

## Characterization of indigenous brinjal (*Solanum melongena* L.) lines using morphological traits under Jharkhand condition

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### ABSTRACT

A total of 25 indigenous lines collected from different agroclimatic zones of Jharkhand were evaluated at Ranchi during rabi season of 2018-19 in randomized block design with three replications. The aim of present study was to assess the extent of genetic variation and identify most promising germplasm for improvement programme. Seventeen quantitative and forty qualitative characters were analysed as per DUS guidelines. Significant differences were recorded in most of the characters. The genotype RKML-11 exhibited highest number of primary branches (6.67) and produced maximum yield (38.54 t ha<sup>-1</sup>). Maximum fruit weight was recorded in RKML-28 (262.8 g). RKML-35 showed maximum value of fruit diameter (33.9 cm) but had minimum number of fruits per plant (6.7). However, RKML-21 showed maximum fruits per plant but had smallest fruit size (8 cm). RKML-26 exhibited precocious bearing habit, it was also second-best genotype in terms of yield (37.7 t ha<sup>-1</sup>). The lowest yield was recorded in the genotype RKML-25 (8.8 t ha<sup>-1</sup>). These accessions could be used as potential donors for hybridization program to develop high heterotic hybrids.

**Keywords:** Brinjal, morphological characterization, indigenous lines, Jharkhand.

### INTRODUCTION

Brinjal (*Eggplant*, *Aubergine*) is a traditional crop of India. The Genus *Solanum* comprises approximately 2000 species, which include both tuber bearing and non-tuber bearing form *Solanum melongena* is an important edible species under non-tuber bearing form. Brinjal fruit contains carbohydrates, proteins, fibre and vitamins like thiamine, niacin, pantothenic acid and folacin as well as minerals like calcium, iron, potash, zinc, copper and manganese, thus it has fair nutritional importance. It is an indigenous crop of India, hence greatest level of diversity is found in country. Brinjal is a major vegetable crop of Jharkhand and it is cultivated round the year in the state. It is grown in 80.09 thousand hectare area in state with production of 252.60 thousand metric tons in 2017-18 (Horticulture Stat. Division 2018). Phenotypic characterization with appropriate statistical tools increases the quality of obtained information from morphological traits. The study of morphological characters is helpful in assessing similarities and dissimilarities among the genotypes. The variations present in the genotype are pre-

requisite of any breeding program of crop improvement. Ranchi, Gumla and Khunti districts are part of eastern plateau of Chotanagpur fall under Jharkhand State, which is blessed with rich floral diversity like wild fruits, wild vegetables, heirloom crop varieties, medicinal and aromatic plants. The Plateau also have significant amount of variability for fruit characteristics such as shape, size, color in solanaceous vegetables i.e. brinjal. But no significant work has been carried out for documentation of indigenous vegetables like brinjal of Jharkhand. There is a need for identification and characterization of potentially valuable lines of brinjal available in state, for their utilization in development of improved high yielding cultivars or hybrid varieties. Despite environmental influences agro-morphological characterization is important technique for characterization of germplasms. Thus, a special emphasis has to be given in conservation and documentation of such land races which are in the level of extinction. Therefore, the present study was initiated to characterize indigenous brinjal lines using morphological traits in Jharkhand.

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## MATERIALS AND METHODS

The investigation was conducted at the experimental field of RKMVERI, Ranchi. The experimental area is situated at 23°44' latitude and 85°54' longitude at an altitude of 651 meter sea level. The climate of the area ranges from semi humid to humid semi-arid and receives annual rainfall of 1200 mm. Collection of promising germplasms was done on the basis of personnel interaction with experienced and progressive farmers during March to September 2017. Based on feedback from growers, seeds were collected from various (35 different) locations. To segregate pure lines based on fruit morphology, an experimental trial was conducted during October 2017 to May 2018 by selfing the lines. The lines were harvested separately according to their distinct fruit morphology. A total 35 germplasms were selected for further studies. All these indigenous lines were grown to characterize plant architecture, grain morphology and quality traits during October 2018 to May 2019. The experimental materials were grown in randomized block design with three replications. The seed of all genotypes were grown in nursery following plug trays method of nursery raising. The growing media consisted of coco pit, vermicompost and soil (1:1:1) was used in nursery. Four weeks old seedlings were transplanted to the main field at the spacing of 75X50 cm. In each plot, there were 20 plants in the area of 9 m<sup>2</sup>. The cultivation practices were followed as per Birsra Agricultural University, Ranchi recommendations. Necessary plant protection measures were taken to control disease and pests. Seventeen quantitative and forty qualitative characters were analysed as per DUS guidelines. The observations were taken from five randomly selected plants from each plot of each replication for all the quantitative characters under study except days to flower initiation, days to 50 % flowering, days to fruit initiation and plant survival % which were recorded on whole plot basis. Data were statistically analysed as per procedure described by Panse and Sukhatme (1985). The mean values of the quantitative descriptors were computed with OPSTAT statistical software (1998).

