CHAPTER - II

REVIEW OF LITERATURE

An impressive array of selecting variety with high yield and better quality is most important factor in commercial floriculture. The present investigation was carried out to study the "Varietal assessment and variability study of Gerbera (Gerbera jamesonii Bolus) in controlled condition." Variety plays an important role in controlling many of the physiological aspects of plants. Introducing and selecting new variety has come as a boon for commercial cultivation of many flower crops. Hence available literature relating to the performance of different cultivars on growth, flower quality, yield and vase life in production of cut flowers as studied by several workers is reviewed here under following heads.

2.1. Varietal performance on growth, flowering and yield attributes
2.2. Varietal performance on flower longevity
2.3. Varietal performance in pigment profiling
2.4. Varietal performance on growth, flowering, yield and flower quality in greenhouse

2.1. Varietal performance on growth, flowering and yield attributes

Fischer et al. (1982) in Germany reported that gerbera cv. ‘Maron Clementine’, ‘Yellow Clemene’, ‘Red Clementine’, ‘Clementine’, ‘Xenia’ and ‘Flamingo’ were the best for yield. Cultivar ‘Maron Clementine’ produced the highest yield (434 flower/m²), whereas the cv. ‘Delphi’ produced only 204 flowers/ m².

Kannan and Ramdas (1990) studied the heritability and variability of different accessions of gerbera e.g. Single Whorled (Acc.1 to 7), Double Whorled (Acc. 8 to 18), and Multi Whorled (Acc. 19 to 48) at Tamil Nadu Agricultural University, Coimbatore and observed significantly the maximum number of leaves in ‘Acc.14’ (74.53) and minimum in ‘Acc.17’ (23.95). They also observed significantly highest number of suckers per plant (29.43) in Multi Whorled ‘Acc-22’ followed by ‘Acc-23’ (29.01) whereas it was found the lowest (5.08) in the Double Whorled-‘Acc-43’.

Jawaharlal et al. (1998) evaluated 49 accessions of gerbera at T.N.A.U. and observed significantly highest stalk length (48.85 cm) in ‘GJ-23’, followed by ‘GJ-11’ (45.00 cm) and ‘GJ-39’ (44.50 cm). The highest stalk girth was observed in accession ‘GJ-23’ (1.80 cm). Flower diameter was recorded significantly highest in ‘GJ-23’
(9.45 cm), which was followed by ‘GJ-44’ (9.15 cm). They also observed significantly highest flower yield in Acc. ‘GJ-23’ (80.45 cm) followed by ‘GJ-27’ (83.00 cm) and ‘GJ-29’ (84.70 cm).

Kumar and Kumar (2001) studied the comparison of different gerbera varieties grown under protected cultivation at Ludhiana and found significantly highest leaf number (32.86) and leaf area (100.62 cm²) in variety ‘Goldspot’ under summer shading. They also revealed that significantly longest stalk length (41.64 cm) and flower diameter (7.89 cm) in variety ‘Blorosa’ under summer shading condition, whereas under winter covering condition stalk length and flower diameter were found 43.01 cm and 8.45 cm, respectively in same variety.

Borate (2002) indicated that the gerbera cv. Twiggy was found the early flowering variety (72.66 days) having maximum flower diameter (8.85 cm) and stalk length (57.47 cm) with highest yield of 12.60 flowers per plant per year under shade net.

Jothi et al. (2002) studied on gerbera cultivars under different environments (structures) and observed significantly highest flower diameter (10.20 cm) in ‘GJ-23’ grown under low cost polyhouse condition. Flower stalk length was found maximum (50.62 cm) in ‘GJ-16’ followed by ‘GJ-23’ (50.51 cm).

Nair and Medhi (2002) indicated that maximum plant spread (34.13 cm); leaf area (91.22 cm²), maximum number of flowers/cm² (314.98) and bigger flowers with maximum diameter (12.3 cm) of flower head were recorded in Versace, while the maximum number of leaves/plant (51.50) was produced by AVP 07. The maximum number of ray florets per flower head and length of flower stalk were recorded maximum in Evening Bells (59.10) and AVP 08 (42.71 cm), respectively.

