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CHARACTERIZATION AND EVALUATION OF LOCAL GERMPLASM OF HORSE GRAM [*MACROTYLOMA UNIFLORUM* (LAM.) VERDCOURT] COLLECTED FROM DIVERSE CLIMATIC CONDITION

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ABSTRACT:
An experiment was carried out to evaluate 44 genotypes of Horse Gram .Among 44 genotypes studied, the genotype DHLH-25 & 26 (days to 50 per cent flowering), DHLH-7,25 &26 (days to maturity), DHLH-1 (plant height), DHLH-5 (number of primary branches per plant), DHLH-44 (number of cluster per plant), DHLH-16 (pod length), DHLH-36 (number of seeds per pod), DHLH-19 (1000 seed weight), DHLH-22 (number of pods per plant), DHLH-22 (seed yield per plant) and DHLN-6 (protein content) showed high performance for the respective characters. The variability for seed yield was ranged between 4.45 to 15.57 g, along with other yield contributing characters also showed good amount of variability. Days to 50 per cent flowering ranged between 62.0 to 93.50 days. Other characters also recorded large range of variability *viz.*; days to maturity (113.50 to 155.50 days), plant height (46.2 to 103.8 cm), number of primary branches per plant (4.4 to 7.5), number of cluster per plant (42.0 to 117.10), pod length (3.86 to 5.56), number of seeds per pod (3.5 to 5.8), 1000 seed weight (19.46 to 29.72 g), protein content (17.21 to 25.10 %).These genotypes may be tested in different enviromment under climate changed concept.

Keywords: Characterization, Evaluation, Local Germplasm, Horse gram

INTRODUCTION:

Arid legumes form very important source of food and nutrients, rich in protein for human beings especially in the dry land regions. Horse gram *(Macrotyloma uniflorum* (Lam.) Verdc) is one among them which is an important component in the dry land crop production system, due to its ability to withstand drought with minimum management. Although it grows under a wide range of soil and climatic conditions but it is well known for its hardiness, adaptability to poor soil and adverse climatic conditions. Like other pulses it plays important role as food and fodder (dual purpose), as green manure crop, as good cover crop in controlling soil erosion, enhancing soil fertility and having ability of fixing atmospheric nitrogen into the soil. It is usually grown as catch crop for late *Kharif* or with the rains after a prolonged drought conditions and aberrant weather conditions.

The average yield of the crop is low because it is usually grown on poor soils where no other pulse crops can be grown (Nagaraja, *et al.* 1997). In spite of greater adoptability and its multiplicity of uses work on genetic improvement is meager. Considering its inherent abilities, high yielding varieties certainly play major role in enhancing the productivity under dry land conditions. All the

varieties developed per recommended to date are mainly by single plant selection from locals. Keeping in view the importance of such crop the local germplasm was collected and evaluated for economically important traits to know the performance in terms of yield and other yield contributing characters. Based on this, promising genotypes can be evaluated and identified. The genotypes performing well can be put to further use in breeding programme as a breeding line. Hence, an experiment was carried out to evaluate forty four horse gram genotypes for various phenotypic characters. Assessment of genetic diversity and variability existing in the germplasm collection for yield and its attributes is prerequisite for any successful breeding programme.

MATERIALS AND METHODS:

The experimental materials consisting forty four germplasm of Horse gram collected from Aurangabad. Ahmednagar, Solapur, Satara, Sangali, Jalgaon, Pune, Dhule and Nandurbar districts of Maharashtra. The experiment was laid out in RBD with three replications at Department of Botany, College of Agriculture, Dhule (M.S.). By adopting a spacing of 30 cm between rows and 10 cm between plants respectively, at recommended package of practices were followed to raise good and healthy crop stand. Data were collected on eleven yield and yield contributing characters *viz.,* days to 50% flowering, days to maturity, plant height, number of primary branches, number of cluster per plant, pod length (cm),number of seeds per pod, 1000 seed weight, , number of pods per plant, seed yield per plant and protein content (%).

