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Agro-morphological characterization of exotic and indigenous *kabuli* chickpea lines

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Abstract
Eighty nine exotic and indigenous *kabuli* chickpea lines received from different sources (SAU's, ICRISAT and ICARDA) evaluated for nineteen qualitatative traits as per on DUS guideline. Field experiment was conducted under Seed Breeding Farm, Department of Plant Breeding and Genetics, College of Agriculture, J.N.K.V.V, Jabalpur (M.P.) in two *Rabi* season 2018-19 and 2019-20 in Randomized Complete Block design in 3 replications. Morphological traits are needed to overcome the yield barriers within the genotypes. Yield is a complex trait, governed by many traits and selections directly for grain yield in plants are not easy. Thus, any morphological character that is associated with higher seed yield or which makes a significant contribution to yield would be useful in the improvement of grain yield. Plant growth habit is a distinguishing feature in plant characterization. Results showed that 28 lines were semi-spreading, 44 semi-erect while 17 lines were erect type. Further, seventy six lines were recorded medium stature, 8 short, whereas 5 lines tall. Lines FLIP12-278C, FLIP12-161C, JGK-2018-5, ICCV181309 and ICCV181305 had semi erect to erect type with tall stature would be suitable for mechanical harvesting. All lines characterized by white colour flower with no stripes on standard and had one flower per peduncle, no anthocyanin pigmentation and pinnate type of leaf pattern. Foliage colour showed wide variation, 6 lines had dark green, 55 lines had light green and 28 lines had medium green. Results exhibited that 37 lines were recorded as early flowering, better suited to grow under late sown conditions, whereas 50 lines medium and 2 lines were recorded late flowering. All the *kabuli* lines recognized as owl's head shape seed having beige colour seed coat with smooth seed surface. Among 89 lines ICCV181313 was recorded small seeded and 40 lines were medium seeded whereas seven *kabuli* chickpea lines were recorded extra-large seeded (JGK-2018-1,2,3,4, RVSVT-K-105,110 and ICCV181307) and 33 large seeded would be screen out as export purpose, directly associated higher seed yield and also used in hybridization programme. Therefore, characterization facilitates to develop distinct profile of these lines and helped in identification and evaluation of elite *kabuli* chickpea lines.

Keywords: Morphological characterization, *kabuli* Chickpea, DUS test

Introduction
Chickpea provides high quality protein for human and animal consumption as well as offers economic benefits to farmers because of the high market value for chickpea grains and not only meets its own nitrogen requirement but also leaves residual nitrogen for succeeding crop, improves physical and chemical properties of the soil, and decreases pests, diseases and weeds of rainy season (*kharif*) crops *Kabuli* chickpea fetches higher price than *desi* varieties and thus could work as a catalyst in bringing additional area under irrigated condition of the country and also improving livelihood of the pulse growers It. It is one of the oldest and widely cultivated pulse crops over 50 countries of the world.

Traditionally, characterization of morphological traits has been used as a basis for classification, visual identification, differentiation and cataloguing of the germplasm. It could unveil their phylogeny, which considerably beneficial to a plant breeder in utilizing these germplasm in frontier area of research programme of chickpea. Morphological characterization studies are done by using morphological markers that are highly heritable traits. They are inexpensive, simple and rapid to score. The measurement of the descriptor is used to assess diversity, but the environmental effect on these traits renders this measure relatively insensitive, particularly where differences are small. Therefore, morphological markers need to be supported with more sensitive markers especially when measuring diversity between and within populations of a single species (Williams *et al.*, 1990) [23]. Plant morphological characters have been recognized as the universally undisputed descriptors for DUS testing and varietal characterization of crop varieties (Joshi *et al.*, 2018) [9]. Thus, any

morphological character that is associated and makes a significant contribution to higher seed yield would be useful in the improvement of yield. According to aforesaid facts, this investigation was carried out to characterize 89 elite *kabuli* lines on the basis of qualitative DUS descriptor which facilitates to identify distinguish line, further it would be used in chickpea improvement programme.

