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Genetic Diversity of *Amaranthus dubius* Mart. (Khedha) Used Tribal Place in Chhattisgarh, India

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Abstract

In India, the leaves of a large number of wild and cultivated plants are used as vegetables. They have a very high protective food value and are very easy to grow. In Chhattisgarh, the life and economy of the tribal and local people are intimately connected with the natural vegetation. The present investigation research was conduct during Rabi Season during year 2014-15 and 2015-16 at Research and Instructional Farm, Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment was comprised of twenty five genotypes and check variety CO-1 of *Amaranthus dubius* Mart. (Khedha) laid out in Randomized Block Design (RBD) with three replications. The information was based on an ethno-botanical field study of the different parts of Chhattisgarh. Morphological characters recorded in all the genotypes as per the minimal descriptors for leafy vegetables presented in table no. 1. The plant height varies from 5 m to 10 m among various species. Leaves are oblong to elliptical with color ranged from light to dark green with some expressing red pigment throughout the genus. The inflorescence is very prominent, colorful, terminal and contain one male flower per glomerule. The obtained data expressed maximum fibre content in variety of CO-1 (15.67%) followed by genotype IGKB-2014-51 (15.50%) and IGKB-2014-53 (15.13%) was observed. Variety CO-1 and genotype IGKB-2014-51 are statically at par with each other.

Keywords: Identification, khedha, Raipur

1. Introduction

Khedha (*Amaranrhus dubius* Mart.) are leafy vegetable locally known as *khedha bhaji* (jari) belong to the family Amranthaceae. The green Amaranthus consist of approximately 60 species out of which about 18 species are occurring in India. There are three major producing Amaranthus species, *A. caudatus, A. cruentus* and *A. hypochondriacus*, all believed to originate from Central and South America; and three major leafy vegetable species, *A. tricolor*, *A. dubius* and *A. blitum* (*A. lividus*), of which *A. tricolor* is thought to originate from India or Southern (Yadav et al., 2014). The plant height varies from 5 m to 10 m among various species. Leaves are oblong to elliptical with color ranged from light to dark green with some expressing red pigment throughout the genus. The inflorescence is very prominent, colorful, terminal and contain one male flower per glomerule. India about 800 species are consumed as wild edible plant saver the country (Singh and Arora, 1978). India is the largest producer of vegetable crops next to China. Leafy vegetables are cultivated in an area of 9205 thousand hectare with an annual production of 162187 thousand MT (Anon., 2013). In Chhattisgarh, vegetables occupied an area of 377.21 thousand hectare with an average production of 4965.33 thousand MT out of these, leafy vegetables are cultivated in an area of 7688 hectare with an average production of 72902 MT (Anon., 2014). Despite such a huge production in the country, less than the appropriate requirement of balanced diet is provided to every individual.

In Chhattisgarh, the life and economy of the tribal and local people are intimately connected with the natural vegetation. Leafy vegetables play a major role in the nutritional requirement of the tribal and local population in remote parts of the Chhattisgarh. The use of leafy vegetables as food has been formed an integral part of the culture and tradition of many indigenous communities of the world. It constitutes an essential component in the diet and food security of many tribal and local communities particularly people living around the forest fringe. Looking to the various types of leafy vegetables grown in Chhattisgarh *i.e.* Amari Bhaji, Tinpania Bhaji, Bathua Bhaji, Chaulai Bhaji, Chech Bhaji, Chunchunia Bhaji, Karmota Bhaji, Lal Bhaji, Methi Bhaji, Palak, Patawa Bhaji, Patharri Bhaji, Poi Bhaji, Sarson Bhaji, Jadi Bhaji, Bohar Bhaji and rapid urbanization of developing country like India, food security is a major concern (Chauhan et al., 2014). In Chhattisgarh state, leafy vegetables are found naturally in

both cultivated and non-cultivated lands and there are major dietary component of tribal as well as rural people of the state. It's provides rural households with supplemental income opportunities through their sale in the markets. Vegetable amaranth serves as an alternative source of nutrition for people in developing countries since it is a rich and inexpensive source of carotenoid, protein, vitamins and dietary fibre (Shukla et al., 2003).