The mean of five plants was subjected to statistical analysis. The data for different characters were statistically analyzed for significance by using analysis of variance technique described by Panse and Sukhatme (1985).The adapted design was Randomized Block Design (RBD) with three replications. The significance of mean sum of square for each character was tested against the corresponding error degrees of freedom using "F" Test (Fisher and Yates,1967). Statistical analysis was done by using WINDOSTAT program.

RESULTS AND DISCUSSION:

The mean performance of all forty four horse gram genotypes with regards to different agronomic characters was given in the Table 1. In respect of days to 50% flowering ,among the genotypes , most significantly early genotypes were DHLH 25 (62.0 days),DHLH 26 (62.0 days) followed by DHLH 7(64.0 days),DHLH 10 (64 Days), DHLH 37(64.0,)DHLH 40(64.5 days), DHLH 41 (64.5), DHLH 38(65.0),DHLH 23(65.5), DHLH 28(65.5), DHLH 33(65.5), DHLH 34(65.5) and DHLH 36(65.5).Some early genotypes also show the higher seed yield per plant DHLH 23(10.26 g),DHLH 10(10.01 g), DHLH 34 (9.96) , DHLH 36 (9.10 g), DHLH 41(8.55 g), DHLH 33(8.45 g) and DHLH 37(7.95 g) except DHLH 26 (4.90 g),DHLH 7(6.28 g),DHLH 40 (6.79 g),DHLH 38(4.45 g),these genotypes given significantly lower seed yield per plant.This indicates that early flowering genotypes could be used in breeding programme to necessitate harvesting over late maturing genotypes. Kulkarni and Mogle(2011) also reported the same trend in the horse gram.

Significant early maturity was expressed by the genotypes DHLH-7 (113.5 days), DHLH-25 (113.5 days), DHLH-26 (113.5 days), DHLH-27 (113.5 days) and DHLH-37 (113.5 days). The genotype DHLH-18 (155.5 days) showed significantly late maturity, followed by DHLH-8, DHLH-17, DHLH-24 (154.5 days) The population mean for this attribute was 131.65 days and variation ranged from 113.5 to 155.5 days. The five genotypes (11.36%) were found in the mid late group and twenty five genotypes (56.81%) were found earlier than the population mean as compare to the populations mean. (Table.1and 2)

The genotype DHLH-1 (103.8 cm) was found tall followed by DHLH-2 (96.4cm), DHLH-44 (96.4cm), DHLH-38 (91.6 cm), and DHLH-9 (87.9 cm). The genotypes DHLH-33 (46.2 cm) was very dwarf followed by DHLH-36 (46.9cm), DHLH-15 (50.8 cm) and DHLH-23 (51.2 cm). The population mean for this attribute was 70.72cm and ranged from 46.2 to 103.8 cm. Among all genotypes fourteen (31.81%) were found dwarf, sixteen genotypes were mid tall (36.36%) and fourteen genotypes recorded tall nature (31.81%) than the population mean.

The genotypes DHLH-5 (7.5) exhibited significantly higher number of primary branches per plant followed by DHLH-11 (7.1), DHLH-1 (7.0) and DHLH-8 (6.6). The general mean for number of primary branches per plant was 5.78 and the variation ranged between 4.4 to 7.5. The genotypes DHLH-33 (4.4), DHLH-37 (4.6) and DHLH-38 (4.8) produced less number of primary branches per plant. Out of forty four genotypes tested, six (13.63 %) genotypes produced more number of primary branches than the populations mean and thirty five (79.54 %) genotypes recorded medium number of primary branches per plant. (Table 1 and 2)