Material and method

The study was conducted on the site of seed breeding farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during two *rabi* seasons of 2018-19 and 2019-20. The experimental material comprised of 89 elite lines of *kabuli chickpea* included 2 checks. Elite lines of *kabuli* chickpea were obtained from ICRISAT (Pattancheru), ICARDA (Morocco) and JNKVV (Jabalpur). All lines were evaluated in three replications using Randomized Complete Block Design (RCBD) with each entry in two rows of 4.0 m length in each replication. Inter and intra-row space was 45 x 10cm. The recommended agronomical and plant protection practices were followed for the successful raising of the crop. Observations were recorded on 19 qualitative traits including morphological and seed traits based on the DUS guide line of chickpea for each character in each replication at different crop growth stages. Qualitative traits along with its descriptors and stage of observation have been depicted in Table 1.

Table 1: List of Morphological Traits with Descriptors

S.No. N	Characteristics	Descriptors	Stage of observation
1	Stem: Anthocynin coloration	Absent, Present	Before flowering
2	Plant:Growth habit	Erect, Semi-erect, Semi Spreading, Spreading	50% flowering
3	Color of foliage	Light green, Medium green Dark green, Greenish purple	50% flowering
4	Leaflet:Size	Small, Medium, Large	50% flowering
5	Leaf: Pattern	Simple, Compound, Pinnate	50% flowering
6	Flower:Color	White, Pink, Blue, Purple	50% flowering
7	Peduncle: Length(mm)	Short, Medium, Long	Pod development
8	Seed:Color	Beige (*Kabuli*), Creamy beige, Green, Yellow, Orange, Brown, Dark brown, Grey, Black	30 days after harvest
9	Seed: Size	Very small, Small, Medium, Large, Very large	30 days after harvest
10	Seed: Shape	Pea-shaped, Owl's head, Angular	30 days after harvest
11	Seed: Testa texture	Rough, Smooth, Tuberculated	30 days after harvest
12	Seed:Ribbing	Absent, Present	30 days after harvest

Results

Crop improvement in chickpea is hampered due to the presence of narrow genetic base which need to be broadened so as to realize the genetic potential of these lines. Hence, assessment of genetic diversity is a prerequisite for formulating crop improvement strategies in any crop. Since, the assessment of the genetic diversity and characterization of primary genetic resource specimens is one of the most important conditions for the proper and rational use of working collections in future breeding programmes. Therefore, agro-morphological traits of different lines studied and showed that although some of the lines have common qualitative features rather than one or few characters, they can be differentiated from each other on the basis of their mono-morphic traits. The objective of this investigation was to characterize the *kabuli* chickpea lines for seventeen qualitative traits on the basis of DUS guideline and prepared their distinct profile to discriminate the different lines.

No variation was found among the elite lines for Leaf pattern and all they had pinnate type of leaf pattern. Plant growth habit is a distinguishing feature in plant characterization of chickpea. Large variation was observed in growth habit 28 lines were semi spreading, 44 lines, semi-erect, while 17 lines were erect type. Further, Seventy six lines among 89 recorded medium stature, 8 lines short, whereas 5 lines were tall. Lines *viz.*, FLIP 12-278C, FLIP 12-161C, JGK- 2018-5, ICCV 181309 and ICCV 181305 had semi erect to erect type with tall stature would be suitable for mechanical harvesting. Results indicated that there was wide variation showed in foliage color, 55 lines showed light green, 28 lines observed medium green, while 6 lines showed dark green. It is a visual trait easily observable in vegetative stage of plant. In order to size of leaflets, the variation was observed in the lines which were categorized into three main groups *viz;* small, medium and large, 11 lines observed small size leaflets (10.0mm), 55 observed medium (10.0-15.0mm), while the remaining 23 were large (>15.0mm) leaflets size. Color of flower is one of the most important diagnostic visual easily observable traits. It is widely used as a marker gene in genetic studies and breeding work. All indegineous and exotic *kabuli* chickpea lines were characterized by white colour flower with no stripes on standard and had one flower per peduncle. No anthocyanin pigmentation and dark coloration on stem, whole plant and pods and all lines had pinnate type of leaf pattern. The peduncle length is a peculiar trait, can be classified in to three categories 7 lines exhibited short peduncle, while in 32 lines noted medium peduncle length and the remaining 50 lines showed long peduncle.