Singh and Mandhar (2002) evaluated the performance of nine exotic cultivars of gerbera under fan and pad cooled greenhouse. Significantly highest plant height (48.83 cm) and number of leaves per plant (46.27) were obtained in variety ‘Tiramisu’ and ‘Ornella’, respectively, while the lowest plant height and number of leaves per plant were recorded in variety ‘Whitsun’ (47.88 cm) and ‘Tiramisu’ (26.74), respectively. They also observed significantly greatest flower diameter (10.70 cm) and flower stalk length (58.27 cm) in var. ‘Tiramisu’ and ‘Lyonella’, respectively. The thickest (0.70 cm diameter) and heaviest (22.20 g) flower stalks were recorded in var. ‘Twiggy’, whereas the thinnest (0.60 cm diameter) and lightest stalk (13.94 g) were found in var. ‘Whitsun’. They also observed significantly highest
(1058.0) number of flowers per plot in a year, the mean numbers of flowers per plant (47.26) and per month in a year (5.02) in cv. ‘Ornella’, whereas the lowest were obtained in cv. ‘Tara’ i.e. 591.33, 29.48 and 2.82, respectively. Significantly highest number of suckers (5.16) was found in variety ‘Lyonella’, while lowest in variety ‘Sunset’ (3.82).

Singh and Ramchandran (2002) studied the performance of different cultivars of gerbera under fan and pad cooled greenhouse conditions and found significantly highest plant height (47.10 cm) in variety ‘Lyonella’, whereas maximum number of leaves per plant (46.10) was found in variety ‘Ornella’. They also recorded significantly maximum flower diameter (10.51 cm) in cv. ‘Sunset’, flower stalk length (61.13 cm) in cv. ‘Lyonella’ and heaviest flower stalk (22.58 g) in cv. ‘Twiggy’. This difference in cut flower quality characters might be due to inherent characters of the individual cultivar. They also recorded gerbera production under fan and pad cooled greenhouse conditions reported highest (46.72) number of flowers per plant/year, number of flowers per month in a year (4.99) and number of suckers per plant (4.85) in cv. ‘Ornella’.

Jeevajothi et al. (2003) evaluating in vitro progenies of gerbera under different environments, observed the genotypic influence on the performance of cultivars with respect to quality. The flower stalk length and flower diameter ranged from 39.00 (Rosabella) to 54.39 cm (Supreme) and 5.70 (YCD-2) to 9.60 cm (Terracerise), respectively.

Kandpal et al. (2003) reported that gerbera cultivars DB-232, Orange Glem, Alasmeera and PG-2, promising for Tarai condition at Pantnagar. However, cv. PG-2 also may be recommended for its attractive cherry colour flowers and early flower bearing habit.

Mahanta et al. (2003) evaluated five black centered gerbera cultivars under naturally ventilated polyhouse and obtained maximum number of flowers per plant (5.66) and per square meter (51.00) from Ellymay and Aquilla (5.00 and 45.00, respectively). Maximum flower diameter (9.92 cm) was observed in cultivar Aquilla, followed by Golden Gate and length of flower stalk in Sunway (54.77 cm), followed by Golden Gate (38.77 cm).

Parthasarthy and Nagaraju (2003) reported the significant differences among the gerbera accessions for stalk diameter and diameter of the flower. They observed
that the maximum stalk diameter (4.04 mm) and largest flower (10.67 cm) were recorded in RCG-12 and RCG-9, respectively under mid hills of Meghalaya.

Sarkar and Ghimiray (2004) evaluated varieties of gerbera and observed significantly highest flower stalk length (62.43 cm) in var. ‘Foske’. Flower diameter was recorded maximum (12.26 cm) in ‘Flauance’ whereas minimum flower diameter (8.95 cm) was recorded in var. ‘Kalimpong Yellow.’ They also revealed that under protected conditions total number of flowers per clump in gerbera produced in a year was significantly highest in ‘Kalimpong Red’ (39.62) and followed by ‘Foske’ (34.75) and ‘Red Explosion’ (31.85).

