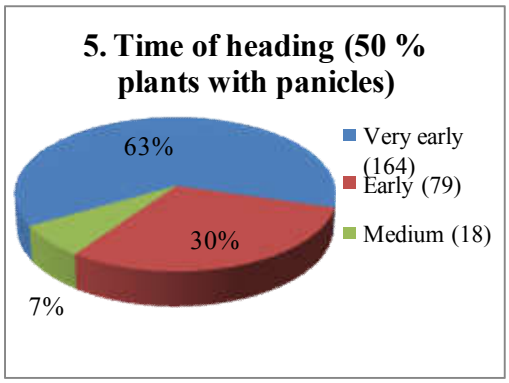
Table1. Qualitative characters along with their descriptors

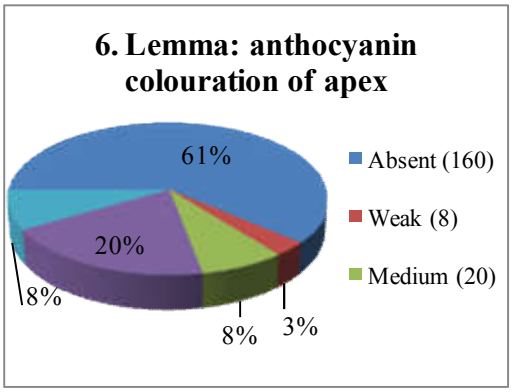
	Qualitative traits	**Descriptors**	**Stage of observation**
1	Coleoptile colour	Colourless, Green, Purple	Emergence of first leaf through coleoptiles
2	Basel leaf sheath colour	Green, light purple, Purple lines, uniform purple	Booting
3	Leaf: distribution of anthocyanin coloration	On tips only, on margens only, in bloches only, uniform	Booting
4	Leaf: colour of Auricle	Colouress, light purple, purple	Booting
5	Leaf: collar	Present, Absent	Booting
6	Leaf: ligule	Present, Absent	Booting
7	Shape of ligule	Truncate, Acute, Split	Booting
8	Leaf: colour of ligule	White, light purple, purple	Booting
9	Time of heading (50 % plants with panicles)	Very early, early, medium, late	Booting
10	Male sterility	Present, Absent	Anthesis half way
11	Lemma: anthocyanin colouration of apex	Absent, Medium, Strong, Very strong	Anthesis half way
12	Spikelet: colour of stigma	White, light purple, purple	Anthesis half way
13	Stem length (excluding panicle)	Very short, short, medium, long, very long	Milk development stage
14	Stem: anthocyanin colouration of node	Absent, present	Milk development stage
15	Panicle length	Short, medium, long, very long	Caryopsis hard
16	Panicle: exsertion	Partially exerted, mostly exerted, Well exerted	Caryopsis hard
17	Flag leaf: attitude of blade (late observation)	Erect, Semi erect, Horizontal, Deflexed	Caryopsis hard
18	Awn colour	Yellowish white, Yellowish brown, Brown, Reddish brown, Light red, Red, Light purple, Purple black, Absent	Caryopsis hard
19	distribution of awns	Tip only, Upper half only, Whole length	Caryopsis hard
20	Sterile lemma colour	Straw, gold, red, purple, brown, black, white	Caryopsis hard
21	Decorticated grain colour	White, Light brown, Variegated, Brown, Dark brown, Light red, red, Variegated purple, Purple, Dark purple	Caryopsis hard