All the *kabuli* lines recognized as owl's head shape seed, having beige colour seed coat with smooth seed surface. For *kabuli* chickpea, seed size is a most preferable traits to the consumers because large and extra-large seeded *kabuli* chickpea fetches 2-3 times higher price than *desi* varieties and thus it could work as a catalyst in bringing additional area and improving livelihood of the pulse growers. Seed size traits showed mono-morphic as well as polymorphic. Among 89 lines, a line ICCV 181313 recorded as small seed size (20-25g), showed mono morphic in nature, whereas 40 lines noted as medium seeded (26-35g), 33 elite lines as large seed seeded (36-45g) and seven *kabuli* chickpea lines recorded as extra-large seeded (JGK- 2018-1,2,3,4, RVSVT-K-105, 110 and ICCV 181307). These large and extra-large seeded lines would be screenout as export purpose and also used in chickpea hybridization programme.

Table 2: Frequency distribution of phenological, morphological and seed traits of 89 *kabuli* chickpea lines

S. No.	Traits	Expressions	No of lines belonging to each class out of 89 lines	Percentage contributions (%)
1.	Growth habit	Erect (0-15^0 from vertical)	17	19.1
		Semi-erect (16-25^0 from vertical)	44	49.4
		Semi-spreading (26-60^0 from vertical)	28	31.4
2.	Size of leaflets	Small (<10mm long- 4mm wide)	11	12.3
		Medium (10-15mm long, 412mm wide	55	61.8
		Large (>15mm long, >12mm wide)	23	26.0
3.	Time of 50% flowering	Early (40-60 days)	37	41.5
		Medium (61-80 days)	50	56.1
		Late (>80 days)	2.0	2.2
4.	Plant height (cm)	Short (< 45cm)	8.0	8.9
		Medium (45-65cm)	76	85.3
		Tall (> 65cm)	5.0	5.6
5.	Flower stripes on standard	Absent	89	100
6.	Flower color	White	89	100
7.	Flower number per peduncle	One	89	100
8.	Foliage colour	Dark green	6.0	6.7
		Light green	55	61.8
		Medium green	28	31.5
9.	Leaf pattern	Pinnate	89	100
10.	Stem anthocyanin coloration	Absent	89	100
11.	Peduncle length (mm)	Short (<5mm)	7.0	7.9
		Medium (5- 10mm)	32	35.9
		Long (>10mm)	50	56.2
12.	Seed colour	Beige	89	100
13.	Seed size	small(20-25g)	1.0	1.1
		Medium (26-35g)	48	53.9
		Large (36-45g)	33	37.1
		Extra large (> 45g)	7.0	7.8
14.	Seed shape	Owl head	89	100
15.	Seed surface/ texture	Smooth	89	100
16.	Seed ribbing	Absent	89	100
17.	Seed type	*kabuli*	89	100
18.	Shattering resistance (%)	Present	89	100
19.	Lodging resistance (%)	Present	89	100

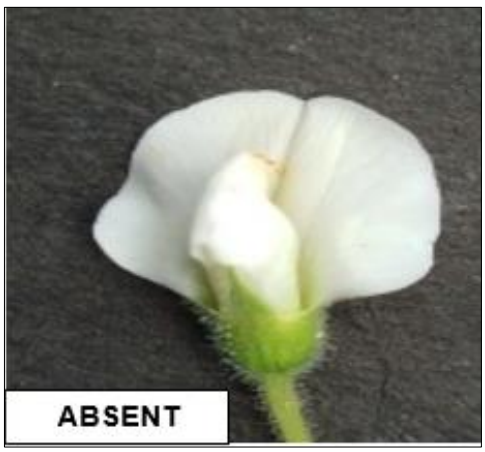

Fig 1: Flower Stripes on Standard

Fig 2: Flower Number per Peduncle

Fig 3: Color of Flower

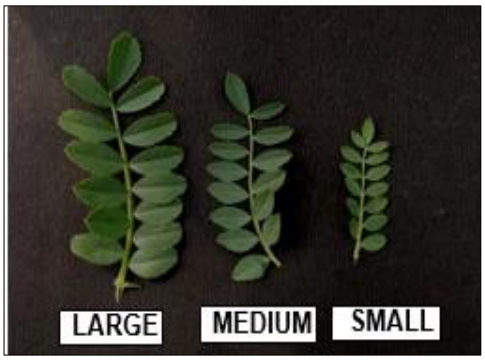

Fig 4: Leaflet Size

Fig 5: Leaf Pattern

Fig 6: Anthocyanin Coloration

Fig 7: Plant Growth Habit

Fig 8: Seed shape: Owl's Head

Fig 9: Seed Ribbing: Absent

Fig 10: Seed Colour: Beige

Fig 11: Peduncle length

Fig 12: Seed Size (Weight of 100 Seeds At 10% Moisture Content)

