The Pharma Innovation Journal 2022; SP-11(4): 547-550

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(4): 547-550

www.thepharmajournal.com
Received: 13-02-2022
Accepted: 16-03-2022

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Germplasm evaluation of tulip cultivars at 1587 m above mean sea level under Kashmir Himalayas

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Abstract
Germplasm assessment of tulip cultivars was carried out during 2018-19 at Division of Floriculture and Landscape Architecture SKUAST- K Shalimar with an objective to assess the genetic diversity on the basis of qualitative and quantitative traits of growth, flowering and propagation ratio. Results of the investigation recorded minimum to maximum values for days to sprouting after planting 84 days for White flag & 103 days for Apeldoorn, days to flowering 110 days for Alectric & 125.00 days for Avant grade, flower diameter 4.70 cm for Candela & 8.18 cm for Apeldoorn, duration of flowering 12 days for White flag & 19 days for Angelique, plant height 33.31 cm for Candela & 52.53 cm for Apeldoorn, number of leaves per plant 4 for White flag & Candela & 6.00 for Apeldoorn, number of bulbs plant^{-1}1.10 for Atillagraffity & 1.62 for Apeldoorn and weight of bulbs plant^{-1} 12.30g for Candela) & 17.24 for Apeldoorn, simultaneously and respectively. It was concluded that highly significant varietal differences indicated the presence of high amount of variability.

Keywords: Flowering, morphology, tulip cultivars, variability

1. Introduction
Commercial floriculture is progressing at 10% growth rate with an turnover of around US $ 60 billion annually. Being an emerging business transformed from a domestic activity to a global industry has a great scope of progress as there is increase in demand and consumption of cut flower production, live plant propagation, seed and bulbs. Aesthetic and recreational taste of masses is increasing and consequently, the demand of ornamentals for landscaping of houses, educational institutes, roads, farm-complexes and industrial units has also increased. India's share in this global floricultural trade is around $0.75 billion. The area under floriculture in India has almost crossed 2.5 lakh hectares. Domestic production has increased manifold and the export earnings have gone 2000 crore. Tulip (*Tulipa* sp.), belongs to family Liliaceae. In international market, Tulip ranks first amongst the bulbous crops and demanded temperate ornamental bulbous crop in international floriculture trade (Masoodi *et al.* 2018) [9]. Around 3,000 tulip varieties belonging to 14 groups are available in trade including early, mid and late flowering. When assessing the situation of import, temperate bulbs particularly Tulip are imported annually worth crores of rupees. These are planted in plains as annuals and in Kashmir as perennials. In India, Kashmir is endowed with highly suitable agro-climate and offers immense scope for bulb production. So in absence of any interstate competition, Kashmir can supply bulbs of tulip, not only in the state but to national markets. But which variety can perform best from vegetative to reproductive point of view is always questionable. Thus current study of evaluation envages a scope for delaminating varieties of tulip which can be explored from commercial point of view.

2. Materials and Methods
2.1 Geographical features
Srinagar is situated between 34º05′ to 34º07′ north latitude and 74º08′to 74º09′ east longitude at an altitude of about 1587 m above mean sea level.

2.2 Experimental site
The experiment was carried out at the Experimental Farm of Division of Floriculture and Landscape Architecture SKUAST- K Shalimar, Kashmir.

2.3 Experimental details
Number of varieties: 10
Design: RCBD (Randomized Complete Block Design)
Replications: 03

2.4 Preparation of beds for experimental trial
The field selected for the experiment was prepared by ploughing with tractor thoroughly and leveled properly. The stubbles of previous crop weeds and grasses were removed and then field was finally leveled to make the soil pulverized.

2.5 Application of manures and fertilizers and Cultural practices
Recommended dose of well decomposed farmyard manure (FYM) and inorganic fertilizers were applied and mixed thoroughly with the soil before the planting of bulbs. Uniform cultural practices were followed through the growth period. Irrigation, weeding-cum-hoeing and plant protection measures were carried out as and when required.