## RESULT AND DISCUSSION

### Growth characters

The plant height was recorded at first fruit attaining physiological maturity. Significant differences were recorded among 35 genotypes. RKML-34 produced tallest (75.9 cm) while lowest value was recorded in RKML-6 (50.5 cm). Number of primary branches varied between 2.67 and 6.67, where RKML-11 produced highest and RKML-33 minimum number of primary branches (Table 1). RKML-35 (19.7 cm) had maximum leaf length and was significantly superior over all the genotypes with minimum leaf length recorded in RKML-2 (12.6 cm). Maximum leaf width was observed in RKML-35 (14.1 cm) which was statistically at par with RKML-9 (13.1 cm) and significantly superior over rest of the genotypes and lowest leaf width was recorded in RKML-28 (7.3 cm). The range of petiole length was from 2.29 to 5.55 cm. The longest petiole was found in RKML-35 (5.55 cm) and shortest in RKML-6 (2.29cm). Plant canopy spread from North to South was recorded between 59.83 to 83.91 cm with highest in RKML-26 (83.91cm) and it was significantly different from all the genotypes evaluated except RKML-5 (82.62cm). The minimum plant spread was recorded in RKML-10 (59.83 cm). In east west direction plant spread was recorded in range of 58.15 to 86.74 cm. The RKML-5 (86.74 cm) exhibited highest plant spread and RKML-10 (58.15 cm.) lowest in east west direction. Large variation in growth characters was also obtained by Das *et al.* (2017), Dash *et al.* (2019), Chithaguntiet *al.* (2018).

### Flower characters

Floral characteristics (Table1) revealed that RKML-26 needed least days for flower initiation (56.7 days). The maximum days to flower initiation were recorded in genotype RKML-16 (87 days). RKML-26 has taken 63.7 days (minimum) to reach 50% flowering which was at par with RKML-31 (64 days) and significantly superior over the other genotypes studied. Maximum number of days to attain 50% flowering stage was recorded in RKML-16 (98.3). This trend of variation was in accordance with the findings of Konyak *et al.* (2019).

Table 1: Performance of indigenous lines of brinjal in relation to growth and flower characters

