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Research Article

CHARACTERIZATION OF GARLIC (*Allium sativum* L.) GENOTYPES BASED ON MORPHOLOGICAL CHARACTERS

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Abstract- The present investigation was carried out at Research Farm of the department of Vegetable Science, CCS Haryana Agricultural University, Hisar during spring *Rabi* season of 2014-15 on the basis of characterization and variability present in twenty-five garlic genotypes. The twenty-five genotypes were laid out in Randomized Block Design with three replications. The cloves of each genotype were planted manually on 28th October 2014 in flat beds of 3x2 m size at a spacing of 15x10 cm. The genotypes were categorized on the basis of plant height, number of leaves, leaf length, leaf width, foliage colour, pseudostem length, polar and equatorial diameter of bulb, number of cloves per bulb, skin colour of bulb and cloves and days to harvesting, which differentiate the garlic genotypes. The material assessed in the present investigation possessed wide range of variation for various characters observed. The genotypes were characterized for their morphological characters.

Keywords- Garlic, genotypes, characterization.

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Introduction

Garlic (*Allium sativum*L.), a member Alliaceae family, is the second most important widely cultivated bulbous cropsafter onion. The word *Allium* has been derived from the Celtic word *all*, which means pungent. It is originated from the progenitor *Allium longicuspis* and its centre of origin is Central Asia [1]. Of the two botanical varieties, *sativum* and *ophioscorodon*, former is of commercial importance and characterized by a bulb with many white or pink blushed cloves along with weak and sterile flower stalk, if it bolts at all [2]. It exhibits a wide range of diversity in morphological, reproductive and quality traits [3] because of its apomictic nature, which leads to the existence of extensive spontaneous mutations [4].

Garlic is a rich source of carbohydrates (29%), proteins (6.3%), minerals (0.3%), and essential oils (0.1-0.4%) and a fair source of fat, vitamin C and sulphur[5]. Its nutritive value is very high among bulbous crops [6]. Its unique characteristic flavour and pungency is due to the presence of diallyl disulphide, which is an odoriferous sulphur compound [7]. In garlic, alliin is the predominant flavour compound, while allicin is consequently the major thiosulphinate accounting for 60-95% of the total thiosulphinate[8]. Besides, it has several medicinal properties such as antibacterial [9], antifungal [10], antiviral [11], antiprotozoa properties [12] and antioxidant and anticancer properties [13]. It is good for heart and immune system and acts as anti-diabetic and anti-arthritis [14,15]. Therefore, its medicinal significance has increased to the extent that its oil capsules are now marketed through pharmacies and health food stores [16]. Much of the literature on garlic as medicine has been cited in most of the religious epics and Vedas.

The genus *Allium* has morphologically been relatively uniform and there are only few common morphological characters (synapomorphies) for the delimitation of natural groups within the genus. Therefore, in the lack of synapomorphies characters, molecular evidences in accord with the morphological characteristics may yield the acceptable results [17]. Garlic, despite a long history of obligate apomixis and exclusive nature of vegetative propagation, exhibits a good amount of morphological variation [18]. Inter clonal differences have been observed for plant height, bulb size and colour, number and size of cloves, bolting, purple blotch resistance, yield and quality traits. The objective of germplasm characterization is to check the occurrence of characters, which assist in the identification of a particular genotype. Characterization of cultivars developed on the ideotype concept to ascertain their distinctiveness is of key significance to complete the conditions of distinctness, uniformity and stability as laid down by the International Union for Protection of Plant Varieties [19] and seed act, Government of India.

Material and methods

The present investigation was carried out at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during spring *Rabi* season of 2014-15 on the basis of characterization and variability present in twenty-five garlic genotypes. The genotypes were categorized on the basis of plant height, number of leaves, leaf length, leaf width, foliage colour, pseudostem length, polar and equatorial diameter of bulb, number of cloves per bulb, skin colour of bulb and cloves and days to harvesting, which differentiate the garlic genotypes. Replication wise mean values of each of the 25 genotypes were computed for respective characters and subjected to statistical analysis. The experimental data was compiled by taking the mean values of the 25 genotypes of garlic for respective traits from all the three replications. All the statistical analysis was carried out by using OPSTAT statistical analysis tool (www.hau.ernet.in).