2.6 Observations recorded
Observations were observed on days to bulb sprouting after planting, days to flowering, flower diameter, duration of flowering, Plant Height (cm), number Of leaves per plant, number of bulbs plant^{-1} and bulb weight plant^{-1}

3. Results and Discussion
Data depicts the variability response of different tulip cultivars for growth, flowering and propagation ratio. Results of the investigation (Table 1) recorded minimum to maximum values for days to sprouting after planting 84 days for White flag & 103 days for Apeldoorn, days to flowering 110 days for Alectric & 125.00 days for Avant grade, flower diameter 4.70 cm for Candela & 8.18 cm for Apeldoorn, duration of flowering 12 days for White flag & 19 days for Angelique. Data on phenotypic and propagation co-efficient of variation (Table 2) recorded plant height 33.31 cm for Candela & 52.53 cm for Apeldoorn, number of leaves per plant 4 for White flag & Candela & 6.00 for Apeldoorn, number of bulbs plant^{-1}1.10 for Atillagraffity & 1.62 for Apeldoorn and weight of bulbs plant^{-1} 12.30g for Candela) & 17.24 for Apeldoorn, simultaneously and respectively. On the basis of performance significant variability in all parameters of growth, flowering and propagation ratio was observed. (Fig 1,2 & 3). All the varieties performed as per genetic potential and phenotypically for all the traits indicating that the genotypic expression is superimposed by the environmental influence. These findings are in agreement with the work of Dhiman *et al.* (2015) [5] in Asiatic hybrid lily, Masoodi *et. al.* (2018) [9] for Asiatic, Oriental & LA lilium cultivars for growth, flowering and propagation ratio. From scientific point of view selection of superior genotypes from phenotypic parameter point of view play key role in achieving induction of quantitative traits. Correlated findings were reported by Sestra *et al.* (2007) [12] and Bhatia *et al.* (2013) [2] in tulip. Desh-Raj and Mishra (2000) [4]. Kavitha and Anburani (2009) [8] reported selection based on extent of genetic divergence has been successfully utilized in different crop species. Correlated findings were reported by Nimbalkar *et al.* (2016) [11], Sheikh and Khanday (2008) [13], Bihari *et al.* (2009) [3], Desh Raj and Misra (2000) [4] and Kavitha and Anburani (2009) [8]. Grassotti *et al.* (1990) [6] and Balode (2010) [1] reported higher phenotypic variability for plant height in Lilium. Singh and Sen (2000) [14] suggested that if the phenotypic coefficient of variation is greater than the genotypic co-efficient of variation, the apparent variation is not only due to genotypes, but also due to influence of environment. Bhatia *et al.* (2013) [2] also observed similar results for spike length and plant height in tulip, Mishra *et al.* (2006) [10] in spray chrysanthemum for the time taken for bud initiation. Irtefa *et al.* (2020) [7] reported variability in vegetative and reproductive traits in Daffodils.

Table 1: Estimation of sprouting and flowering behavior of tulip cultivars

Variety	Days to sprouting (DAP	Days to flowering (DAP	Flower diameter (cm)	Duration of flowering (Days)
Alectric	90.00	110.00	6.00	17.50
Angelique	100.00	115.00	7.15	19.00
Apeldoorn	103.00	122.00	8.18	18.50
Apricot impression	96.00	118.00	7.33	17.00
Atillagraffity,	104.00	130.00	7.15	16.00
Avant grade	100.00	125.00	7.50	17.00
Candela	107.00	117.00	4.70	9.00
Orange brilliant	99.00	122.00	6.70	17.00
White flag	84.00	118.00	5.50	12.00
CD($p \leq 0.05$)	0.155	0.409	0.690	0.903

Table 2: Response of tulip cultivars to vegetative and propagation traits

Variety	Plant Height (cm)	No Of Leaves Per Plant	No. Of Bulbs Plant^{-1}	Bulb Weight Plant^{-1} (g)
Alectric	39.12	4.50	1.27	13.45
Angelique	42.30	5.00	1.38	15.40
Apeldoorn	52.53	6.00	1.62	17.24
Apricot impression	48.22	5.00	1.46	16.30
Atillagraffity,	36.21	4.50	1.10	12.30
Avant grade	42.34	4.5	1.40	15.75
Candela	33.31	4.00	1.13	12.30
Orange brilliant	43.07	5.5	1.40	16.00
White flag	39.06	4.00	1.17	13.30
CD($p \leq 0.05$)	0.789	0.151	0.003	0.012

