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## Agro-morphological characterization in grain amaranth (*Amaranthus hypochondriacus* L.)

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### Abstract

The present experiment carried out during rabi 2021-22 at the experimental area of the Department of Genetics and Plant Breeding at Research cum Instructional Farm, IGKV, Raipur, Chhattisgarh using 40 genotypes of grain amaranth including four check variety viz., BGA-2, GA-2, BGA-7 and C.G. Rajgira 1 with the objective of characterization of agro-morphological traits. Grain amaranth is a potential crop that exhibits a high degree of qualitative morphological diversity. All forty genotypes significant differences for qualitative characters viz. early plant vigour (poor, good and very good), plant growth habit (spreading, erect and drooping), leaf colour (pinkish green, yellowish green, green and reddish green), inflorescence colour (yellowish green, pink and yellow), inflorescence compactness (lax, intermediate and dense), stem colour (yellow, yellowish green and reddish green), stem surface (ridged and smooth), inflorescence shape (globose, straight and semi-drooping), inflorescence spininess (smooth and spiny) and seed colour (creamish, pale yellow and brown). These study has enabled broad differences between group of lines to be characterized and has identified particular lines with characteristics that recommend them for inclusion as parents in inheritance studies designed to elucidate the contribution that individual character make to overall productivity, attractiveness and nutrition of this useful.

**Keywords:** Characterization, checks, grain amaranth, morphological traits, accessions, variation

### Introduction

Grain amaranth (*Amaranthus hypochondriacus* L.) also known as Rajgira or Pigweed or Ramdanna belongs to family amaranthaceae, self-pollinated ( $2n = 32$ ) crop that consists of hardy, weedy, herbaceous and fast growing pseudo-cereal that are widely cultivated in India in the sub-Himalayan ranges and in the Nilgiri Hills of South India. It has 14-16% protein, 5.5-6% lysine and 6-10% oil. It is still underutilized crop due to lack of popularity and poor yield. In addition to proteins, carbohydrates, dietary fibre and lipids, grain amaranth also contains high levels of calcium, iron, magnesium, phosphorus, copper, manganese cobalt, chromium, iodine, selenium, zinc, molybdenum and sodium like other cereals (Becker *et al.*, 1981)<sup>[1]</sup>.

The exact information about the statistics on acreage and production in India is lacking. However, as a grain crop it is estimated to be grown in about 40-50 thousand hectares with 1200 kg/ha in India (Dua *et al.*, 2009)<sup>[3]</sup> and 2000 kg/ha productivity in plain zone of Chhattisgarh (Yadav, 2016)<sup>[6]</sup>. The existence of variability within population for different agro-morphological characters is necessary for a successful breeding programme which generally depends on selection of suitable parents. Characterization can only be possible by their efficient management, which requires knowledge of genetic diversity of traits to facilitate designing of efficient breeding strategies for achieving specific objectives. The diversity analysis can easily be sort out the diverse genotypes to create segregating population with maximum variability for selection and introgression of desirable genes from germplasm lines. Descriptors may be utilized as genetic markers.

### Materials and Methods

Forty genotypes of grain amaranth were evaluated in RBD with 3 replications at the experimental area of the Department of Genetics and Plant Breeding at Research cum Instructional Farm, IGKV, Raipur during rabi- 2021-22 and 2022-23. Each genotype was grown in a plot size 1.0 m × 3.0m keeping row to row and plant to plant spacing of 45×15cm for each plot in each replication. All normal recommended agronomic practices, irrigation and plant protection measures were followed during the crop growth period.

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Data were recorded on 10 characters *viz.* early plant vigour, plant growth habit, leaf colour, inflorescence colour, inflorescence compactness, stem colour, stem surface, inflorescence shape, inflorescence spininess and seed colour. These observation were carried out using the ICAR (2015) [7] descriptor list of grain amaranth.

### Result and Discussion

The data on qualitative characters of grain amaranth are presented in Table 1. All forty genotypes significant differences for qualitative characters. Out of 40 genotypes early plant vigour 7 genotypes were recorded poor early plant vigour, 26 were good and 7 were recorded very good early plant vigour. 36 genotypes showed erect type of growth habit whereas the 4 genotypes exhibited spreading type plant growth habit.