Result and Discussion

The genotypes showed variation with respect to all the traits. Based on plant height, five genotypes were dwarf, ten genotypes medium and ten genotypes tall, and based on number of leaves, the genotypes were categorized into few, medium and many. Two genotypes were put in category of few leaves, seventeen genotypes in medium and six genotypes in category of many leaves. Genotypes were classified based on leaf length as short, medium and long. Out of twenty five genotypes, eleven genotypes had short, ten genotypes medium and four genotypes long leaves. The genotypes based on observations for leaf width were grouped into narrow, medium and broaden category of leaf width. Out of twenty five genotypes, seven genotypes were kept in narrow, seventeen in medium and four in broaden category. With respect to foliage colour, ten genotypes showed light green, six genotypes medium green and nine genotypes dark green colour.

Table-1 *List of germplasm lines and standard released varieties included in the study*

Sr. No.	Genotype	Sr. No.	Genotype
1.	HG 1	14.	GRS 1340
2.	HG 2	15.	GRS 1345
3.	HG 3	16.	GRS 1349
4.	HG 4	17.	BGSD 1222
5.	HG 5	18.	BGSD 1225
6.	HG 6	19.	BGSD 1230
7.	HG 7	20.	BGSD 1232
8.	HG 8	21.	CGSD 1232
9.	HG 17	22.	CGSD 1247
10.	HG 27	23.	CGSD 1249
11.	GRS 1328	24.	CGSD 1252
12.	GRS 1330	25.	CGSD 1265
13.	GRS 1332		

Based on pseudostem length, the genotypes revealed significant variation for this character. Out of twenty five genotypes, three genotypes showed short, nine genotypes medium and thirteen genotypes long pseudostem. Based on observations for polar and equatorial diameter, two genotypes were put in the category of small, eighteen genotypes in medium and five genotypes in the category of large polar and equatorial diameter. Based on number of cloves per bulb, the genotypes were categorized into few, medium and many. Out of twenty five genotypes, three genotypes had few, thirteen genotypes medium and six genotypes many cloves per bulb. The genotypes with respect to skin colour of bulb and cloves were classified into two categories, *i.e.*, white and purple. Thirteen genotypes had white and twelve genotypes purple skin colour of bulb and cloves. The garlic genotypes based on days to harvesting were categorized into early, medium and late group. Out of twenty five genotypes, six genotypes were put in early, eighteen in medium and one in late category. [20] also characterized garlic genotypes based on above mentioned traits.

Table-2 *Categorization of garlic genotypes based on growth Characters*

	Plant height			No. of leaves		
	Dwarf(<70cm)	Medium (70-80cm)	Tall (>80 cm)	Few (<9)	Medium (9-12)	Many (>12)
Genotypes	HG 6, HG 7, HG8, CGSD1247 and CGSD1249	HG1, HG5, HG17, GRS 1328, GRS1340, CGSD 1265, HG 2, HG 3, HG 4, HG 27, GRS 1330, GRS1332, RS1345, BGSD1225, CGSD 1232 and CGSD 1252	GRS 1349, BGSD 1222, BGSD 1230 and BGSD 1232	BGSD 1225 and CGSD 1249	HG 1, HG 2, HG 3, HG 4, HG 5, HG6, HG 7, HG 8, HG 17, HG 27, GRS 1328, GRS1340, BGSD 1232, CGSD 1232, CGSD 1247, GRS 1330 and GRS 1332	GRS 1345, GRS 1349, BGSD1222, BGSD 1230, CGSD 1252 and CGSD 1265
Total	5	16	4	2	17	6