The genotypes DHLH-44 (117.1) exhibited significantly higher number of cluster per plant followed by DHLH-22 (111.2), DHLH-1 (100.0) and DHLH-21 (96.9). The general mean for number of cluster per plant was 67.68 and the variation ranged between 42.9 to 117.1. The genotypes DHLH-29 (42.9), DHLH-36 (47.5), DHLH-8 (47.7) produced less number of cluster per plant. Out of forty four genotypes tested, eleven (25.0 %) genotypes produced more number of primary branches than the populations mean and nineteen (43.18%) genotypes recorded medium number of cluster per plant. (Table 1 and 2)

The genotypes DHLH-16 (5.56cm) exhibited significantly higher pod length per plant followed by DHLH-43 (5.28cm), DHLH-33 (5.05). The general mean for pod length per plant was 4.68 and the variation ranged between 3.86 to 5.56. The genotypes DHLH-38 (3.86), DHLH-32 (4.14), DHLH-13 (4.24) produced less pod length. Out of forty four genotypes tested, three (6.81%) genotypes produced more number of pod length than the populations mean and thirty eight (86.26%) genotypes recorded medium number of pod length per plant. (Table 1 and 2)

The genotypes DHLH-36 (5.8) exhibited significantly higher number of seeds per pod followed by DHLH-33, 44 (5.0), DHLH-6 (4.8). The general mean for number of seeds per pod was 4.31 and the variation ranged between 3.5 to 5.8. The genotypes DHLH-25 (3.5), DHLH-13 (3.6), DHLH-38 (3.7) produced less number of seeds per pods. Out of forty four genotypes tested, three genotypes (6.81%) produced more

number of seeds per pod than the populations mean and thirty nine (88.53 %) genotypes recorded medium number of seeds per pod. (Table 1 and 2)

The genotype DHLH-19 (29.72 g) recorded maximum 1000 seed weight followed by DHLH-36 (29.61g), DHLH-11 (28.13g), DHLH-34 (27.73), DHLH-18 (27.58) While, the genotype DHLH-30 (19.46g) recorded lowest 1000 seed weight followed by DHLH-35 (19.62), DHLH-31 (20.30 g), DHLH-40 (22.39 g) and DHLH-27 (22.89 g). The variation for this character was observed between 19.46 g to 29.72 g. Out of all 44 genotypes ten (22.72%) genotypes recorded significantly high 1000 seed weight while nine (20.43 %) genotypes recorded to be low 1000 seed weight and twenty five (56.75 %) genotypes recorded medium 1000 seed weight than population mean of 24.82 g (Table 1 and 2)

The genotypes DHLH-22 (122.9) exhibited significantly higher number of pods per plant followed by DHLH-1 (117.8), DHLH-39 (110.2). The general mean for number of pods per plant was 79.11 and the variation ranged between 52.9 to 122.9. The genotypes DHLH-35 (52.9), DHLH-29 (56.5), DHLH-28 (58.9) produced less number of pods per plant. Out of forty four genotypes tested, eleven (25.0) genotypes produced more number of pods per plant than the populations mean and eighteen genotypes (40.90%) recorded medium number of pods per plant. (Table 1 and 2)

The seed yield per plant ranged between 4.45 g to 15.87 g. Among all forty four genotypes tested only twelve (27.27%) genotypes recorded significantly superior performance than the population mean (8.54 g). (Table 4.2). The genotypes DHLH-22 (15.87 g) recorded highest seed yield followed by DHLH-1 (14.87 g), DHLH-11 (14.79g) and DHLH-2 (13.45). While the genotype DHLH-38 (4.45 g) produced low seed yield followed by DHLH-8 (4.71). Fourteen (31.81%) genotypes produce low seed yield while eighteen (40.90 %) genotypes produce medium seed yield per plant than the population mean. (Table 1 and 2).

Twenty two (50 %) genotypes recorded significantly high protein content than the population mean. Seventeen (38.63%) genotypes showed the lowest protein content. The protein content ranged between 17.21 to 25.10 %. Five (11.36 %) genotypes recorded medium performance than population mean of 21.63%. (Table 4.1and 4.2). The genotypes DHLH-6 (25.10 %g) recorded significantly highest protein content followed by DHLH-38 (24.53%), DHLH-35 (24.37%) and DHLH-5 (24.36). While the genotype DHLH-34 (17.21%) produced low protein content followed by DHLH-26 (17.23%). DHLH-33 (18.57%) and DHLH-10 (18.62%). Gopalan *et al.* (1976) and Patil and Deshmukh (1985) also reported the same trend.