For leaf colour the 23 genotypes showed green colour of leaf whereas yellowish green leaf colour was exhibited in the 3 genotypes. The reddish yellow leaf colour was recorded in 14 genotypes. Similarly, for inflorescence colour the 5 genotypes showed yellowish green inflorescence colour whereas, 15 genotypes red colour of inflorescence. The green colour of inflorescence was recorded in 19 genotypes while 1 genotypes showed reddish-green colour of inflorescence. The lax inflorescence compactness was recorded in 3 genotypes

whereas 27 genotypes recorded intermediated type of inflorescence compactness. The dense inflorescence compactness was found in 10 genotypes. For stem colour the 27 genotypes showed yellowish-green stem colour whereas the 13 genotypes exhibited reddish-green stem colour. The 29 genotypes showed smooth type of stem surface whereas 11 genotypes exhibited ridged type of stem surface. For inflorescence shape the 21 genotypes showed semi-drooping type of inflorescence shape whereas the 19 genotypes exhibited straight type of inflorescence shape. Further, the 15 genotypes showed smooth type inflorescence spininess whereas the spiny type inflorescence was exhibited in the 25 genotypes. For seed colour all of the genotypes exhibited creamish type of seed colour.

The characterization results revealed wide range of variation for most of the morphological parameters. Large range of variation for morphological parameters was recorded by Jacques *et al.*, 2022 [4] for number of leaves/plant, Yadav, 2021 [8] for leaf colour, stem colour, inflorescence colour and seed colour, Mvuyeni *et al.*, 2021 [5] for growth habit, leaf colour, inflorescence colour, stem colour, inflorescence spininess and seed colour and Bhalekar *et al.*, 1981 [2] for growth habit, leaf colour, inflorescence colour, inflorescence shape, stem surface and seed colour.

**Table 1:** Frequency distribution and percentage value of agro-morphological traits of forty indigenous accessions of grain amaranth

Traits	Descriptors (Parameters)	Name of the accessions	No. of accessions	Frequency (%)
Early plant vigour	1. Poor	IC95333, IC95288, IC95291, IC95298, IC95299, IC41765 and SKGPA 177.	7	17.5
	2. Good	IC95302, IC95321, IC95580, IC42427, IC93962, IC95593, IC37156, IC38483, IC38501, IC38542, IC41766, IC41768, IC41769, IC42008, IC42265, SKGPA179, SKGPA172, SKGPA182, SKGPA175, SKGPA 173, SKGPA 180, SKGPA 174, IC46789, IC15660, GA 2 (C) and RMA 7 (C)	26	65
	3. Very good	IC95308, IC42281, SKGPA178, SKGPA181, SKGPA176, BGA 2(C) and C.G. Rajgira 1(C)	7	17.5
Plant growth habit	1. Erect	IC95302, IC95308, IC95321, IC95333, IC95288, IC42427, IC93962, IC95593, IC95298, IC37156, IC42277, IC38483, IC38501, IC38542, IC41765, IC41766, IC41768, IC41769, IC42281, IC42265, SKGPA179, SKGPA178, SKGPA172, SKGPA182, SKGPA181, SKGPA176, SKGPA175, SKGPA173, SKGPA177, SKGPA174, IC46789, IC15660, BGA2(C), GA2(C), RMA7(C) and C.G Rajgira 1(C)	36	90
	2. Spreading,	IC95580, IC95291, IC95299 and IC42008.	4	10
	3. Drooping,	-		
	99. Others	-		
Leaf colour	1. Yellow	-		
	2. Yellowish- orange	-		
	3. Yellowish- green	IC37156, BGA2(C), and RMA7(C)	3	7.5
	4. Orange	-		
	5. Green	IC95302, IC95321, IC95333, IC95288, IC42427, IC93962, IC95593, IC95291, IC95298, IC42277, IC38483, IC38501, IC38542, SKGPA179, SKGPA178, SKGPA172, SKGPA181, SKGPA173, SKGPA177, SKGPA174, IC46789, IC15660 and C.G. Rajgira 1 (C)	23	57.5
	6. Greenish-orange	-		
	7. Pink	-		
	8. Pinkish-green	-		
	9. Reddish –yellow	IC95308, IC95580, IC95299, IC41765, IC41766, IC41768, IC41769, IC42008, IC42281, IC42265, SKGPA182, SKGPA176, SKGPA175, and GA2(C).	14	35
	10. Reddish- green	-		
	11. Red	-		
	12. Dark-red	-		
99. Others	-			
Inflorescence colour	1. Light-yellow	-		
	2. Yellow	-		
	3. Yellowish-orange	-		
	4. Yellowish- green	IC95302, IC38542, SKGPA173, SKGPA177, and BGA2(C)	5	12.5
	5. Orange	-		