Thomas et al. (2004) studied the comparative performance of different gerbera cultivars under polyhouse conditions and observed significantly highest flower diameter, flower stalk length and flower stalk girth in cv. ‘Sangaria’ with value of 10.8 cm, 54.6 cm and 0.69 cm, respectively. They also observed significantly higher total yield of flowers/plant (11.4 flowers/plant) in gerbera var. ‘Thalassa’ and minimum (8.4 flowers/plant) in var. ‘Pink Elegance’. The var. ‘Thalassa’ produced significantly highest number of suckers 2.4 per plant, while the var. ‘Sangaria’ recorded least number of suckers i.e. 1.7 per plant.

Bhayani et al. (2005) evaluated six varieties of gerbera in low cost polyhouse and recorded significantly highest plant height (28.40 cm), length of leaves (33.70 cm) and breadth of leaves (11.50 cm) in variety ‘Dardanella’, whereas number of leaves per plant was found maximum in variety ‘Charmander’ (15.27). They also observed significantly maximum number of flowers per plant (9.67) and per square meter (38.67) in variety ‘Charmander’, followed by variety ‘Dardanella’ (33.33). Maximum number of suckers (2.47/plant) was found in var. ‘Charmander’, whereas it was recorded minimum in var. ‘Yellow Mistake’ (1.07/plant).

Bhuyar et al. (2004) evaluated the performance of ten gerbera (Gerbera jamesonii) cultivars viz., Cabana, Charmander, Pinkelegance, Piton, Rodis, Rosalin, Ruby Red, Sangria, Sunway and Tonneke at Satpuda Botanic Garden. The results revealed that the cultivar Ruby Red performed better in terms of growth and flower yield and bud initiation. However, cultivar Rodis showed significantly best results in terms of flower quality parameters and vase life. Thus, Ruby Red and Rodis cultivars worth considering for commercial cultivation under polyhouse conditions.

Dalal et al. (2005) studied the performance of 11 gerbera (G. jamesonii) cultivars (Xenia, Kozak, Torro, Gold Disk, Masai, Yellow Venus, Lady, Harlekin,
Sphinx, Carrousel and Pinta) was evaluated under polyhouse conditions during 2002-03. Observations were recorded for vegetative growth, flowering, yield, flower quality and vase life. Kozak, Yellow Venus, Masai and Xenia were found the most promising.

Kumar and Yadav (2005) revealed that the maximum number of leaves per plant (46.33) and number of suckers (9.60) were recorded in gerbera hybrids RCGH-114 and RCGH-89, respectively. Gerbera hybrid RCGH-117 produced maximum stalk length (47.66 cm) fresh weight of flower stalk (7.8 g) and flower (6.74 g), whereas maximum stalk diameter (0.60 cm) was recorded in RCGH-63 under subtropical mid hills altitude of Meghalaya.

Aswath and Rao (2006) conducted an experiment on breeding of gerbera lines suitable for open field cultivation at IIHR, Bangalore and found significantly maximum flower stalk length (44.73 cm) in line ‘IIHR 99-4’ followed by ‘check 2’ (42.3 cm), whereas maximum flower diameter (8.76 cm) was observed in ‘IIHR 99-1’, followed by ‘check 2’ (8.64 cm) and ‘IIHR 99-3’ (8.56 cm). they also revealed that significantly maximum number of flowers/plant/month (3.90) was recorded in ‘IIHR 99-2’ followed by ‘IIHR 99-1’ (3.31), ‘IIHR 99-3’ (2.9) and ‘IIHR 99-4’ (2.83).

Naik et al. (2006) revealed that the cv. Lexus produced maximum number of quality cut flowers (38.82) followed by Alberino (37.20), Scilla (36.95) and Bonnie (31.26). The same cultivars also produced the longest stalk, bigger sized flowers and number of ray florets apart from vegetative parameters like more number of leaves per plant, plant spread, suckers production, leaf area and lea area index of gerbera cultivars under naturally ventilated polyhouse.

Paraneetha (2006) studied the promising seven bedding type accessions and ten named cultivars of gerbera and found that diameter of the flower stalk (0.55 cm), flower diameter (10.17 cm) and more number of suckers/plant/year (11.27) in the accession Gj-23. Among the ten cut flower genotypes, Rosalin performed well for the characters like plant height (27.75 cm), flower yield/plant/year (23.35), flower diameter (11.65 cm) and number of suckers/plant/year (10.32).

