Characterization of Indian garlic accessions through IPGRI morphological descriptors

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ABSTRACT

Garlic (*Allium sativum* L) is the most nutritious bulbous spice and vegetable crop having highest sulphur content and possesses anti-cancerous properties. Keeping in view its utmost importance, morphological characterization was carried out at CSK Himachal Pradesh Agricultural University, Palampur, Kangra, Himachal Pradesh during 2017-2018 in randomized complete block design, using 25 garlic accessions for different traits viz bulb skin colour, clove skin colour, foliage colour, leaf waxiness, bolting/non-bolting and plant growth habit by following IPGRI morphological descriptors for making them to arrange into different sub-categories. In this review, main focus was primarily aimed at bulb, clove and plant morphological traits because of their economic importance for culinary, medicinal and propagation purposes. The studied traits can act as a base for the formulation of a core group of Indian garlic gene pool which can subsequently be exploited for developing an ideotype in garlic.

Keywords: Garlic; morphological characterization; IPGRI; descriptors; accessions

INTRODUCTION

Garlic (*Allium sativum* L), an asexually propagated crop and member of family Amaryllidaceae (Allen 2009), is an important spice crop and is the second most widely cultivated *Allium* after onion throughout the world. The primary centre of origin of garlic is central Asia (India, Afganistan, west China, Russia), whereas, Mediterranean region is considered as its secondary habitat (Brewster 1994). The most probable wild progenitor of garlic is *A longicuspis* (Pooler and Simon 1993). Garlic has been considered as Nectar of Life in Ayurveda as it is richest source of sulphur-reducing blood lipids cholesterol as it has got anti-cancerous and anti-scorbutic effects. Garlic also contains carbohydrates, sugar, dietary fibre, fat, protein, thiamine, riboflavin, niacin, vitamin C, calcium and essential oils which impart strong flavour to it. The chief constituents of its oil are diallyl disulphide, diallyl trisulphide, allyl-propyl disulphide and a small quantity of diethyl disulphide and diallyl polysulphide. Among these diallyl disulphide is known to possess the true garlic odour.

Globally, China is key producer of garlic in the world with 70 per cent of total production followed by India where it is mainly grown as short-day plant. However, long day varieties need photoperiod of more than 13 h with 20-25°C temperature for bulbing. Hence temperate areas like Jammu and Kashmir, Himachal Pradesh and Uttarakhand are most suitable for long day garlic cultivars (Malik et al 2017). Atif et al (2020) reported that early sowing, longer photoperiod and higher temperature plays key role in quality garlic production.

The major constraints in garlic production are lack of availability of improved varieties for commercial cultivation, processing and export purpose. Therefore, farmers are limited to use garlic landraces inferior in yield and prone to attack of diseases and insects. Most of the cultivated varieties of garlic are indigenous clonal stocks, however, some high yielding exotic genotypes have also been introduced recently. Because of lack of systematic study to improve this crop, very little information is available on morphological

characterization and character association for bulb yield and related traits.

Despite its infertile behaviour, it displays an inclusive range of variation as some garlic accessions are adapted to specific environments over both artificial and natural selection. Morphological traits such as bulb skin colour, clove skin colour, foliage colour, leaf waxiness, bolting/non-bolting and plant growth habit have shown wide variations (Ayed et al 2019). Valuation of such garlic accession is thus necessity of the hour for their effective utilization contributing immense value in selection of garlic ideotypes (Kamenetsky 2007).

MATERIAL and METHODS

The present study, involving 25 garlic accessions collected both within and outside the state (Table 1), was undertaken at the vegetable farm of Himachal Pradesh Agricultural University, Palampur, CSK Himachal Pradesh during rabi season 2017-2018 at an elevation of 1,290 m amsl with 32°6' N latitude and 76°3' E longitude. Agro-climatically, the location represents mid-hill zone of Himachal Pradesh with high rainfall of 2,500 mm annually, of which 80 per cent is received during June to September. The soil is acidic in nature with pH ranging from 5.0 to 5.6 and soil texture is silty clay loam. Mean temperature during the crop season varied from 13.5 to 25.8°C while relative humidity varied from 52 to 84.36 per cent. Each experimental plot consisted of 4 rows each of 0.6 m length, accommodating 6 plants per row. The observations were recorded on 10 randomly selected competitive plants from each entry per plot in each replication for skin colour (bulb skin colour and clove skin colour). Colour chart was used to differentiate colour intensity of garlic accessions (Anon 2001).

The morphological characters studied were bulb skin colour, clove skin colour, foliage colour, leaf waxiness, bolting/non-bolting and plant growth habit which were measured at various growth stages using the standard morphological descriptors of garlic developed by International Plant Genetic Resources Institute.