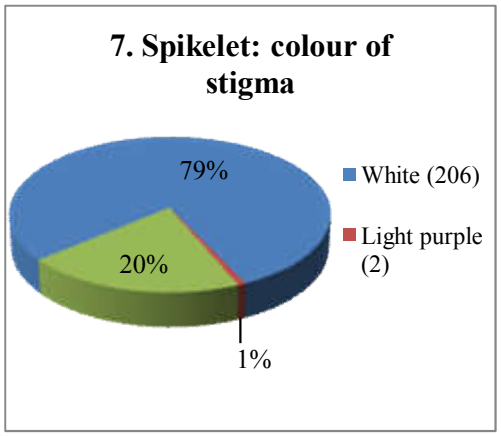
essential in plant breeding as it helps in identifying a particular plant variety and maintaining the gene pool. Qualitative characterization is one of the genetic diversity assessment approach. Out of 21 Qualitative character under study except, coleoptile colour, presence of leaf collar, presence of leaf ligule, shape of ligule and presence of male sterility, all the other 16 characters were found to be ploymorphic. Sinha and Mishra [14] also found coleoptile colour, presence of leaf collar, presence of leaf ligule, shape of ligule and male sterility to be monomorphic. The basal leaf sheath colour of most of the farmers' variety was found to be green but varieties like Tendumari, Jeera Shankar and Padma showed purple lines and Karanphool, Biranjiphool and Safed Saraiya showed light purple colour, eleven varieties having uniform purple colour basal leaf sheath are Sitha, Monya Kali, Nagkeshar, Sultho, Sarsari Dhan, Sitri, Lohandi, Lallohandi, Ranikajal, Kalajeera and Badalphool. Regarding leaf blade colour only three varieties, namely, Nagkeshar, Monya Kali and Padma had uniform purple colouration. Trait leaf: colour of auricle had two varieties each showing light purple (Jeera Shankar and Padma) and purple colouration (Sultho and Sitri). For trait leaf: colour of ligule three alternative forms of traits were observes, maximum of which had white colour ligule but five varieties showed light purple colour, namely, Jeera Shanker, Padma, Lohandi, LalLohandi and Ranikajal and six varieties showed purple colour, namely, Chhinoor (Lohara), Nagkeshar, Sultho, SarsariDhan, Sitri and Gurmatiya. 63% varieties showed very early heading time while medium and early heading time was contributed by only 30% and 7% of the varieties and non of the varieties was of late type. This result shows that farmers prefer varieties which takes less time (<71 days) for 50% heading. Six polymorphic forms of Lemma: anthocyanin colouration of apex was found 20% showed

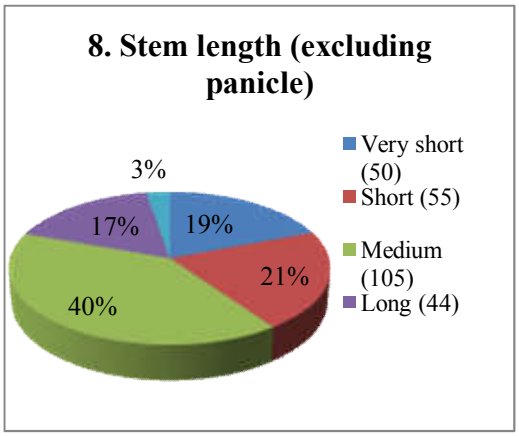
strong, 8% very strong and medium, 3% weak and 61% had no colouration. Two varieties i.e. lalitaDhan and DanguDhan was found to had light purple stigma colour and fifty three varieties showed purple colour stigma rest of the varieties had white colour stigma. Maximum varieties (40%) had stem length (excluding panicle) ranged between 111cm to 130cm, 21% varieties was of short stature, 19% varieties were very short, 17% varieties were long and only 3% of the varieties were of long type. Five varieties, Tedumari, BhataMakdi, Nungi, Sitri and lohandi showed stem: anthocyanin colouration of node. Regarding panicle length 46% varieties showed medium length ranging from 21cm to 25cm. 33% varieties shad long panicle, 15% had very long panicles and 6% had short type panicles. Trait panicle: exsertion was found to be trimorphic, 50% varieties had well exerted panicle, 44% varieties had mostly exerted panicle and panicles of 6% varieties were partially exerted. Six varieties i.e. KamleshDhan, DhanDharm, HriDhan, Gurmatiya, Bhejri and Nawari showed erect flag leaf attitude of blade even at its maturity while maximum varieties (73%) had semi erect attitude of flag leaf. Presence of awns is a protective characteristics of a genotype, it helps prevent grazing. Varieties Haruhan, Lalajeera, ChhindiKapoor, Barra Dhan, SairiChhote, Basmati Shiv, Retua, Mangar(Raimun), DubrajTeduha, Vishnu Bhog, Sonkharchi Shiv, VeerbhanmangalDhan, KalimoonchPouni, Sheri Karhi, Dubraj, Kali Kammo, Sukraphool, JhularDhan had awns throughout the length of its panicle and Varpani Dhan, Kislai Dhan, Khurdy, DihulaSafed and BiranjiphodJanki had awns on the upper half portion of the panicle. While NihalDhan, Kardhana, Barrachhatridhan, HansaKanak, MakrandMahagaon, BakramParaswada, Chhindikappoor, Karanphool, Bhejri and Rakera had considerably short awns only on the tips of the panicle. Trait awn colour was found to be pentamorphic, but most of the varieties posses yellowish white colour though two varieties, Lalajeera and SairiChhote had Yellowish brown awns, three varieties i.e. Mangar(Raimun), Sonkharchi and Kali Kammo had reddish brown awns and four varieties Sukraphool, ChhindiKapoor (from Balaghat), KalimoonchPouni and Chhindikappoor (from Dindori) had purple black awns. Yan *et al* [17], Nethra *et al* [8] and Joshi *et al* [4] observed polymorphism for traits of panicle awns, stem anthocyanin coloration of nodes, stigma colour. Varieties could be grouped into seven classes based on sterile lemma colour most of which had straw colouration and only three varieties which are, Kali Kammo, Sukraphool and Sukdas had purple straw colour. Kernal colour is the colour of the pericarp after removing the husk. White colour kernel was found abundantly among the farmers variety. Only one variety i.e. HaruDhan posses dark purple colour and Kardhana posses brown colour kernel. Nine varieties having dark brown kernel are LalDhan, Kali Saraiya, AssanChuni, ChhotaSathiya, Kardhana, DihulaSidhi, KarhaniJuri, BharriDhan and Dihula and six varieties having light red kernel colour are Thhari Devi, Khada, HridhanBrij, Kardhana, BagariNaresh and SheraKher. Sinha *et al* [15] also reported similar results for kernel colour and lemma palea colour.