2. Materials and Methods

The field study was carried out in the villages and forest villages of the different region of Chhattisgarh. Methodology covers two types of survey namely: Field Survey and Literature Collection. The main aim of the survey was to collect information about the leafy vegetables plant species which are used by the tribal and local peoples and also the species are identified and documented by collecting samples of plant species. The total respondents were 30-35 in numbers per villages to collect information on *Amaranthus dubius* Mart. **(**Khedha Bhaji), along with utilization of wild edible plants of the study area. Raipur district is situated in the central part of Chhattisgarh, agro-climatologically known as Chhattisgarh plains and lies between 21°16' N latitude and 81°36' E longitude with an altitude of 289.56 meters above the mean sea level. Raipur, the place of investigation, comes under dry, sub-humid region. It comes under seventh agro-climatic zone of the country, *i.e.* eastern plateau and hills. The annual average rainfall is 1200-1400 mm, out of which about 85% is received from third week of June to mid-September and very little during October to February. May is the hottest (46 °C) and December is the coolest (6°C) month of the year. The experimental site was located at Research and Instructional Farm, Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) having with adequate facilities for irrigation and drainage are available.

3. Results and Discussion

The present investigation was undertaken to study the mean performance of *Amaranthus dubius* Mart. (khedha) genotypes and to assess the genetic diversity in *Amaranthus dubius* Mart. (khedha) genotypes for yield and its component characters (Table 1 and Figure 1). All the genotypes of khedha were evaluate for the branching index were categorized into two group *viz.*, nine genotypes had only at base (IGKB-2014-31, IGKB-2014-34, IGKB-2014-39, IGKB-2014-42, IGKB-2014-45, IGKB-2014-49, IGKB-2014-52, IGKB-2014-55 and variety CO-1), seventeen genotypes had branches all over the stem (IGKB-2014-32, IGKB-2014-33, IGKB-2014-35, IGKB-2014-36, IGKB-2014-37, IGKB-2014-38, IGKB-2014-40, IGKB-2014-41, IGKB-2014-43, IGKB-2014-44, IGKB-2014-46, IGKB-2014-47, IGKB-2014-48, IGKB-2014-50, IGKB-2014-51, IGKB-2014-53 and IGKB-2014-54).

The stem pubescence were categorized into three group *viz.*, one genotype had none stem pubescence (IGKB-2014-31), sixteen genotypes had low stem pubescence (IGKB-2014-32, IGKB-2014-33, IGKB-2014-36, IGKB-2014-37, IGKB-2014-38, IGKB-2014-39, IGKB-2014-40, IGKB-2014-41, IGKB-2014-44, IGKB-2014-45, IGKB-2014-46, IGKB-2014-47, IGKB-2014-48, IGKB-2014-49, IGKB-2014-50 and IGKB-2014-53), seven genotypes had medium stem pubescence (IGKB-2014-34, IGKB-2014-35, IGKB-2014-42, IGKB-2014-43, IGKB-2014-51, IGKB-2014-52 and variety CO-1), two genotypes had conspicious stem pubescence (IGKB-2014-54 and IGKB-2014-55)

The stem pigmentation were categorized into two group *viz.*, twenty-three genotype had green (IGKB-2014-31, IGKB-2014-32, IGKB-2014-33, IGKB-2014-36, IGKB-2014-38, IGKB-2014-39, IGKB-2014-40, IGKB-2014-41, IGKB-2014-42, IGKB-2014-43, IGKB-2014-44, IGKB-2014-45, IGKB-2014-46, IGKB-2014-47, IGKB-2014-48, IGKB-2014-49, IGKB-2014-50, IGKB-2014-51, IGKB-2014-52, IGKB-2014-53, IGKB-2014-54, IGKB-2014-55 and variety CO-1) while, three genotypes had green with base pink (IGKB-2014-34, IGKB-2014-35, IGKB-2014-37).

Leaf shape were categorized into three group *viz.*, seven had obovate (IGKB-2014-31, IGKB-2014-42, IGKB-2014-43, IGKB-2014-45, IGKB-2014-46, IGKB-2014-47 and IGKB-2014-48), fourteen had cuneate (IGKB-2014-32, IGKB-2014-33, IGKB-2014-34, IGKB-2014-35, IGKB-2014-36, IGKB-2014-39, IGKB-2014-40, IGKB-2014-41, IGKB-2014-44, IGKB-2014-51, IGKB-2014-52, IGKB-2014-53, IGKB-2014-54 and IGKB-2014-55), five had lanceolate (IGKB-2014-37, IGKB-2014-37, IGKB-2014-49, IGKB-2014-50 and variety CO-1).