RESULTS and DISCUSSION

Using the standard descriptors of garlic developed by International Plant Genetic Resources Institute for morphological characterization, qualitative

Table 1. List of garlic accessions used

Genotype	Code	Source
Yamuna Safed-1	G-9	NHRDF, Karnal, Haryana
Yamuna Safed-2	G-12	NHRDF, Karnal, Haryana
Yamuna Safed-3	G-8	NHRDF, Karnal, Haryana
Yamuna Safed-4	G-2	NHRDF, Karnal, Haryana
Yamuna Safed-5	G-5	NHRDF, Karnal, Haryana
Yamuna Safed-8	G-13	NHRDF, Karnal, Haryana
Yamuna Safed-9	G-1	NHRDF, Karnal, Haryana
Agrifound Parvati	G-11	NHRDF, Karnal, Haryana
Agrifound Parvati-2	G-10	NHRDF, Karnal, Haryana
Agrifound White	G-7	NHRDF, Karnal, Haryana
GHC-1	G-3	CSK HPKV, Palampur, HP
Leda Local Selection	G-4	Local Collection, HP
Bijni Local Selection	G-6	Local Collection, HP
Ner Chowk Local Selection	G-14	Local Collection, HP
Mahadev Local Selection	G-15	Local Collection, HP
Kangra Local Selection	G-16	Local Collection, HP
Kanaid Local Selection	G-17	Local Collection, HP
Gheru Local Selection	G-18	Local Collection, HP
Chambi Local Selection	G-19	Local Collection, HP
Biara Local Selection	G-20	Local Collection, HP
Kasharala Local Selection	G-21	Local Collection, HP
Jhungi Local Selection	G-22	Local Collection, HP
Chakar Local Selection	G-23	Local Collection, HP
Pungh Local Selection	G-24	Local Collection, HP
Badraina Local Selection	G-25	Local Collection, HP

Table 2. Morphological characterization of accessions using IPGRI garlic descriptors

Genotype	Bulb skin colour	Clove skin colour	Foliage colour	Leaf waxiness	Plant bolting/ non-bolting	Growth habit
Yamuna Safed-1	Whitish purple	Whitish purple	Light green	Present	Present	Erect
Yamuna Safed-2	Creamish white	Whitish purple	Light green	Absent	Present	Erect
Yamuna Safed-3	Whitish purple	Purplish white	Light green	Absent	Present	Erect
Yamuna Safed-4	Whitish purple	Purplish	Light green	Absent	Present	Erect
Yamuna Safed-5	Whitish purple	Purplish white	Light green	Absent	Absent	Semi spreading
Yamuna Safed-8	Light pink	Whitish purple	Light green	Absent	Present	Erect
Yamuna Safed-9	Purplish white	Purplish white	Dark green	Absent	Absent	Semi spreading
Agrifound Parvati	Whitish purple	Light pink	Dark green	Present	Present	Spreading
Agrifound Parvati-2	Whitish purple	Creamish white	Dark green	Present	Present	Semi spreading
Agrifound White	Creamish white	Creamish white	Dark green	Absent	Present	Semi spreading
GHC-1	Whitish purple	Reddish brown	Dark green	Present	Present	Spreading
Leda Local Selection	Whitish purple	Creamish white	Light green	Absent	Present	Erect
Bijni Local Selection	Whitish purple	Light pink	Light green	Absent	Present	Erect
Ner Chowk Local Selection	Purplish white	Purplish	Dark green	Absent	Absent	Semi spreading
Mahadev Local Selection	Creamish white	Purplish	Light green	Absent	Absent	Erect
Kangra Local Selection	Purplish	Purplish	Light green	Absent	Absent	Erect
Kanaid Local Selection	Whitish purple	Creamish white	Dark green	Present	Present	Spreading
Gheru Local Selection	Creamish white	Purplish white	Dark green	Present	Absent	Spreading
Chambi Local Selection	Whitish purple	Light brown	Dark green	Present	Absent	Spreading
Biara Local Selection	Purplish white	Purplish white	Dark green	Absent	Absent	Semi spreading
Kasharala Local Selection	Purplish white	Purplish	Light green	Absent	Absent	Semi spreading
Jhungi Local Selection	Whitish purple	Light brown	Dark green	Present	Absent	Spreading
Chakar Local Selection	Purplish white	Purplish white	Light green	Absent	Absent	Erect
Pungh Local Selection	Purplish white	Purplish	Dark green	Present	Absent	Erect
Badraina Local Selection	Purplish	Purplish white	Light green	Present	Absent	Erect

traits among 25 garlic accession (Table 2) were grouped under sub-categories viz purplish-2, purplish white-6, whitish purple-12, creamish white-4 and light pink-1 for bulb skin colour (Table 2) and clove skin colour of different garlic genotypes was categorized as: purplish-6, purplish white-7, creamish white-4, whitish purple-3, two genotypes each of light pink, light brown and single genotype was reddish brown; 12 genotypes were with dark green foliage and remaining were light green in colour (Plate 1); all the genotypes were observed for presence or absence of leaf waxiness in which 10 genotypes possessed leaf waxiness, while, it was absent in remaining 15 genotypes; 12 exhibited the presence of bolting, while,