Genotype	Pl. Ht. (cm)	No. of Pri. branches	Leaf Length (cm)	Leaf width (cm)	Petiole length (cm)	Plant Spread N-S (cm)	Plant Spread E-W (cm)	Flower Initiation (DAT)	Days to 50% Fl. (DAT)
RKML-1	61.7	5.7	14.5	9.8	3.8	75.2	75.8	78.7	84.0
RKML-2	53.0	4.7	12.6	7.8	3.4	62.5	65.0	62.0	68.0
RKML-3	55.2	5.3	13.7	8.0	3.3	66.7	58.5	60.7	68.0
RKML-4	61.6	6.3	16.4	11.1	4.8	71.5	78.2	81.3	85.7
RKML-5	63.9	5.3	14.4	9.6	3.7	82.6	86.7	83.3	87.0
RKML-6	50.5	4.7	14.0	8.6	2.3	63.9	61.6	64.3	70.7
RKML-7	62.6	6.0	15.7	11.6	5.2	73.2	73.6	80.7	85.0
RKML-8	58.3	5.0	15.6	11.6	4.7	72.2	68.0	82.7	89.0
RKML-9	65.0	5.3	16.8	13.1	5.5	68.9	71.7	85.3	89.0
RKML-10	53.5	4.3	14.1	8.9	3.1	59.8	58.1	82.0	89.7
RKML-11	68.7	6.7	17.2	11.2	5.3	70.4	70.9	78.7	87.7
RKML-12	63.6	4.7	14.4	10.0	3.5	62.9	65.3	82.7	93.0
RKML-13	57.3	4.7	12.8	8.0	2.6	61.1	65.7	80.7	90.0
RKML-14	66.0	5.3	14.5	10.3	3.9	67.3	67.5	86.3	96.7
RKML-15	51.9	3.3	12.8	9.0	2.3	63.8	60.8	76.7	86.7
RKML-16	62.3	5.3	14.0	9.7	2.8	65.0	66.0	87.0	98.3
RKML-17	59.3	4.0	13.9	8.8	2.6	62.7	62.7	76.3	84.3
RKML-18	59.0	4.3	14.7	9.5	3.0	72.3	67.2	76.0	84.0
RKML-19	59.2	4.3	14.1	9.4	2.9	71.2	74.7	82.0	90.0
RKML-20	56.3	4.0	15.2	9.7	3.6	70.6	73.2	76.7	86.0
RKML-21	53.7	3.3	13.9	8.9	2.8	65.3	68.7	77.3	89.3
RKML-22	55.6	5.0	15.1	9.5	4.2	70.1	70.9	76.3	84.3
RKML-23	53.7	3.0	14.8	8.7	3.1	65.4	69.0	80.0	87.7
RKML-24	54.6	4.0	14.9	9.1	3.7	69.4	75.0	80.3	87.0
RKML-25	51.6	3.0	12.7	7.9	3.1	60.8	64.3	76.0	89.3
RKML-26	64.4	6.0	14.2	9.0	3.8	83.9	83.7	56.7	63.7
RKML-27	56.4	4.7	14.9	8.8	2.8	71.3	73.3	63.7	71.0
RKML-28	53.9	3.7	12.9	7.3	2.8	69.9	72.9	61.3	69.7
RKML-29	55.5	4.0	13.9	8.1	2.5	62.3	66.5	66.3	75.3
RKML-30	54.1	3.7	13.3	7.8	2.5	64.6	65.2	57.7	67.0
RKML-31	61.7	5.0	15.1	9.2	3.7	65.3	72.7	57.3	64.0
RKML-32	53.0	3.3	14.2	8.5	2.6	61.0	65.3	58.0	70.0
RKML-33	53.7	2.7	13.9	7.9	2.6	64.6	65.3	62.7	69.3
RKML-34	75.9	6.0	14.6	9.4	4.2	78.1	81.8	72.0	76.7
RKML-35	62.6	5.3	19.7	14.1	5.5	73.3	77.8	86.7	92.0
C.D. at 5%	3.10	1.14	1.44	1.13	0.95	2.90	5.11	2.92	2.53
SE(m)	1.09	0.40	0.51	0.40	0.33	1.03	1.81	1.03	0.90

### Yield attributes and fruit yield

The genotype RKML-26 (70.7 days) needed minimum days for fruit initiation and was significantly superior over rest of the genotypes except RKML-30 and RKML-32 (72 days). However, RKML-19 took maximum time for fruit initiation (102.7 days). Similar result was reported by Kumar *et al.* (2008). The genotype RKML 14 recorded significantly longest fruit (22.6 cm) while the smallest in the genotype RKML-21 (8.0 cm). Similar range of fruit length was observed by Syed *et al.* (2018) and Dash *et al.* (2019). The fruit diameter ranged from 18.9 to