Singh and Singh (2006) at Bangalore reported that flower yield per year exhibited highest and positively significant correlation with number of suckers per plant (0.78), followed by number of leaves clump (0.568) and strong and negative correlation with flower diameter (-0.698). Flower stalk thickness also asserted significantly positive correlation with flower diameter (0.664).
Bhayani et al. (2008) revealed that the characters to be the best variety of gerbera in case of earlier flowering with highest yield of flowers (36.67 flowers/sq.mt), flower diameter (9.67 cm) bigger flower stalk length (47.50 cm) and fresh weight of flower (17.50 cm). Moreover it had more suckering habit (2.47 suckers/plant).

Singh and Srivastava (2008) evaluated gerbera cultivars under low cost polyhouse and shade net house (50 %) conditions at Pantnagar and found significantly maximum stalk length of 64.24 and 56.92 cm in cv. ‘Dune’, while minimum stalk length i.e. 23.30 and 17.00 cm was recorded in cv. ‘Gold Spic’ in low cost polyhouse and shade net house conditions, respectively. The cv. ‘Dalma’ showed maximum stalk diameter (0.91 and 0.80 cm) under both conditions. The maximum flower diameter of 11.12 and 10.10 cm was recorded in cv. ‘Essance’ in low cost and shade net condition, respectively. They also evaluated highest number of flowers per plant were reported in cv. ‘Rudy red’ i.e. 33.2 and 26.0, while minimum number of flowers per plant were reported in cv. ‘Gold spic’ i.e. 7.0 and 4.0 under low cost polyhouse and shade net condition, respectively.

Barooah and Madhumita (2009) compared twelve cultivars of gerbera. Maximum plant height and plant spread were noticed in Cv. Pride of Sikkim (43.50 cm and 65.83 cm², respectively) followed by Cv. Popular (42.54 cm and 60.33 cm²). Whereas more number of leaves per plant and suckers per plant were observed in Cv. Red Gem (45.98 and 12.66).

Anop et al. (2010) conducted a study on five genotypes under green house condition at Gujarat. Maximum plant height, number of leaves per plant and leaf area were recorded in the variety Balance (41.05 cm, 25.91 and 5895.00 cm², respectively) followed by varieties Dune and Zingaro.

Chobe et al. (2010) evaluated thirty gerbera cultivars and Cv. Sonata recorded more number of leaves (48.33), maximum plant spread (74.26 cm), while, cultivar Marinque recorded lowest number of leaves (32.07) with less plant spread (57.96 cm). Significantly maximum leaf area was recorded in Cv. Grizzly (274.93 cm²) followed by Cv. W. Grizzly (272.76 cm²).

Magar et al. (2010) revealed that the gerbera varieties Esmara, Lomboegine, Sonata, Verginia and Devil produced higher number of suckers indicating their capacity to give higher sucker yield. The varieties Martinque, Banesa, Esmara, Devil, Verginia, Gucci and Opium observed with large flower diameter and flower stalk
length while, Solem, Pinksnow, Opium and Mademoiselle produced highest stalk thickness which is suitable for cut flower production. Gerbera cvs. Sonata, Esmara, Opium, Solem, Devil, Banesa, Verginia, Naome, Diana, Martinque and Mademoiselle were superior over the rest of the varieties in terms of flower quality and lower yield and can be recommended for commercial cultivation under naturally ventilated polyhouse conditions.

Patil et al. (2010) revealed that gerbera varieties Savanath, Goliath and winter queen were early to flower by 15 days than Tropic Blend and Rosalin. Maximum number of suckers per plant was observed in variety Dalma, Rosalin, Dana Ellen and Tropical Blend, while least was in Amulet, Sunway and Goliath. With respect to yield, maximum number of flower per plant was observed in variety Savanath (32.00) Dalma (31.50) Sunway (29.60) and Rosalin (29.60), while it was least in variety Winter Queen (21.50), Tropic Blend (23.00) and Dana Ellen (25.32). As regard the flower quality, superior flower were produced by variety Savannath, Winter Queen, maximum stalk length, stalk diameter, flower diameter as compared to other varieties tried viz; Dalma, Sunway, Rosalin, Dana Ellen, Amulet and Tropica I Blend.