The leaf pubescence were categorized into three group *viz.*, eighteen genotypes had low leaf pubescence (IGKB-2014-31, IGKB-2014-32, IGKB-2014-33, IGKB-2014-36, IGKB-2014-37**,** IGKB-2014-38, IGKB-2014-40, IGKB-2014-41, IGKB-2014-44, IGKB-2014-45, IGKB-2014-46, IGKB-2014-47, IGKB-2014-48, IGKB-2014-49, IGKB-2014-50, IGKB-2014-53 and variety CO-1), six genotypes had medium leaf pubescence (IGKB-2014-34, IGKB-2014-35, IGKB-2014-42, IGKB-2014-43, IGKB-2014-51 and IGKB-2014-52), two genotypes had conspicious leaf pubescence (IGKB-2014-54 and IGKB-2014-55).

The leaf pigmentation were categorized into three group *viz.*, eleven genotype had normal green (IGKB-2014-31, IGKB-2014-32, IGKB-2014-36, IGKB-2014-38, IGKB-2014-40, IGKB-2014-44, IGKB-2014-45, IGKB-2014-46, IGKB-2014-52, IGKB-2014-53 and IGKB-2014-55) while, ten genotypes had dark green (IGKB-2014-33, IGKB-2014-34, IGKB-2014-37, IGKB-2014-41, IGKB-2014-42, IGKB-2014-43, IGKB-2014-47, IGKB-2014-50, IGKB-2014-54 and variety CO-1), five genotypes had dark green with margin pigment (IGKB-2014-35, 39, IGKB-2014-48, IGKB-2014-49 and IGKB-2014-51) respectively.

The leaf colour intensity were categorized into three group *viz.*, twelve genotype had light colour (IGKB-2014-34, IGKB-2014-37, IGKB-2014-39, IGKB-2014-40, IGKB-2014-41, IGKB-2014-42, IGKB-2014-44, IGKB-2014-50, IGKB-2014-51,

Table 1: Morphologival effect of yield and its component in *Amaranthus dubius* Mart. (Khedha)

Characters	Collection place (Village, District)	Branching index	Stem pubescence	Stem pigmentation	Leaf shape	Leaf pubescence	Leaf pigmentation	Fibre content %
IGKB-2014-31	Basantpali, Raigarh	Only at base	None	Green	Obovate	Low	Normal Green	6.77
IGKB-2014-32	Gharghoda, Raigarh	Branches all over the stem	Low	Green	Cuneate	Low	Normal Green	4.73
IGKB-2014-33	Gaitra. Tilda	Branches all over the stem	Low	Green	Cuneate	Low	Drak Green	4.60
IGKB-2014-34	Timarlaga, Raigarh	Only at base	Medium	Green with base pink	Cuneate	Medium	Drak Green	5.47
IGKB-2014-35	Sakti, Raigarh	Branches all over the stem	Medium	Green with base pink	Cuneate	Medium	Drak green with margin pigmented	3.75
IGKB-2014-36	Mahasamund, Arang	Branches all over the stem	Low	Green	Cuneate	Low	Normal Green	7.00
IGKB-2014-37	Tulsi, Tilda	Branches all over the stem	Low	Green with base pink	Lanceolate	Low	Drak Green	12.17
IGKB-2014-38	Tila, Abhanpur	Branches all over the stem	Low	Green	Lanceolate	Low	Normal Green	12.93
IGKB-2014-39	Khilora, Abhanpur	Only at base	Low	Green	Cuneate	Low	Drak green with margin pigmented	11.93
IGKB-2014-40	Sonpairi, Abhanpur	Branches all over the stem	Low	Green	Cuneate	Low	Normal Green	7.13
IGKB-2014-41	Tila, Abhanpur	Branches all over the stem	Low	Green	Cuneate	Low	Dark Green	6.87
IGKB-2014-42	Gaitra. Tilda	Only at base	Medium	Purple	Obovate	Medium	Dark Green	13.33
IGKB-2014-43	Khilora, Abhanpur	Branches all over the stem	Medium	Green	Obovate	Medium	Dark Green	13.17
IGKB-2014-44	Sonpairi, Abhanpur	Branches all over the stem	Low	Green	Cuneate	Low	Normal Green	11.70
IGKB-2014-45	Tulsi, Tilda	Only at base	Low	Green	Obovate	Low	Normal Green	9.83
IGKB-2014-46	Gaitra, Tilda	Branches all over the stem	Low	Green	Obovate	Low	Normal Green	10.80
IGKB-2014-47	Palari, Balaudabazar	Branches all over the stem	Low	Green	Obovate	Low	Dark Green	7.87
IGKB-2014-48	Pandaripani, Raigarh	Branches all over the stem	Low	Green	Obovate	Low	Drak green with margin pigmented	7.13
IGKB-2014-49	Raigarh	Only at base	Low	Green	Lanceolate	Low	Drak green with margin pigmented	6.37
IGKB-2014-50	Gaitra. Tilda	Branches all over the stem	Low	Green	Lanceolate	Low	Drak green	11.50
IGKB-2014-51	Plari, Balaudabazar	Branches all over the stem	Medium	Green	Cuneate	Medium	Drak green with margin pigmented	15.50
IGKB-2014-52	Pod, Abhanpur	Only at base	Medium	Green	Cuneate	Medium	Normal Green	11.37