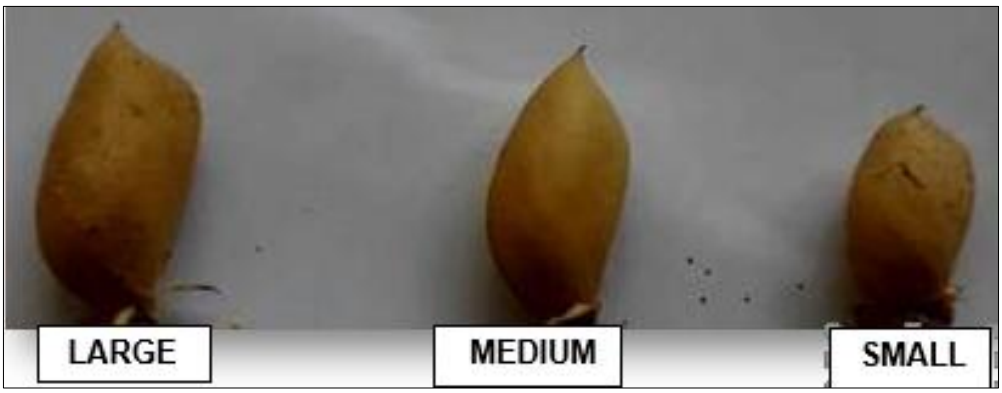

Fig 13: Pod Size (Length)

Morphological characters

Table 3: Distinguishable Agro-morphological traits of *kabuli* chickpea lines under late sown conditions

S. No.	Lines	Anthocyanin	Leaf Pattern	Growth habit	Color of foliage	Leaflet size	Flower color	Peduncle length	Seed color	Seed size	Seed shape	Seed testa texture	Seed ribbing
1	ICCV 181314	Absent	Pinnate	Semi Spreading	Dark green	Large	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
2	ICCV 181301	Absent	Pinnate	Semi erect	Medium green	Large	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
3	ICCV 181305	Absent	Pinnate	Semi erect	Medium green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
4	ICCV 181318	Absent	Pinnate	Erect	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
5	ICCV 181311	Absent	Pinnate	Semi Spreading	Medium green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
6	ICCV 181317	Absent	Pinnate	Semi erect	Dark green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
7	ICCV 181304	Absent	Pinnate	Erect	Light green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
8	ICCV 181310	Absent	Pinnate	Semi erect	Medium green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent

9	ICCV 181316	Absent	Pinnate	Erect	Light green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
10	ICCV 181303	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
11	ICCV 181308	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
12	ICCV 181307	Absent	Pinnate	Semi erect	Medium green	Large	White	Long	Beige	Extra large	Owl's head shape	Smooth	Absent
13	ICCV 181315	Absent	Pinnate	Semi erect	Medium green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
14	ICCV 181309	Absent	Pinnate	Semi erect	Medium green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
15	ICCV 181312	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
16	ICCV 181302	Absent	Pinnate	Erect	Light green	Large	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
17	ICCV 181313	Absent	Pinnate	Erect	Medium green	Large	White	Long	Beige	Small	Owl's head shape	Smooth	Absent
18	ICCV 181306	Absent	Pinnate	Erect	Medium green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
19	RVSVT-K 101	Absent	Pinnate	Semi Spreading	Dark green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
20	RVSVT-K 102	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
21	RVSVT-K 103	Absent	Pinnate	Semi Spreading	Dark green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
22	RVSVT-K 104	Absent	Pinnate	Semi Spreading	Light green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
23	RVSVT-K 105	Absent	Pinnate	Semi Spreading	Light green	medium	White	Medium	Beige	Extra large	Owl's head shape	Smooth	Absent
24	FLIP88-85C	Absent	Pinnate	Semi erect	Dark green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
25	RVSVT-K 107	Absent	Pinnate	Semi Spreading	Medium green	medium	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
26	RVSVT-K 108	Absent	Pinnate	Semi Spreading	Light green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
27	RVSVT-K 109	Absent	Pinnate	Semi erect	Dark green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
28	RVSVT-K 110	Absent	Pinnate	Erect	Light green	medium	White	Medium	Beige	Extra large	Owl's head shape	Smooth	Absent
29	JGK 2018-1	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Extra large	Owl's head shape	Smooth	Absent
30	JGK 2018-2	Absent	Pinnate	Erect	Light green	medium	White	Medium	Beige	Extra large	Owl's head shape	Smooth	Absent
31	JGK 2018-3	Absent	Pinnate	Erect	Light green	medium	White	Long	Beige	Extra large	Owl's head shape	Smooth	Absent
32	JGK 2018-4	Absent	Pinnate	Erect	Light green	medium	White	Long	Beige	Extra large	Owl's head shape	Smooth	Absent
33	JGK 2018-5	Absent	Pinnate	Erect	Medium green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
34	FLIP12-53C	Absent	Pinnate	Semi Spreading	Medium green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
35	FLIP12-281C	Absent	Pinnate	Semi Spreading	Medium green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
36	FLIP12-169C	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
37	FLIP12-131C	Absent	Pinnate	Semi erect	Medium green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
38	FLIP12-202C	Absent	Pinnate	Erect	Light green	Small	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
39	FLIP12-192C	Absent	Pinnate	Semi erect	Light green	Small	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
40	FLIP12-85C	Absent	Pinnate	Semi Spreading	Medium green	Small	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
41	FLIP12-261C	Absent	Pinnate	Semi Spreading	Medium green	Small	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
42	FLIP12-128C	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
43	FLIP12-	Absent	Pinnate	Semi erect	Medium	Small	White	Medium	Beige	Large	Owl's head	Smooth	Absent