	6. Pink,	-		
	7. Pinkish- green	-		
	8. Purple	-		
	9. Red	IC95308, IC95580, IC95299, IC41765, IC41766, IC41768, IC41769, IC42008, IC42281, IC42265, SKGPA182, SKGPA176, SKGPA175, IC37156, and GA2(C)	15	37.5
	10. Reddish- green	SKGPA174	1	2.5
	11. Green	IC95321, IC95333, IC95288, IC42427, IC93962, IC95593, IC95291, IC95298, IC42277, IC38483, IC38501, SKGPA179, SKGPA178, SKGPA172, SKGPA181, IC46789, IC15660, RMA7(C) and C.G Rajgira1(C).	19	47.5
	99. Others	-		
Inflorescence compactness	3. Lax	IC42427, IC95299 and IC41769	3	7.5
	5. Intermediate	IC95333, IC95580, IC95288, IC93962, IC95593, IC95291, IC95298, IC37156, IC38483, IC38501, IC41765, IC41766, IC41768, IC42008, IC42281, SKGPA179, SKGPA178, SKGPA182, SKGPA176, SKGPA175, SKGPA177, SKGPA174, IC46789, IC15660, GA2(C), RMA7(7) and C.GRajgira1 (C).	27	67.5
	7. Dense	IC95302, IC95308, IC95321, IC42277, IC38542, IC42265, SKGPA172, SKGPA181, SKGPA173 and BGA2(C)	10	25
	99. Others	-		
Stem colour	1. Yellow	-		
	2. Yellowish-green	IC95302, IC38542, IC42265, SKGPA178, SKGPA181, SKGPA173, IC37156, IC15660, IC95321, IC95333, IC95288, IC42427, IC93962, IC95593, IC95291, IC95298, IC42277, IC38483, IC38501, SKGPA179, SKGPA172, SKGPA177, SKGPA174, IC46789, BGA2(C), RMA7(C), and C.G. Rajgira 1 (C)	27	67.5
	3. Orange	-		
	4. Pink	-		
	5. Red	-		
	6. Reddish-green	IC95308, IC95580, IC95299, IC41765, IC41766, IC41768, IC41769, IC42008, IC42281, SKGPA182, SKGPA176, SKGPA175 and GA2(C)	13	32.5
	7. Reddish-orange	-		
99. Others	-			
Stem surface	1. Smooth	IC95302, IC95321, IC95333, IC95580, IC95288, IC42427, IC93962, IC95593, IC95291, IC38483, IC 38542, IC41765, IC41766, IC41768, IC41769, IC42008, IC42281, IC42265, SKGPA 178, SKGPA172, SKGPA182, SKGPA176, SKGPA175, SKGPA173, IC46789, IC15660, GA2 (C), RMA7(C) and C.G. Rajgira 1 (C)	29	72.5
	2. Ridged	IC95308, IC95298, IC95299, IC37156, IC42277, IC38501, SKGPA179, SKGPA181, SKGPA177, SKGPA174, and BGA2 (C).	11	27.5
	99. Others	-		
Inflorescence shape	1. Globose	-		
	2. Semi-drooping	IC95333, IC95580, IC95288, IC42427, IC95593, IC38483, IC38501, IC41765, IC41768, IC41769, IC42281, SKGPA178, SKGPA182, SKGPA181, SKGPA173, SKGPA177, IC35774, IC46789, IC15660, GA2 (C) and C.G.Rajgira1(C).	21	52.5
	3. Completely drooping	-		
	4. Straight	IC95302, IC95308, IC95321, IC93962, IC95291, IC95298, IC95299, IC 42276, IC42277, IC38542, IC41766, IC42008, IC42265, SKGPA179, SKGPA172, SKGPA176, SKGPA175, BGA2 (C) and RMA7 (C)	19	47.5
	99. Others	-		
Inflorescence spininess	1. Smooth	IC95308, IC95333, IC95580, IC42427, IC37156, IC38483, IC41765, IC41766, IC41768, IC41769, IC42008, IC42281, IC42265, SKGPA182, and GA2(C)	15	37.5
	2. Glabrous	-		
	3. Prickly	-		
	4. Spiny	IC95302, IC953221, IC95288, IC93962, IC95593, IC95291, IC95298, IC95299, IC42277, IC38501, IC38542, IC42008, SKGPA179, SKGPA178, SKGPA181, SKGPA176, SKGPA175, SKGPA173, SKGPA177, SKGPA174, IC46789, IC15660, BGA2(C), RMA7(C) and C.G Rajgira 1 (C)	25	62.5
	99. Others	-		
Seed colour	1. White			
	2. Creamish	All accessions	40	100
	3. Pale-yellow	-		
	4. Pink	-		
	5. Red	-		
	6. Brown	-		
	7. Black	-		
	8. Golden	-		
	99. Others	-		

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