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IGKB-2014-53	Tulsi, Tilda	Branches all over the stem	Low	Green	Cuneate	Low	Normal Green	15.13
IGKB-2014-54	Konari, Tilda	Branches all over the stem	Con-spicious	Green	Cuneate	Con-spicious	Dark Green	10.54
IGKB-2014-55	Tila, Abhanpur	Only at base	Con-spicious	Green	Cuneate	Con-spicious	Normal Green	14.47
CO1 variety	Bangalore	Only at base	Medium	Green	Lanceolate	Low	Drak Green	15.67
CD (p=0.05)	-	-	-	-	-	-	-	0.55

Table 1: Continue

Characters	Leaf co-lour in-tensity	Promi-nence of leaf veins	Petiole pigman-tation	Terminal inflores-cence Shape	Presence of axillary in-florescence	Inflorescence density	Inflores-cence colour	Seed colour
IGKB-2014-31	Medium	Smooth	Green	Panicle with short branches	Present	Intermediate	Green	Jet black
IGKB-2014-32	Medium	Smooth	Green	Panicle with long branches	Present	Low	Green	Jet Black
IGKB-2014-33	Medium	Smooth	Green	Panicle with short branches	Present	Low	Green	Jet Black
IGKB-2014-34	Light	Smooth	Green	Panicle with short branches	Present	Low	Green	Black
IGKB-2014-35	Dark	Smooth	Green	Panicle with short branches	Present	Low	Green	Black
IGKB-2014-36	Dark	Smooth	Green	Panicle with short branches	Present	Low	Green	Black
IGKB-2014-37	Light	Smooth	Green	Panicle with short branches	Present	Low	Green	Black
IGKB-2014-38	Dark	Smooth	Green	Panicle with short branches	Present	Low	Green	Black
IGKB-2014-39	Light	Smooth	Green	Spike	Present	Low	Green	Black
IGKB-2014-40	Light	Smooth	Green	Panicle with short branches	Present	Low	Green	Black
IGKB-2014-41	Light	Smooth	Green	Spike	Present	Low	Green	Black
IGKB-2014-42	Light	Smooth	Green	Spike	Present	Low	Green	Reddish Black
IGKB-2014-43	Dark	Smooth	Green	Short branches	Present	Intermediate	Green	Reddish Black
IGKB-2014-44	Light	Smooth	Green	Short branches	Present	Intermediate	Green	Reddish Black
IGKB-2014-45	Medium	Smooth	Green	Spike	Present	Dense	Green	Reddish Black
IGKB-2014-46	Dark	Smooth	Green	Long branches	Present	Dense	Green	Reddish Black
IGKB-2014-47	Dark	Smooth	Green	Short branches	Present	Low	Green	Reddish Black
IGKB-2014-48	Medium	Smooth	Green	Panicle with long branches	Present	Low	Green	Reddish Black
IGKB-2014-49	Dark	Smooth	Green	Panicle with long branches	Present	Low	Green	Reddish Black
IGKB-2014-50	Light	Smooth	Green	Panicle with long branches	Present	Low	Green	Brown Black
IGKB-2014-51	Light	Smooth	Green	Panicle with short branches	Present	Low	Green	Reddish Black

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Characters	Leaf colour intensity	Prominence of leaf veins	Petiole pigmantation	Terminal inflorescence Shape	Presence of axillary inflorescence	Inflorescence density	Inflorescence colour	Seed colour
IGKB-2014-52	Medium	Smooth	Green	Panicle with short branches	Present	Dense	Green	Brown Black
IGKB-2014-53	Light	Smooth	Green	Spike	Present	Low	Green	Brown Black
IGKB-2014-54	Light	Smooth	Green	Spike	Present	Low	Green	Brown Black
IGKB-2014-55	Light	Smooth	Green	Spike	Present	Low	Green	Brown Black
CO1 variety	Dark	Smooth	Green	Panicle with long branches	Present	Intermediate	Green	Black

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Figure 1: Collection and morphological variability in *Amaranthus dubius* Mart. (khedha)

IGKB-2014-53, IGKB-2014-54 and IGKB-2014-55) while, eight genotypes had dark green colour (IGKB-2014-35, IGKB-2014-36, IGKB-2014-38, IGKB-2014-43, IGKB-2014-46, IGKB-2014-47, IGKB-2014-49 and variety CO-1), six genotypes had medium green colour (IGKB-2014-31, IGKB-2014-32, IGKB-2014-33, IGKB-2014-45, IGKB-2014-48 and IGKB-2014-52) respectively.