Sankari et al. (2010) reported that among 30 varieties of gerbera, Vivine variety recorded the maximum plant height (31.7 cm). The maximum number of flower/plant/year was recorded in variety Rosalin (33) followed by Oilila (32) and Junkfru(30). The flower diameter was maximum in Rosalin (10.9 cm) the longest flower stalk was observed in variety Esmara (53.1 cm) in Yercaud hills and for subtropical regions.

Singh and Srivastava (2010) stated that the different gerbera varieties i.e., Ruby araed, Dalma, Essance and Dune were found promising for commercial cultivation under low cost polyhouse.

Vasudevan and Rao (2010) reported that out of thirteen genotypes, three cultivars of gerbera viz; Entourage, Red Explosion and Essence were found to give satisfactory performance based on their quantitave characters. Based on these finding, Entourage of gerbera can be recommended for the commercial cultivation under mid conditions of Garthwal Himalaya.

Dipal (2011) reported that out of ten cultivars of gerbera under polyhouse condition in south Gujarat region, maximum A – grade quality (>65 cm) flowers were reported in V_{8} –Cauca (62.01 %), while variety Gucci (V_{7}) was produced highest flowers (42.06 %) with respect to B – grade (55-65 cm). Mermaid (V_{5}) and White
Grizzly (V10) produced maximum flowers of C-grade (45-55 cm) and D-grade (35-45 cm), respectively.

Ahlawat et al. (2012) observed that the ten gerbera cultivars under naturally ventilated polyhouse, were grown on raised bed at 45 cm × 30 cm. Maximum plant height (25.04 cm) was registered for cv. Dalma, Pink Elegance had higher spread (47.66 cm). Cv. Sunway gave earliest flowering, while Savannah (59.46 cm) gave maximum stake length. Flower yield was maximum (396 per sq. m/y) in Winter Queen, while Avant Garde had longest vase-life (11.8 days).

Barua and Bordoloi (2012) studied nine promising cultivars of gerbera viz. Fanna, Deep Purple, Shania, 68385, Jaffna, Wall street, Venice, Lion and Dephane under low cost polyhouse for cultivation. Cultivar Jaffna recorded maximum plant spread, diameter of flower and yield/m² and minimum stalk length. Cultivar 68385 recorded maximum stalk length, stalk thickness and minimum days to flower. Wall Street recorded maximum number of flowers/plant and minimum yield/m².

Wankhede et al. (2012) taken thirteen gerbera varieties under study; Charmander recorded significantly more life span of flowers on plant. Savannah had significantly more number of flowers per plant and required minimum days for development of flowers. Maximum flower diameter was recorded in variety Sangria. Vino had more vase-life of harvested flowers.

Mahmood et al. (2013) evaluated the ten gerbera cultivars for their growth, yield and quality characteristics under protected conditions during 2011. Among the cultivars studied, there were highly significant variations observed for growth, yield and quality parameters. Longest stalk length (60.3 cm) was exhibited by the cultivar ‘Alberino’ followed by ‘Lexus’ (59.0) and ‘Mammut’ (54.0 cm). The same cultivar also produced flowers with maximum diameter. With respect to vegetative parameters like number of leaves per plant and plant spread were also more in the same cultivar.

Kumar et al. (2014a) revealed that among the cultivars, maximum growth, flowering characteristic and vase-life was noticed in Silvester followed by Salvadore, which was significantly higher than other cultivars.

Kumar et al. (2014b) revealed that the amongst 05 varieties under study, Salvador had significantly more plant height, Plant spread, Suckers, Leaf area, vase life of flowers and number of flowers per plant and required minimum days for development of flowers and recorded maximum Stalk diameter of flower. Intense had significantly more number of leaves per plant.
Sarmah et al. (2014) revealed that the seven varieties under study, Dune had significantly highest plant height (54.70cm) followed by Cacharelle (51.27cm) and Malibu (46.13cm). The same cultivar also required minimum days (40.23) for visibility of flower bud, maximum flower size (15.27cm), flower number (9.37) and stalk length (80.13 cm).