	09C				green						shape		
44	FLIP12-161C	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
45	FLIP12-196C	Present	Pinnate	Semi Spreading	Medium green	medium	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
46	FLIP12-342C	Absent	Pinnate	Semi Spreading	Medium green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
47	FLIP12-278C	Absent	Pinnate	Erect	Light green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
48	FLIP12-19C	Absent	Pinnate	Erect	Medium green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
49	FLIP12-138C	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
50	FLIP12-55C	Absent	Pinnate	Semi erect	Light green	Large	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
51	FLIP12-319C	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
52	FLIP12-146C	Absent	Pinnate	Semi erect	Light green	Large	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
53	FLIP12-195C	Absent	Pinnate	Semi erect	Light green	Large	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
54	FLIP12-334C	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
55	FLIP12-86C	Absent	Pinnate	Semi Spreading	Light green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
56	FLIP12-145C	Absent	Pinnate	Semi erect	Light green	Large	White	Short	Beige	Medium	Owl's head shape	Smooth	Absent
57	FLIP12-193C	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
58	FLIP12-57C	Absent	Pinnate	Semi Spreading	Medium green	medium	White	Short	Beige	Medium	Owl's head shape	Smooth	Absent
59	FLIP12-60C	Absent	Pinnate	Semi erect	Medium green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
60	FLIP12-72C	Absent	Pinnate	Semi erect	Light green	medium	White	Short	Beige	Medium	Owl's head shape	Smooth	Absent
61	FLIP12-63C	Absent	Pinnate	Erect	Light green	Small	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
62	FLIP12-61C	Absent	Pinnate	Semi Spreading	Medium green	medium	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
63	FLIP12-89C	Absent	Pinnate	Semi erect	Light green	Large	White	Short	Beige	Large	Owl's head shape	Smooth	Absent
64	FLIP12-197C	Absent	Pinnate	Semi Spreading	Light green	medium	White	Short	Beige	Large	Owl's head shape	Smooth	Absent
65	FLIP12-180C	Absent	Pinnate	Semi Spreading	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
66	FLIP12-259C	Absent	Pinnate	Semi erect	Medium green	medium	White	Short	Beige	Medium	Owl's head shape	Smooth	Absent
67	FLIP12-198C	Absent	Pinnate	Semi Spreading	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
68	FLIP12-260C	Absent	Pinnate	Semi erect	Light green	Small	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
69	FLIP12-07C	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
70	FLIP12-44C	Absent	Pinnate	Semi Spreading	Light green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
71	FLIP12-36C	Absent	Pinnate	Semi Spreading	Light green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
72	FLIP12-08C	Absent	Pinnate	Semi erect	Medium green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
73	FLIP12-37C	Absent	Pinnate	Semi erect	Light green	Small	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
74	FLIP12-162C	Absent	Pinnate	Semi erect	Light green	Large	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
75	FLIP12-132C	Absent	Pinnate	Semi Spreading	Light green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
76	FLIP12-93C	Absent	Pinnate	Semi Spreading	Light green	Large	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
77	FLIP12-90C	Absent	Pinnate	Semi erect	Light green	Large	White	Long	Beige	Large	Owl's head shape	Smooth	Absent