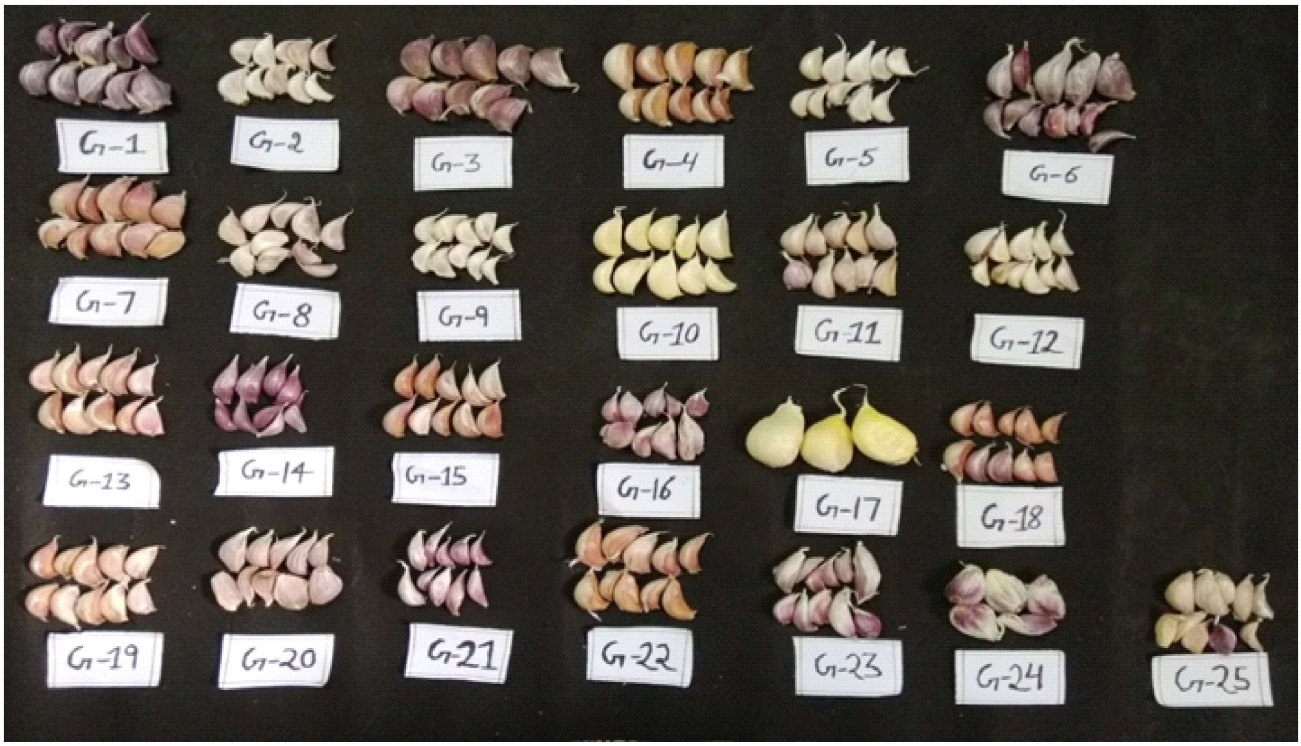

Plate 1. Morphological characterization of garlic accessions

bolting was absent in rest 13 garlic genotypes; 12 had erect, 7 had semi-spreading and remaining 6 had spreading type of plant growth habit. These traits are of immense value for market economics and recognition to fetch higher economic returns (Raghavan 2007) as consumers curiously prefer medium size, colourful, aromatic and flavoury type of unique garlic for garlic bread in restaurants and fast-food corners. The results are in accordance with the findings of earlier researchers (de Menezes-Sobrinho et al 1999, Pandey and Pandey 2005, Negi 2006, Verma et al 2008, Pandey et al 2008) who categorized different garlic accessions based on morphological descriptors in their respective studies.

CONCLUSION

The morphological characterization of garlic accessions has significant value with regard to its record, preparation of catalogue, classification as per traits and primary understanding of breeder to carry advance research. This study also acts as a base material for the formulation of a core group of Indian garlic gene pool for subsequent exploitation. Morphological characterization in this study signified huge diversity which can be utilized and can prove helpful for planning advanced breeding programme in future for improvement of garlic accessions.

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