Deka and Talukdar (2015) evaluated that the cv. Pride of Sikkim was the tallest (61.80 cm) and produced longest stalk length (49.51cm). Cultivar Red Gem produced maximum number of leaves per plant (46.55), plant spread (54.10 cm) and number of suckers per plant (24.04). Cultivar Pink Melody took least number of days, 63.78 and 76.00 for bud visibility and full bloom, respectively. With respect to flower characters, cv. Red Gem recorded the maximum number of flowers per plant (53.17).

2.2. Varietal performance on flower longevity

The difference in shelf life and vase life of gerbera flowers of different species is inherently influenced by and varies among, different cultivars of same species. Hence several judgments is given below.

Fischer et al. (1982) studied on the gerbera clones for shelf life at Germany and found significantly longest vase life (12 days) in cv. ‘Cream Clementine’, whereas the shortest (9.4 days) was reported in cv. ‘yellow Clementine’.

Loser (1987) evaluated 41 gerbera cultivars under greenhouse conditions for production of quality flowers. Of these, nine cultivars showed satisfactory for quality and vase life, whereas Terraqueen was highly promising for yield and vase life. Cultivar Lablinel, Denire and Terrramaxima were also promising with higher proportion (more than 80 per cent) of class-I cut flowers.

Jawaharlal et al. (1998) studied on vase life of gerbera and found the longest vase life of flowers (8.55 days) in accession ‘GJ-23’ closely followed by ‘GJ-24’ (8.35 days), ‘GJ-8’ and ‘GJ-40’ (8.00 days). The lowest vase life period of 3.95 days was recorded in accession ‘GJ-34’.

Nagaraja et al. (2000) revealed that the gerbera jamesonii cv. Local Red flowers were treated with 4, 6, 8 and 10% sucrose, and 150, 200 and 250 ppm silver nitrate for 24 h to determine the effect of pulsing on the shelf life of cut flowers. Pulsing with 4% sucrose or with 250 ppm of silver nitrate for 24 h increased vase life by 3 days compared to the control (7 days). The maximum vase life of flowers was 10 days.
Borate (2002) mentioned that out of eight cultivars of gerbera Testarossa produced attractive red colour flowers having long vase life of 10.40 days in distilled water.

Dumitras et al. (2002) evaluated that the effects of different cut flower preservatives (2 and 3% dextrose [glucose] + 0.15% citric acid or 0.1% salicylic acid) on the vase life of different cultivars of Gerbera hybrida [Gerbera] (cream, rose, red and orange) and Gladiolus hybridus (Windsong, Priscilla, Green Woodpecker, White Prosperity and Rose Supreme) were investigated. Solutions containing 2% dextrose + 0.015% citric acid or 2% dextrose + 0.1% salicylic acid increased the vase life of Gerbera hybrida and Gladiolus hybridus by 4.6 and 3.4 days, respectively.

Dash et al. (2003) carried out an experiment on shelf life of gerbera and found significantly maximum shelf life of flowers in variety BG-2 i.e. 4.50 days, whereas it was found minimum in variety BG-8 i.e. 2.75 days.

Dhane (2003) recorded that variety Thalassa produced flowers with maximum vase life (9.33 days) in plain water, while Tonneke produced flowers with minimum 6.66 days vase life was at par with variety Yarana (7.00 days).

Parthasarathy and Nagaraju (2003) mentioned the highest longevity of gerbera cultivars (16.60 days) was found during October-November under mid hills of Meghalaya.

Emongor (2004) concluded that the freshly cut flower stems of gerbera cv. Ida Red, with two outer disc florets open, were placed in flower vases containing 0, 2.5, 5, or 7.5 mg GA₃/litre. Gerbera cut flowers held in GA₃ recorded delayed flower senescence by increasing the number of disc florets open, and delayed petal fading and abscission, regardless of the rate of the plant growth regulator applied.