	Foliage colour			Pseudostem length		
	Light green	Medium green	Dark green	Short (< 20 cm)	Medium (21-30 cm)	Long (>30 cm)
Genotypes	HG 17, GRS 1328, GRS 1332, GRS 1345, BGSD 1222, BGSD 1225, BGSD 1230, CGSD 1247, CGSD 1249 and HG 6	HG3, HG4, HG5, HG7, HG8 and HG27	HG1, HG2, GRS 1330, GRS 1340, GRS 1349, BGSD 1232, CGSD 1232, CGSD 1252 and CGSD 1365	HG 5, HG 6 and HG 8	HG 1, HG 3, HG 7, HG 17, GRS 1330, BGSD 1225, BGSD 1232, CGSD 1249 and CGSD 1265	HG 2, HG 4, HG 27, GRS 1328, GRS 1332, GRS 1340, GRS 1345, GRS 1349, BGSD 1222, BGSD 1230, CGSD 1232, CGSD 1247 and CGSD 1252
Total	10	6	9	3	9	13

	Leaf length			Leaf width		
	Short (<35 cm)	Medium (35-40 cm)	Long (>40 cm)	Narrow (<2 cm)	Medium (2.1-3 cm)	Long (>3 cm)
Genotypes	HG 1, HG 2, HG 4, HG 17, GRS 1328, BGSD 1230, BGSD 1222, CGSD 1232, CGSD 1247, CGSD 1249 and BGSD 1232	HG 3, HG 5, HG 6, HG 8, HG 27, GRS 1330, GRS 1332, GRS 1340, BGSD 1225 and CGSD 1265	HG 7, GRS 1345, GRS 1349 and CGSD 1252	HG 2, HG 6, BGSD 1225, BGSD 1230, CGSD 1232, CGSD 1249 and GRS 1328	HG 1, HG 3, HG 4, HG 5, HG 7, HG 8, HG 17, HG 27, GRS 1330, GRS 1332, GRS 1340, GRS 1345, BGSD 1222, BGSD 1232, CGSD 1247, CGSD 1252 and CGSD 1265	GRS 1349
Total	11	10	4	7	17	1

Table -3 *Categorization of garlic genotypes based on Yield Characters*

	Polar diameter			Equatorial diameter		
	Small (<3.5 cm)	Medium (3.5-4.5 cm)	Large (>4.5 cm)	Small (<3.5 cm)	Medium (3.5-4.5 cm)	Large (>4.5 cm)
Genotypes	GRS 1330 and CGSD 1247	HG 1, HG 3, HG 4, HG 5, HG 6, HG 7, HG 8 , HG 17, HG 27, GRS 1328, GRS1332, GRS 1340, GRS 1345, BGSD 1222, BGSD1225, BGSD 1232, CGSD 1232 and CGSD 1249	HG 2, GRS 1349, BGSD 1230, CGSD 1252 and CGSD 1265	HG 6, HG 7 and HG 8	HG 1, HG 2, HG 3, HG 4, HG 5, HG 27, GRS 1349, BGSD 1222, GRS 1328, GRS 1330, GRS 1332, GRS 1345, CGSD 1247, CGSD 1249, CGSD 1252 and CGSD 1265	HG 17, CGSD 1232, GRS 1340, BGSD 1225, BGSD 1230 and BGSD 1232
Total	2	18	5	3	16	6

	clove skin colour		Days to harvesting		
	White	Purple	Early (<170 days)	Medium (170-180 days)	Late (>180 days)
Genotypes	HG2, HG3, HG6, HG17, HG27, GRS 1328, GRS 1330, GRS 1332, GRS 1340, GRS 1349, BGSD 1225, BGSD 1232, CGSD 1232	HG1, HG4, HG5,HG7, HG8, GRS 1345, BGSD 1222, BGSD 1230, CGSD 1247, CGSD 1249, CGSD 1252, CGSD 1365	HG 2, HG 8, HG 17, GRS 1330, CGSD 1232 and CGSD 1252	HG 1, HG 3, HG 4, HG 5, HG 6, HG 7, HG 27, GRS 1328, GRS 1332, GRS 1340, GRS 1349, BGSD 1222, BGSD 1225, BGSD 1230, BGSD 1232, CGSD 1247, CGSD 1249 and CGSD 1265	GRS 1345
Total	13	12	6	18	1