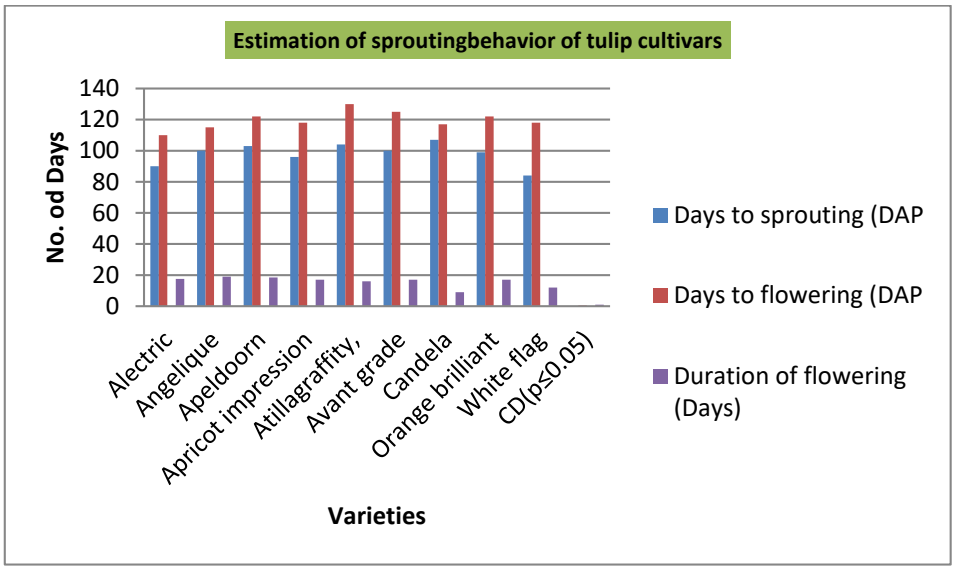

Fig 1: Estimation of sprouting and flowering behavior of tulip cultivars

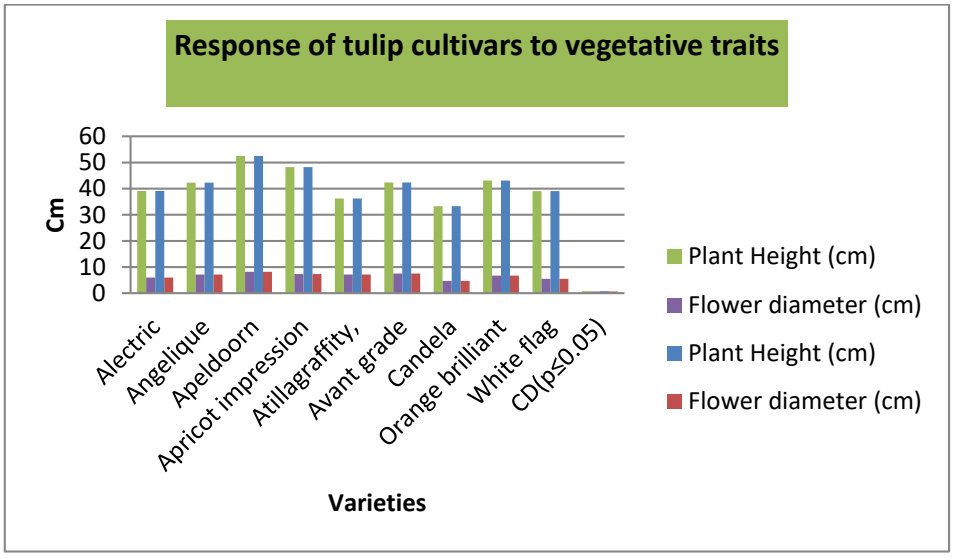

Fig 2: Response of tulip cultivars to vegetative traits

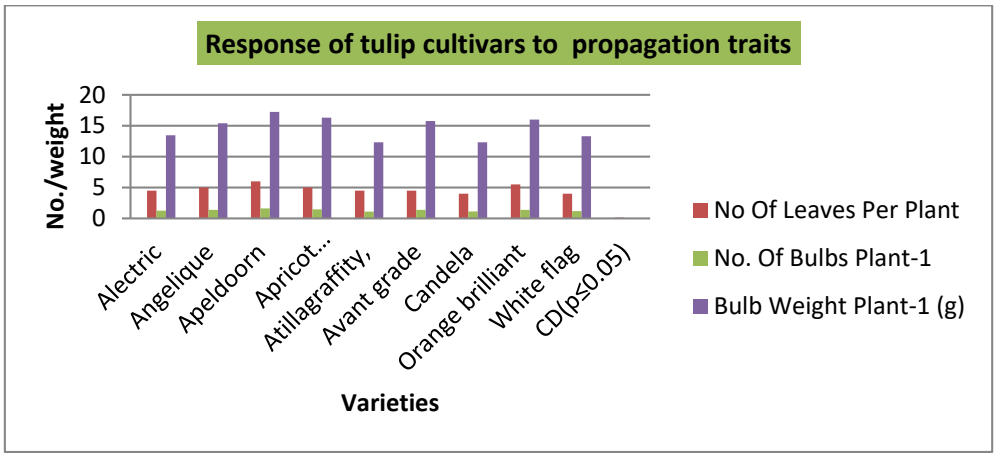

Fig 3: Response of tulip cultivars to propagation traits

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