Sarkar and Ghimiray (2004) studied on the performance of gerbera varieties at Bhubaneswar and noticed longest shelf life in var. ‘Sunway’ (23.15 days) followed by ‘Vital’ (21.05 days) and ‘Sangaria’ (20.15 days), whereas minimum shelf life period was recorded in cv. ‘Kalimpong Yellow’ (14.25 days).

Thomas et al. (2004) studied on the performance of gerbera cultivar under polyhouse at Bangalore and found maximum vase life (8 days) in cv. ‘Pink Elegance’ followed by cultivars ‘Thalassa’ and ‘Sangria’.

Deepa (2005) studied the different cultivars of gerbera and Cv. Carocci recorded maximum vase life of 13.33 days and followed by Cv. Sciella (12.75 days),
Bonnie (12.58 days), Ambra (11.83 days) and Rosella (11.42 days). While the cultivar Ariyana recorded minimum vase life of 5.92 days.

Paraneetha (2006) mentioned that the out of the seven bending type accessions of gerbera, the longest vase life (10.92 days) was recorded in accession Gj-23. However gerbera cv. Rosalin produced the longest vase life flower (16.33 days) as compared to other ten gerbera cultivars under Shervaroy hills of Tamilnadu.

Chakraborty et al. (2008) evaluated that the effect of sucrose and trehalose in combination with other chemicals, on post harvest life of gerbera cv. Calcutta Orange. They tried with fifteen combinations. Among different vase solutions, sucrose 3% combined with 8-hydroxyquinolene sulphate (200 ppm) and sucrose 4% including alluminium sulphate (200 ppm) were found better for most of the floral traits. However, trehalose was not as effective as sucrose.

Singh and Srivastava (2008) evaluated gerbera cultivars at Pantnagar and revealed result that the flowers of cv. ‘Dalma’ and ‘Essence’ had recorded significant maximum shelf life (10.0 days), whereas minimum shelf life was recorded in cv. ‘Gold spic’ (6.0 days).

Patil et al. (2010) reported that the gerbera cultivars Savannah, Winter Queen, Pink Elegance and Goliath were produced the flowers having maximum vase life as compared to other varieties tried viz; Dalma, Sunway, Rosalin, Dana Ellen, Amulet and Tropica I Blend.

Magar et al. (2010) revealed that the gerbera varieties Banesa, Esmara, Opium and Grizzly had more vase life in tap water.

Javad et al. (2011) concluded that the highest vase life and the lowest stem bending as an applied and proper strategy using a basic pulse treatment (HQS 600 ppm, citric acid 300 ppm and sucrose 4%); because of very high variation in new cultivars and also cultivar dependent of stem bending in gerbera. The result showed that there are significant differences between cultivars for vase life, stem bending, ion leakage and water uptake. ‘Tropic Blend’, ‘Cacharelle’ and ‘Aventura’ cultivars had maximum vase life and ‘Onedin’, ‘Ecco’ and ‘Entourage’ had minimum vase life. Stem bending varied from 0 to 100% between different cultivars.

Safa et al. (2012) evaluate that the effect of silver nano-particles on vase life and postharvest quality of cut gerbera cv. ‘Balance’, an experiment based on the completely randomized design with one factor; silver nano-particles in 4 levels (0, 5, 10 and 20 mg l-1) in three replications and 12 plots with 4 flowers per plot was done.
According to the mean comparisons, the maximum vase life and flower diameter decreasing index was obtained in 10 mg l-1 silver nano-particles treatment and the minimum loss of fresh weight belonged to the 20 mg l-1 silver nano-particles treatment.

De-Silva et al. (2013) evaluated the vase life and stem bending percentage were observed daily. Fresh weight of flower heads and stems were measured. Flower quality was recorded after 12 days by a scale developed for the said purpose. The highest fresh weight of flower heads (7.3 g), fresh weight of stems (4.2 g), zero stem bending percentage and the maximum vase life (16 day) were obtained in the treatment containing sucrose 2 % + vinegar 0.6 % + CaCl2 1 % in distilled water.

Jafarpour et al. (2013) evaluated that the two pulse treatments including distilled water (pulse1) and 4% CaCl2 + 3% sucrose (pulse2) for 24 hour were applied before long-time treatments. Thymus essential oil and Stevia essential oils (0, 0.1 and 0.2 mg*l-1). Parameters of fresh weight stem bending, capitulum diameter, carotenoid pigments of petal and vase-life longevity were evaluated during 12 days.