Total 25 genotypes and variety CO-1 of khedha were evaluated for the prominence of leaf veins were categorized into various distinct group *viz.*, twenty-five genotype and variety CO-1 showed smooth vein.

The 25 genotypes and variety CO-1 of khedha were evaluated for the petiole pigmentation were categorized into various distinct group *viz.*, twenty-five genotype and variety CO-1 had showed green petiole pigmentation.

The terminal inflorescence shape were categorized into three group *viz.*, six genotype had panicle with long branches (IGKB-2014-32, IGKB-2014-48, IGKB-2014-49, IGKB-2014-50, IGKB-2014-46 and variety CO-1) while, thirteen genotypes had panicle with short branches (IGKB-2014-31, IGKB-2014-33, IGKB-2014-34, IGKB-2014-35, IGKB-2014-36, IGKB-2014-37, IGKB-2014-38, IGKB-2014-40, IGKB-2014-43, IGKB-2014-44, IGKB-2014-47, IGKB-2014-51 and IGKB-2014-52), seven genotypes had spike (IGKB-2014-39, IGKB-2014-41, IGKB-2014-42, IGKB-2014-45, IGKB-2014-53, IGKB-2014-54 and IGKB-2014-55) respectively.

The 25 genotypes and variety CO-1 of khedha were evaluated for the presence of axillary inflorescence was present in all genotypes.

The inflorescence density were categorized into three group *viz.*, ninteen genotype had low (IGKB-2014-32, IGKB-2014-33, IGKB-2014-34, IGKB-2014-35, IGKB-2014-36, IGKB-2014-37, IGKB-2014-38, IGKB-2014-39, IGKB-2014-40, IGKB-2014-41, IGKB-2014-42, IGKB-2014-47, IGKB-2014-48, IGKB-2014-49, IGKB-2014-50, IGKB-2014-51, IGKB-2014-53, IGKB-2014-54 and IGKB-2014-55), while, four genotypes had intermediate (IGKB-2014-31, IGKB-2014-43, IGKB-2014-44 and variety CO-1), three genotype had dense (IGKB-2014-45, IGKB-2014-46 and IGKB-2014-52), respectively.

The 25 genotypes and variety CO-1 of khedha were evaluated

for the inflorescence colour were categorized into various distinct group *viz.*, twenty-five genotype and variety CO-1 showed green colour respectively.

The seed colour were categorized into four group *viz.*, three genotype had jet black (IGKB-2014-31, IGKB-2014-32 and IGKB-2014-33), while, nine genotypes had black colour (IGKB-2014-34, IGKB-2014-35, IGKB-2014-36, IGKB-2014-37, IGKB-2014-38, IGKB-2014-39, IGKB-2014-40, IGKB-2014-41 and variety CO-1), nine genotypes had reddish black (IGKB-2014-42, IGKB-2014-43, IGKB-2014-44, IGKB-2014-45, IGKB-2014-46, IGKB-2014-47, IGKB-2014-48, IGKB-2014-49 and IGKB-2014-51) while, five genotypes had brown black (IGKB-2014-50, IGKB-2014-52, IGKB-2014-53, IGKB-2014-54 and IGKB-2014-55) respectively.

The obtained data expressed maximum fibre content in variety of CO-1 (15.67 %) followed by genotype IGKB-2014-51 (15.50 %) and IGKB-2014-53 (15.13 %) was observed. Variety CO-1 and genotype IGKB-2014-51 are statically at par with each other.

4. Conclusion

This experiment was undertaken to assess the variability that exist on the selected amaranth germplasm collection at NPGRL in terms of its morphological features. A total of 25 accessions and check variety CO-1 were used in the study. Amaranthus could play an important role in rural areas because its cultivation allows good yields of high quality grain and leaves to be integrated in daily poor diet. They have short crop duration (30-40 days), making them adapted to fit into peri-urban, homestead or cereal-based production systems.

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