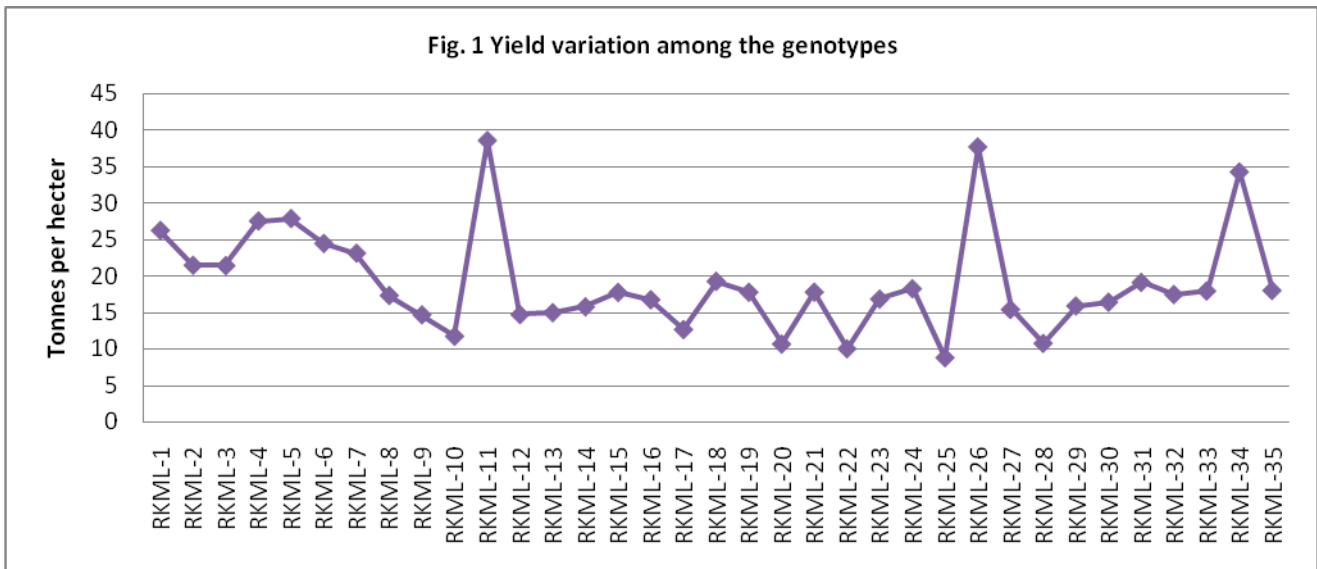
33.9 cm. The genotype RKML 35 had maximum value of fruit diameter (33.9 cm) and minimum in RKML-23 (10.9 cm). These findings are in agreement with the result obtained by Chinthagunti (2018) and Dash *et al.* (2019). The data (Table2) was revealed that all the genotypes differed significantly in terms of fruit per plant. It varied from 6.7 to 40.9 with maximum in genotype RKML-21 (40.9) followed by RKML-23 (33.2) and RKML-29 (29.6). All these genotypes are primitive type having small and spiny fruits. The genotype RKML- 35 (6.7) had minimum fruits per plant followed by RKML- 8 (7.5) and RKML-9 (7.6). These lines are

having large and oval size green fruit. These results are in conformity with the findings of Konyak *et al.* (2019). Single fruit weight among the studied genotypes ranged from 26.2 to 262.8 g. The genotype RKML-28 had recorded maximum fruit weight (262.8 g) followed by RKML-11 (212.4 g). Minimum fruit weight was observed in the genotype RKML-23 (26.2 g). Similar finding was observed by Das *et al.* (2017) and Chinthagunti *et al.* (2018). The yield data of 35 genotypes indicated that the range was from 8.8 to 38.5 t ha<sup>-1</sup>. The genotype RKML-11 (38.5 t ha<sup>-1</sup>) exhibited maximum yield followed by RKML-26 (37.7 t ha<sup>-1</sup>) and RKML-34 (34.2 t ha<sup>-1</sup>). RKML-11 was statistically at par with RKML 26 and superior to RKML-34 and other

genotypes. The lowest value in terms of yield was recorded in genotype RKML-25 (8.8 t ha<sup>-1</sup>). Konyak *et al.* (2019) and Dash *et al.* (2019) found similar result. RKML -5 had minimum number of seeds (275) in the fruits while genotype RKML-9 exhibited maximum number of seeds (3570.7). All genotypes showed significant difference for seeds per fruit. Similar variation in seeds per fruit was also obtained by Konyak *et al.* (2019) in their local varieties of brinjal. The plant survival rate was recorded maximum in the genotype RKML-2 (96.7 %) followed by RKML-13 (95%) and RKML-20 (95%). RKML-29 (62.8%) was most susceptible to disease and pests so the survival rate was recorded minimum in this genotype