Among 44 genotypes studied, the genotype DHLH-25 & 26 (days to 50 per cent flowering), DHLH-7,25 &26 (days to maturity), DHLH-1 (plant height), DHLH-5 (number of primary branches per plant), DHLH-44 (number of cluster per plant), DHLH-16 (pod length), DHLH-36 (number of seeds per pod), DHLH-19 (1000 seed weight), DHLH-22 (number of pods per plant), DHLH-22 (seed yield per plant) and DHLN-6 (protein content) showed high performance for the respective characters.

The variability for seed yield was ranged between 4.45 to 15.57 g, along with other yield contributing characters also showed good amount of variability. Days to 50 per cent flowering ranged between 62.0 to 93.50 days. Other characters also recorded large range of variability *viz.*; days to maturity (113.50 to 155.50 days), plant height (46.2 to 103.8 cm), number of primary branches per plant (4.4 to 7.5), number of cluster per plant (42.0 to 117.10), pod length (3.86 to 5.56), number of seeds per pod (3.5 to 5.8), 1000 seed weight (19.46 to 29.72 g), protein content (17.21 to 25.10 %). Corresponding results were found by Ghorpade (1985), Samal and Senapati (1997), Senapati (1998), Lad *et al.* (1999),Tripathi *et al.* (1999), Joshi *et al.* (2007), Raina *et al.* (2007), Singhal *et al.* (2010), Khulbe *et al.* (2013), Vijay Kumar *et al.* (2016), Rakesh *et al.* (2016) and Priyanka *et al.* (2019).

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Table .1. Mean performance of horse gram genotype

Sr No	Genotype	Days to 50 % flowering	Days to maturity	Plant height (cm)	No. of primary branches/ plant	No. of cluster / plant	Pod length (cm)	No. of Seed/ pod	1000 seed weight (g)	No. Of Pods/ plant	Seed Yield / Plant	Protein content (%)
1	DHLH-1	69.5	124.5	103.8	7.0	100.0	4.82	4.4	25.52	117.8	14.88	23.63
2	DHLH-2	68.5	124.5	96.4	6.4	91.5	4.85	4.2	23.72	104.2	13.45	21.46
3	DHLH-3	93.5	153.5	82.1	6.7	81.2	4.71	4.9	25.88	101.5	12.02	20.25
4	DHLH-4	92.5	153.5	78.4	5.7	72.0	4.75	4.5	25.29	73.4	9.20	23.05
5	DHLH-5	78.5	133.0	71.3	7.5	66.1	4.80	4.7	23.99	76.3	7.64	24.36
6	DHLH-6	93.5	153.5	71.8	6.6	58.0	4.87	4.8	25.5	73.8	7.14	25.10
7	DHLH-7	64.0	113.5	81.5	5.5	59.6	4.96	4.4	23.73	68.4	6.28	23.10
8	DHLH-8	93.5	154.5	68.2	6.0	47.7	4.89	4.3	23.54	60.1	4.71	22.00
9	DHLH-9	66.5	121.5	87.9	6.6	54.2	4.60	4.1	23.32	62.8	4.74	20.09
10	DHLH-10	64.0	120.5	64.6	5.3	72.1	4.80	4.2	25.10	91.9	10.01	18.62
11	DHLH-11	78.5	138.5	64.9	7.1	82.4	4.72	4.3	28.13	95.6	14.79	21.45
12	DHLH-12	79.0	138.5	78.0	6.2	82.7	4.65	4.3	23.14	106.1	10.69	21.53
13	DHLH-13	66.5	125.5	62.2	5.1	63.1	4.24	3.6	25.44	71.6	8.05	22.36
14	DHLH-14	74.5	132.5	60.2	5.2	59.5	4.87	4.1	23.36	67.0	6.07	19.87
15	DHLH-15	74.5	134.5	50.8	6.2	62.8	4.61	4.3	26.30	75.3	7.25	20.15
16	DHLH-16	91.5	152.5	74.7	7.0	60.5	5.56	4.7	26.63	67.2	6.18	23.46
17	DHLH-17	92.0	154.5	73.7	5.3	55.9	4.93	4.6	27.36	74.75	7.61	19.11
18	DHLH-18	92.0	155.5	62.6	5.6	56.5	4.75	4.4	27.58	68.9	8.79	19.81
19	DHLH-19	91.0	153.5	63.1	5.2	56.7	4.85	4.4	29.72	72.7	8.54	21.56
20	DHLH-20	78.5	137.5	58.7	5.8	49.3	4.40	4.1	23.90	58.5	5.75	19.68
21	DHLH-21	70.5	123.5	70.0	5.2	96.9	4.71	4.2	26.80	89.0	12.28	19.89
22	DHLH-22	90.5	152.5	80.0	6.1	111.2	4.42	4.3	25.25	122.9	15.87	23.00
23	DHLH-23	65.5	121.0	51.2	5.0	81.1	4.65	4.1	24.20	85.2	10.26	23.41
24	DHLH-24	92.5	154.5	69.6	6.0	67.0	4.75	4.3	25.85	70.4	8.79	23.06
25	DHLH-25	62.0	113.5	67.8	6.0	67.4	4.55	3.5	24.36	81.1	7.68	22.30
26	DHLH-26	62.0	113.5	79.8	5.5	49.0	4.31	4.1	26.64	58.5	4.90	17.23
27	DHLH-27	93.5	113.5	79.5	6.3	49.2	4.79	4.5	22.89	61.4	5.81	19.34
28	DHLH-28	65.5	120.5	62.8	5.2	50.5	4.45	3.9	24.65	58.9	5.40	20.70