	No. of cloves/bulb			Bulb skin colour	
	Few (<25)	Medium(25-35)	Many (>35)	White	Purple
Genotypes	GRS 1328, GRS 1349 and CGSD 1232	HG 1, HG 3, HG 4, HG 5, HG 6, HG 7, HG 8, GRS 1345, BGSD 1222, BGSD 1225, BGSD 1230, CGSD 1247 and GRS 1332	HG 2, HG 17, HG 27, GRS 1330, GRS 1340, BGSD1232, CGSD 1249, CGSD 1252 and CGSD 1265	HG2, HG3, HG6, HG17, HG27, GRS 1328, GRS 1330, GRS 1332, GRS 1340, GRS 1349, BGSD 1225, BGSD 1232, CGSD 1232	HG1, HG4, HG5,HG7, HG8, GRS 1345, BGSD 1222, BGSD 1230, CGSD 1247, CGSD 1249, CGSD 1252, CGSD 1365
Total	3	13	9	13	12

Conflict of Interest: None declared

References

[1] McCollum G.D. (1976) Onion and allies. In: *Evolution of Crop Plants* (Ed. Simmonds, N.W.). Longman Press, New York, USA, pp. 186-190

[2] Jones H.A. and Mann L.K. (1963) *Onion and Their Allies*. Interscience Publishers Inc., New York, USA, 32 p.

[3] Senula A. and Keller R.J. (2000)*Allium Improvement Newsletter*, 10(3-5).

[4] Ata A.M. (2005) Constitutive heterochromatin diversification of two *Allium* species cultivated in Egypt. In: *Proceedings of the 7th African Crop Science* Society Conference, Kampala, Uganda, pp. 225-231.

[5] Memane P.G., Tomar R.S., Kakade D.K., Kulkarni G.U. and Chovatia R.S. (2008) *Asian Journal of Horticulture*, 3(1), 82-86.

[6] Pandey U.B. (1997) *Garlic Cultivation in India*. National Horticultural Research and Development Foundation, Nasik, Technical Bulletin No. 7. 50 p.

[7] Natale P.J., Camargo A. and Gãlmarjni C.R. (2005) *Acta Horticulturae*, 688, 313-316.

[8] Block E., Naganathan S., Putman D. and Zhao S.H. (1992) *Journal of Agricultural and Food Chemistry*, 40(12), 2418-2430.

[9] Arora S.D. and Kaur J. (1999) *International Journal of Antimicrobial Agents*, 12(3), 257-262.

[10] Hughes B.G. and Lawson L.D. (1991) *Phytotherapy Research*, 5(4), 154-158.

[11] Meng Y., Lu D., Guo N., Zhang L. and Zhou G. (1993) *Virologica Sinica*, 8, 147-150.

[12] Reuter H.D., Koch H.P. and Lawson L.D. (1996) Therapeutic effects and applications of garlic and its preparations. In: *Garlic: The Science and Therapeutic Applications of Allium sativum L. and Related Species* (Eds. Koch, H.P. and Lawson, L.D.). Williams and Wilkins, Baltimore, pp. 135-213

[13] Harris J.C., Cottrell S.L., Plummer S. and Lloyd D. (2001) *Application Microbiology and Biotechnology*, 57, 282-86.

[14] Benjamin R. (1999) *Flavour of life-measuring garlic in natures defence change*. International KHZ Printing Co. Pvt. Limited, Singapore, pp. 5-59.

[15] Kaul M. K. (2001) Pungent bulb with a heart of gold. *The Tribune*, June 17.

[16] Rahim M.A. and Fordham R. (1994) *Acta Horticulturae*, 358, 369.

[17] Bachmann K., Blattner F., Fischer D., Friesen N., Fritsch R., Klaas M., Mes T. and Pollener S. (2001) *Acta Horticulturae*, 546, 159-163

[18] Klaas M. and Feiesen N. (2002) Molecular markers in *Allium*. *In*: *Allium* Crops Science: Recent Advances (Eds. Rabinowitch, H.D. and Currah, L.). CAB International, UK, pp. 159-185.

[19] Anonymus UPOV, (1994) *International Union for protection of Plant Varieties*. www.upov.int.

[20] Vatsyayan S. and Brar P.S. (2012) Evaluation of garlic (*Allium sativum* L.) germplasm for morphological traits and shelf life. M.Sc. (Agri.) Thesis, Punjab Agriculture University, Ludhiana, Punjab, India, 78 p.