Table 2: Yield attributes and yield of brinjal genotypes

Genotype	Fr. I (DAT)	Fruit Length (cm)	Fruit Diameter (cm)	Fruit/Plant	Single frt. Wt. (g)	Seed per fruit	Plant Survival rate (%)	Yield (tha <sup>-1</sup> )
RKML-1	86.0	16.4	17.0	9.6	133.0	2127.0	81.7	26.2
RKML-2	74.7	14.1	15.8	14.3	103.7	2308.0	96.7	21.4
RKML-3	77.3	13.0	21.0	17.7	125.8	2301.0	75.0	21.4
RKML-4	93.3	17.3	27.0	8.6	205.9	2000.3	90.0	27.5
RKML-5	98.3	14.8	23.9	9.6	175.3	275.0	86.7	27.8
RKML-6	80.0	10.4	17.5	16.9	78.8	2109.7	73.3	24.4
RKML-7	93.3	14.6	18.5	12.3	112.2	1558.3	93.3	23.1
RKML-8	98.0	18.9	31.3	7.5	151.6	2099.3	88.3	17.3
RKML-9	96.0	16.0	28.8	7.6	150.1	3570.7	93.3	14.6
RKML-10	99.0	11.3	18.2	23.6	63.4	2127.0	63.3	11.7
RKML-11	85.7	18.0	26.9	13.2	212.4	1712.0	85.0	38.5
RKML-12	100.0	17.8	24.3	9.3	196.0	1582.7	86.7	14.7
RKML-13	97.3	17.1	17.9	16.7	73.8	2180.7	95.0	14.9
RKML-14	95.3	22.6	18.5	11.5	114.6	661.7	81.7	15.7
RKML-15	91.7	17.0	20.1	11.8	108.2	3476.7	75.0	17.7
RKML-16	101.7	14.7	30.5	15.3	125.8	1449.3	86.7	16.7
RKML-17	92.7	19.1	18.7	16.9	100.3	3103.3	91.7	12.6
RKML-18	97.3	10.6	16.3	27.5	47.1	1628.7	85.0	19.2
RKML-19	102.7	9.6	14.6	29.6	41.0	2236.0	78.3	17.7
RKML-20	90.7	8.4	16.5	27.9	27.0	2242.3	95.0	10.6
RKML-21	94.0	8.0	11.7	40.9	42.4	1373.7	85.9	17.7
RKML-22	92.0	9.9	14.1	18.2	54.5	1817.7	83.3	10.0
RKML-23	100.3	8.3	10.9	33.2	26.2	2387.7	91.7	16.8
RKML-24	94.7	8.7	17.4	23.2	92.3	2251.7	90.0	18.2
RKML-25	92.0	9.1	14.7	29.4	42.5	2633.7	76.7	8.8
RKML-26	70.7	13.1	24.6	26.5	106.9	2164.0	83.3	37.7
RKML-27	88.7	9.9	18.1	20.5	30.0	1487.3	78.3	15.4
RKML-28	80.7	8.9	14.3	24.2	262.8	1823.7	84.3	10.7
RKML-29	97.0	8.3	13.8	14.5	44.2	1296.3	62.8	15.9
RKML-30	72.0	10.3	18.3	19.7	50.8	1921.0	70.0	16.4
RKML-31	76.3	10.7	18.1	25.9	37.8	2975.0	88.3	19.1
RKML-32	72.0	9.0	14.7	19.3	39.5	1301.7	80.0	17.4
RKML-33	78.3	9.4	16.3	17.4	47.3	1014.0	75.0	17.9
RKML-34	85.0	17.0	31.7	12.6	204.8	2234.3	90.0	34.2
RKML-35	102.7	18.9	33.9	6.7	196.5	2154.7	91.7	18.0
C.D. at 5%	2.65	1.90	1.89	3.04	16.29	86.11	18.06	3.21
SE(m)	0.94	0.67	0.67	1.07	5.76	30.45	6.39	1.14



### Qualitative characters

**Leaf and stem:** Among the genotypes, 27 expressed anthocyanin colourations on stem and rest of the lines (8) did not show any pigmentation. Stem pubescence was observed in all the 35 genotypes studied. All genotypes had entire type of leaf margin. The colour of leaf blade in all the genotypes was green except one genotype (RKML-22) which had purple colour of leaf blade. Anthocyanins and chlorophylls together are responsible for the dark violet to black pigmentation characteristic of many eggplant varieties (Dash *et al.*, 2019). Most of the genotypes (27) had prickles on the leaf blade and 8 genotypes did not show prickles on their leaves. Brinjal Cultivars with smooth textured leaves were more preferred by the jassid compared to the cultivars with leaves having leathery texture and leathery texture with spines (Deole, 2008).

**Flower inflorescence:** The predominant flowering pattern was mixed type i.e. 1-3 in the same plant (33 genotypes) and 2 genotypes had showed clustering nature (>3 flowers) of inflorescence. Flower colour varied from light purple to dark purple. Light purple flower was reported in 18 genotypes, purple flower in 12 genotypes and rest 5 genotypes had dark purple flower. These findings were also supported by Dissanayake *et al.* (2017).

**Fruit:** The data (Table 3) revealed that brinjal genotypes under study showed distinct variation in fruit shape and colour. Most of genotypes showed ovoid (42.8%) and green fruits (71.4%).