29	DHLH-29	72.0	125.0	70.7	5.4	42.9	4.38	3.8	25.01	56.5	5.52	22.92
30	DHLH-30	70.5	125.0	80.6	6.1	68.3	4.54	4.1	19.46	109.9	7.96	23.41
31	DHLH-31	70.5	124.5	74.5	5.6	79.3	4.61	4.6	20.305	86.0	5.36	22.16
32	DHLH-32	70.5	124.5	58.6	5.6	65.7	4.14	4.2	24.86	71.3	8.01	22.04
33	DHLH-33	65.5	119.5	46.2	4.4	58.8	5.05	5.0	23.9	77.9	8.45	18.57
34	DHLH-34	65.5	119.5	52.6	5.2	62.1	4.74	4.5	27.73	70.7	9.96	17.21
35	DHLH-35	72.0	124.5	66.7	5.5	49.5	4.98	4.2	19.62	52.9	5.06	24.37
36	DHLH-36	65.5	121.5	46.9	6.5	47.5	4.61	5.8	29.615	67.9	9.10	22.08
37	DHLH-37	64.0	113.5	60.7	4.6	68.1	4.55	3.9	23.73	77.7	7.95	23.06
38	DHLH-38	65.0	120.5	91.6	4.8	49.3	3.86	3.7	24.11	59.7	4.45	24.53
39	DHLH-39	91.0	152.5	80.7	5.1	95.8	4.65	4.2	23.00	110.2	11.71	21.09
40	DHLH-40	64.5	120.5	64.9	4.9	57.0	4.44	3.8	22.39	70.1	6.79	23.10
41	DHLH-41	64.5	120.5	60.6	5.9	70.0	4.37	4.5	25.49	86.8	8.55	22.92
42	DHLH-42	70.5	124.5	74.85	5.6	76.0	4.69	4.4	25.91	88.0	10.2	19.79
43	DHLH-43	74.5	134.5	69.4	5.5	65.7	5.28	4.0	24.95	74.4	8.77	22.04
44	DHLH-44	74.5	134.5	96.4	6.25	117.1	4.88	5.0	24.42	104.4	13.02	22.99
	Mean	**75.5568**	**131.6591**	**70.7289**	**5.7875**	**67.6834**	**4.6827**	**4.3153**	**24.8247**	**79.1106**	**8.5402**	**21.6369**
	S.E.	**1.2266**	**1.8442**	**2.3487**	**0.304**	**3.5158**	**0.1416**	**0.2175**	**0.5143**	**3.1516**	**0.5171**	**0.1366**
	C.D. 5%	**3.4984**	**5.2598**	**6.6987**	**0.867**	**10.0273**	**0.4039**	**0.6203**	**1.4668**	**8.9885**	**1.4748**	**0.3895**
	C.V.	**5.2959**	**4.981**	**7.6963**	**10.428**	**10.3461**	**7.277**	**10.1272**	**5.9299**	**8.6339**	**8.5628**	**2.8926**