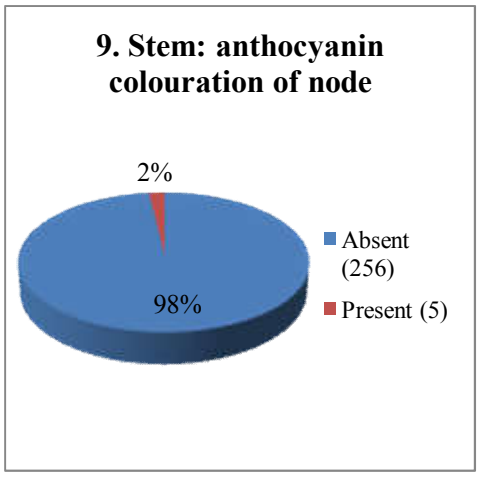


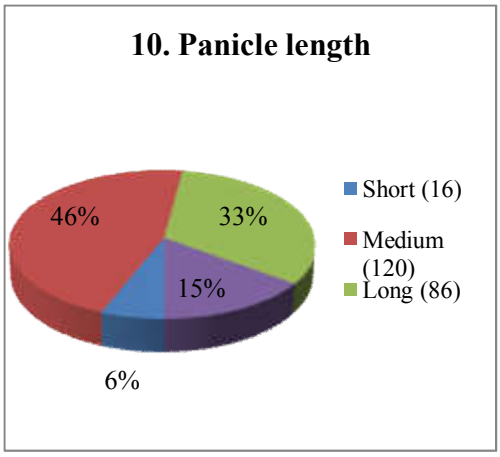

5. Time of heading (50 % plants with panicles)
63%
30%
7%
Very early (164)
Early (79)
Medium (18)


6. Lemma: anthocyanin colouration of apex
61%
20%
8%
8%
3%
Absent (160)
Weak (8)
Medium (20)


7. Spikelet: colour of stigma
79%
20%
1%
White (206)
Light purple (2)


8. Stem length (excluding panicle)
3%
17%
19%
21%
40%
Very short (50)
Short (55)
Medium (105)
Long (44)


9. Stem: anthocyanin colouration of node
2%
98%
Absent (256)
Present (5)


10. Panicle length
46%
33%
15%
6%
Short (16)
Medium (120)
Long (86)

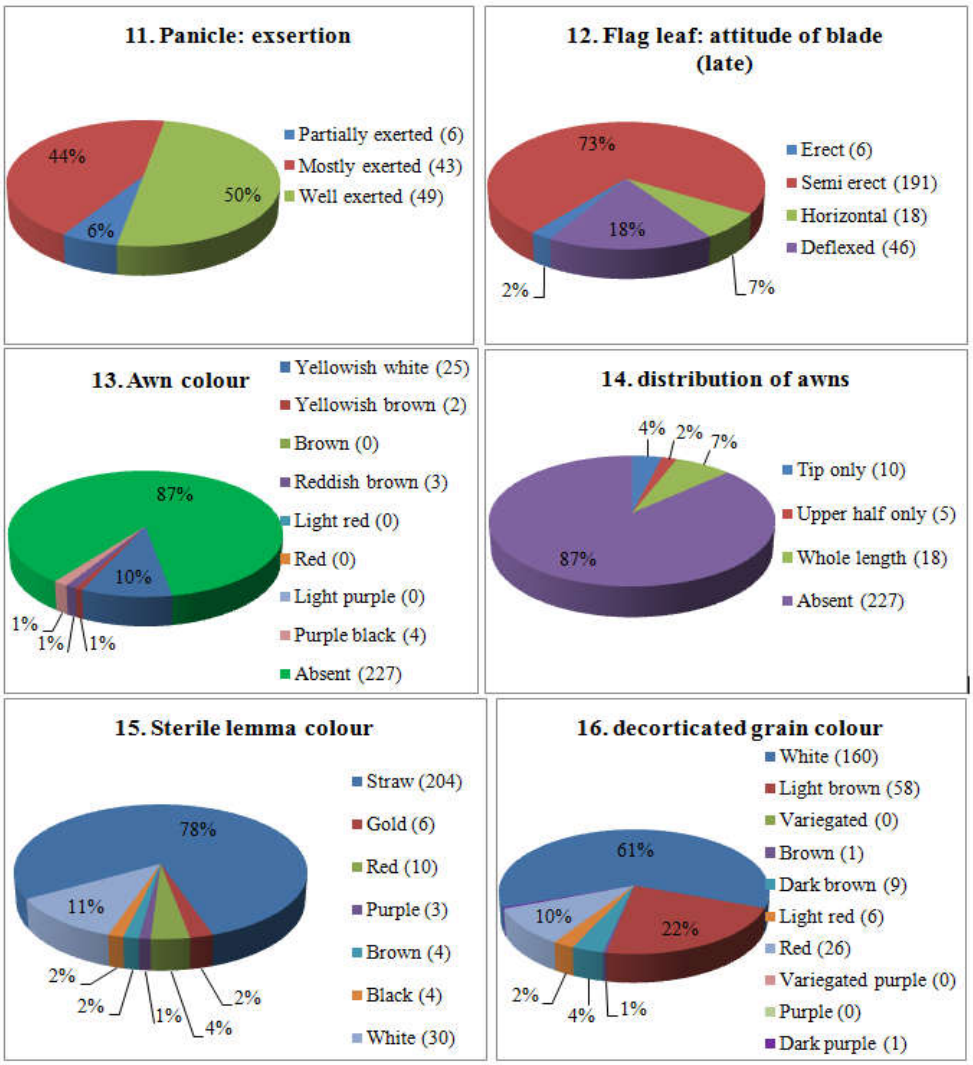


Fig 1: Frequency distribution of important morphological characters

Preliminary result on morphological diversity of Farmers' variety of rice collected from different rice grown ecology of Madhya Pradesh showed that the studied varieties posses variations for all the traits under study. Thus, all the varieties were significantly distinct from each other for each qualitative trait with the exception to coleoptile colour, presence of leaf collar, presence of leaf ligule, shape of ligule and presence of male sterility, which were monomorphic. In the studied varieties, various degree of purple anthocyanin pigmentation in leaves, stigma, auricle, ligule, lemma palea, awns and kernel were found. Nagkeshar, Monya Kali and Padma had uniform purple leaf blade therefore looked like an ornamental plant. Though rice is a self pollinated crop purple colour stigma is common in wild varieties as it attract insets and aids to its survival. A variety HaruDhan collected from Mandla district had Dark Purple colour pericarp (outer layer) of kernel. This rice is high in antioxidant and nutritive value. Anthocyanin accumulation in different tissues is sometimes involved in photosynthesis, defense, and reproduction and in many physiological functions, such as modulation of hormone responses, protection from damage by ultra-violet radiation, and defense responses to biotic and abiotic stresses [10; 1, 6]) and important secondary metabolites in rice [11]. The information collected herein would help in producing a data base which will help in identification of the varieties and thus protect farmer's right under Protection of Plant Varieties and Farmer's Rights Act.

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