78	FLIP12-127C	Absent	Pinnate	Semi erect	Light green	medium	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
79	FLIP12-108C	Absent	Pinnate	Semi erect	Light green	medium	White	Short	Beige	Medium	Owl's head shape	Smooth	Absent
80	FLIP12-343C	Absent	Pinnate	Erect	Light green	Small	White	Long	Beige	Large	Owl's head shape	Smooth	Absent
81	FLIP12-320C	Absent	Pinnate	Erect	Light green	Small	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent
82	FLIP12-80C	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
83	FLIP12-187C	Absent	Pinnate	Semi erect	Light green	Large	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
84	FLIP12-311C	Absent	Pinnate	Semi Spreading	Medium green	medium	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
85	FLIP12-78C	Absent	Pinnate	Semi Spreading	Medium green	Large	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
86	FLIP12-331C	Absent	Pinnate	Semi erect	Medium green	Small	White	Medium	Beige	Large	Owl's head shape	Smooth	Absent
87	ILC482	Absent	Pinnate	Semi Spreading	Light green	Large	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
88	Vihar Check	Absent	Pinnate	Semi erect	Light green	medium	White	Medium	Beige	Medium	Owl's head shape	Smooth	Absent
89	JGK1	Absent	Pinnate	Semi Spreading	Light green	medium	White	Long	Beige	Medium	Owl's head shape	Smooth	Absent

Discussion

Understandings of various seed traits *viz.*, seed color, seed size, shape and texture facilitate the identification for selection of desirable traits, designing new populations and transferring their desirable genes. Large seeded lines would be directly associated with selection of higher yielding lines. These results supported by the research of (Kumawat *et al.*, 2021, Solanki *et al.*, 2019), and Loko *et al.* (2018), Bayahi *et al.*(2015), Shrivastava *et al.* (2012), Upadhyaya *et al.* (2008), Kaul *et al.* (2007) [12, 20, 14, 2, 18, 21, 10]. Morphological features of the lines have been a major component of varietal identification, distinctness, characterization and evaluation of best elite lines. Similar findings reported by earlier scientists (Gediya *et al.*, 2018), Sangram Singh *et al.* (2018), Kosev and Vasileva (2018), Joshi *et al.* (2018), Bayahi and Rezgui (2015)**,** saha (2017) and Zaccardelli *et al.* (2013) [5, 16, 11, 15, 25].

It is not possible to identify advanced promising lines using any single parameter. A detailed morphological description of plants and seeds should therefore be assigned distinctive morphological profiles. Similar facts suggested by Janghel *et al.* (2020), Solanki *et al.* (2019), and Adem and Tesso (2019) [8, 20, 1].

Differential behaviour in respect of growth, dry matter production potential and translocation of photosynthates from source to sink showed significant variation in yield which leads to distinguish lines from each other. Similar results noticed by Bodake *et al.* (2014) and Heidarvand *et al.* (2011) [3, 7].

Utilization of agro-morphological features in sequential fashion is useful and convenient to distinguish different genotypes. Similarly, genotypes identification based on distinguishable morphological characters were reported by (Sarao *et al.*, 2009), Lalitha (2007), Upadhyaya *et al.* (2002), Yadav and Shrivastava (2002), Chowdhury *et al.* (2002) and Singh (2001) [17, 13, 22, 24, 4, 19] in chickpea, However systematic characterization leads to a more efficient use of material under consideration in chickpea improvement programme.

Conclusion

Results of investigation concluded that distinct morphological profile would be most practically valuable to a plant breeder while selecting genotypes in field and seed level. Morphological character those associated with higher seed yield or which makes a significant contribution to yield would be useful in the further improvement of seed yield. Therefore, morphological characterization facilitates to develop distinct profile of these lines and helped in identification, characterization and evaluation of elite *kabuli* chickpea lines. Hence, systematic characterization leads to a more efficient use of material under consideration in chickpea frontier area of research and these lines prefer to selection to better exploit in hybridization programme.

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