Table 2: The best accession performance for different genetic parameters of Horse gram.

Genetic Parameters	Range	Accession of the best performance
Days to 50% flowering Mean=75.55	62.0 to 93.50 days	DHLH-1, DHLH-2, DHLH-7, DHLH-9, DHLH-10, DHLH-13, DHLH-21, DHLH-23, DHLH-25, DHLH-26, DHLH-29, DHLH-28, DHLH-29, DHLH-30, DHLH-31, DHLH-32, DHLH-33, DHLH-34, DHLH-35, DHLH-36, DHLH-38, DHLH-40, DHLH-41, DHLH-42
Days to maturity	113.50 to 155.50 days	DHLH-1, DHLH-2, DHLH-7, DHLH-9, DHLH-10, DHLH-13, DHLH-21, DHLH-23, DHLH-25, DHLH-26, DHLH-27, DHLH-28, DHLH-29, DHLH-30, DHLH-31, DHLH-32, DHLH-33, DHLH-34, DHLH-35, DHLH-36, DHLH-37, DHLH-38, DHLH-40, DHLH-41, DHLH-42
Plant height	46.2 to 103.8 cm	DHLH-1, DHLH-2, DHLH-3, DHLH-4, DHLH-7, DHLH-9, DHLH-12, DHLH-22, DHLH-26, DHLH-27, DHLH-30, DHLH-38, DHLH-39, DHLH-44
Number of primary branches per plant	4.4 to 7.5	DHLH-1, DHLH-3, DHLH-5, DHLH-9, DHLH-11, DHLH-16
Number of cluster per plant	42.0 to 117.10	DHLH-1, DHLH-2, DHLH-3, DHLH-11, DHLH-12, DHLH-21, DHLH-22, DHLH-23, DHLH-31, DHLH-39, DHLH-44,
Pod length	3.86 to 5.56 cm	DHLH-16, DHLH-33, DHLH-43
Pods per plant	52.9 to 122.9	DHLH-1, DHLH-2, DHLH-3, DHLH-10, DHLH-11, DHLH-12, DHLH-21, DHLH-22, DHLH-30, DHLH-39, DHLH-44
Number of seeds per pod	3.5 to 5.8	DHLH-33, DHLH-36, DHLH-44
1000 seed weight	19.46 to 29.72 g	DHLH-11, DHLH-15, DHLH-16, DHLH-17, DHLH-18, DHLH-19, DHLH-21, DHLH-26, DHLH-34, DHLH-36
Protein content	17.21 to 25.10 %	DHLH-1, DHLH-4, DHLH-5, DHLH-6, DHLH-7, DHLH-13, DHLH-16, DHLH-22, DHLH-23, DHLH-24, DHLH-29, DHLH-30, DHLH-31, DHLH-32, DHLH-35, DHLH-36, DHLH-37, DHLH-38, DHLH-40, DHLH-41, DHLH-43, DHLH-44