One genotype RKML1 had purple fruit and 9 other genotypes had green fruit with purple tinge. Whereas, 9 genotypes had globular fruit, 5 obovate, 5 cylindrical fruit and one with pear shaped dark purple fruit. Among genotypes with cylindrical fruit shape one genotype (RKML-1) had curve fruit and two showed slightly curved fruit. Solitary fruiting pattern was found in 29 genotypes, 2 had cluster pattern of fruiting and rest 4 expressed mixed type of fruiting. Two types of fruiting pattern were found in all the genotypes i.e. pendant (82.9%) and semi pendant (17.1%). Out of 35 genotypes, 29 genotypes had striped fruit and 6 genotypes showed patches on their fruit. Peduncle prickliness was present in 23 genotypes out of 35. Variation in colour and prickliness of calyx has been observed. Tiwari *et al.* (2016) studied morphological traits of brinjal landraces and grouped in to prickly and non-prickly types of accessions further classified on the basis of growth habit and fruit characters like shape and colour. Three types of flesh density were found in the fruit of genotypes. It varied from loose to compact. 3 genotypes had loose flesh, 12 genotypes with medium type of density in flesh and 20 had compact flesh density. Fruit creasing of calyx was strong in 18 genotypes, weak in 3 genotypes and medium type was found in 14 genotypes. Plant growth habit was reported to be semi-erect in maximum genotypes (65.7%) and rest (34.3%) showed spreading type growth habit. Similar trend of plant growth was obtained by Chattopadhyay *et al.* (2011). Depending on the cultivar, the fruit can vary from small to large and pendulous, from oblong to round and might be such colours as green, white

Table 3: Morphological descriptors, states and their frequency of indigenous lines of brinjal

Descriptors	States	Relative Frequency
Stem Anthocyanin Colour	Absent	22.86
	Present	77.14
Stem Pubescence	Weak	00.00
	Medium	100.00
	Strong	00.00
Leaf Margin	Entire	100.00
	Dentate	00.00
Leaf Blade Colour	Sinuate	00.00
	Green	97.14
Leaf Blade Prickliness	Purple	2.86
	Absent	22.86
Inflorescence/ No. of Flower	Present	77.14
	1to3	94.20
	>3	5.71
Flower Colour	Greenish White	00.00
	Light Purple	51.43
	Purple	34.29
	Dark Purple	14.28
Fruit Shape	Globular	25.74
	Ovoid	42.85
	Obovate	14.28
Fruit Colour	Pear Shaped	2.85
	Cylindrical	14.28
	Green	71.43
	Purple	2.86
Fruit Curvature	Green Purple	25.71
	Absent	91.43
	Slight	5.71
Fruiting Pattern	Medium	2.86
	Strong	00.00
	Solitary	82.86
Fruiting Position	Cluster	5.71
	Mixes	11.43
	Pendent	82.86
Fruit Stripes	Semi pendent	17.14
	Absent	82.86
Fruit Patches	Present	17.14
	Absent	17.14
Fruit Size of Calyx	Present	82.86
	Small	5.71
	Medium	62.86
Calyx Prickliness	Large	31.43
	Absent	31.43
	Weak	11.43
Flesh Density	Medium	34.29
	Strong	22.85
	Loose	8.57
Plant Growth Habit	Medium	34.29
	Compact	57.14
	Erect	00.00
Seediness	Semi spreading	65.71
	Spreading	34.29
	Low	5.71
	Medium	57.14
	High	37.14

or yellow, among others or even striated shades and colour gradients. Fruit morphology was also studied by Dissanayake *et al.* (2017) and Dash *et al.* (2019). These differences in morphological

traits are generally occurs due to varietal effect and sometimes influenced by environmental condition too.

**Seed size and colour:** Varietal preference also depends on seediness of fruit, which was high in 37.1% genotypes studied, medium in 57.1% and low in 5.7% genotypes. Das *et al.* (2017) also reported low to high range of seediness in brinjal. In Jharkhand, green ovoid/globular and less seediness type fruit of brinjal is preferred over purple long/ovoid type by consumer. From the findings of the present study it is revealed that, RKML-11 showed better performance in terms of yield and desired fruit morphology. Fruits have smooth and soft flesh too. RKML-26 also produces at par yield with RKML 11 and it

showed better earliness character. The other genotype *viz.* RKML 34, RKML-1, RKML-4, RKML-5, RKML-6, RKML-7, RKML-3, RKML-2 were good performer genotypes which have better yield potential than other genotypes.

Further it is concluded that these heirloom varieties of brinjal are the source of diversified flora. It needs further extensive and intensive investigation to suggest method of conservation as well as preservation of these genetic resources, as they may prove potential donors for hybridization programmes.

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