Kumar et al. (2013) concluded that the vase life study, maximum fresh weight change was recorded in Kayak (124.29 %) on 8th day and minimum fresh weight change (87.92 %) in Scope on 16th day. Among all the cultivars, Dune recorded maximum water uptake (50.24 g/flower) and water loss (38.84 g/flower). The water balance exhibited significant differences among the cultivars and recorded maximum (11.40 g/flower) in Dune. The longest vase life exhibited by Dune (15.67 days) followed by Winter Queen (14.47 days) and Dana Ellen (14.40 days).

Yagi et al. (2014) revealed that the during simulated transport on the vase life of Gerbera cut flowers. First, cut flower Gerbera wore held in solution containing 1% to 3% sucrose plus CMI/MI-AS at 10°C for 72 h. Thu flowers were then transferred to distilled, water (DW) and held at 23°C. Sucrose at 2% and 3% plus CMI/MI-AS significantly extended the vase life, although the effect was small. Next, flowers were held in solution containing 2% or 4% sucrose plus CMI/MI-AS with or without ABA, at 10°C for 24 h to simulate storage, then at 15°C for 48 h to simulate transport, They were then transferred to OW and held at 23°C. The vase life was extended to as much as 4.5 times compare with treatment with DW.

2.3. Varietal performance in pigment profiling

Mizuta et al. (2009) reported that the flowers with white petals are devoid of anthocyanin and anthocyanin constitution of the purple group flowers is more varied.
than that of the red group flowers, and this wider variety among purple flowers contributes to extending the diversity of flower colour.

Hatamzadeh et al. (2012) studied that interaction of different parameters affecting colour have a determinant role in perception of petals final colour in gerbera. In different varieties, some of parameter had a more apparent role, such as interference of anthocyanins and carotenoids in final colour of flowers in Baston, Balance white colored, lacked any colored pigments.

Lema-Ruminska et al. (2013) revealed that the research analysed the occurrence of anthocyanins and carotenoids in ray florets and chlorophylls in leaves of Chrysanthemum × grandiflorum /Ramat./Kitam., ‘Baton Rouge’ grown in the glasshouse over 2010–2011. From the ray floret tissues carotenoids were extracted using concentrated acetone and anthocyanins with 1% HCl in methanol, whereas to extract chlorophylls a and b from leaf explants, concentrated acetone was used. There was also defined the colour of ray florets and leaves applying the RHSCC Colour Chart [1966]. It was found that the date of plant planting and their flowering, affects the concentration of pigments: anthocyanins and carotenoids in ray florets and chlorophylls in leaves and as a result also their colour.

Tan et al. (2014) reported that the total anthocyanin content of six different orchids’ petals was determined spectrophotometrically and the value ranged from 0 mg/g (in Dendrobium Shavin white) to 2.128 mg/g (in Mokara Aranda). Total anthocyanin content was found to be the highest when compare to β-carotene and chlorophyll content. In correlation analysis, PAL activity was found to be significant positive correlated with the anthocyanin content.

Park et al. (2015) investigated to determine anthocyanin and carotenoid levels and to confirm the effects of the pigments on the flower colors using high-performance liquid chromatography (HPLC) and electrospray ionization-mass spectrometry (ESI-MS) on flowers of twenty-three cultivars of Dendranthema grandiflorum Ramat.

2.4. Varietal performance on growth, flowering, yield and flower quality in greenhouse

Polyhouse is a framed structure covered with polyhouse polythene film which can provide the favorable condition for the growth and development of plants in
several ways, viz. favorable environmental conditions, protection from heavy rain, wind, pest, disease and other climatic condition.

Various factors limit the growth and production of quality flowers of rose. In order to ascertain the influence of the growing season especially with appropriate temperature (not exceed 30°C) and relative humidity (60 to 65 %) ensure the better growth and flowering. The effective season for crop production and quality decrease with rise in the temperature (Dhaduk and Singh, 2008). The humidity directly affected the plant transpiration in manufacturing the carbohydrates. Low Vapor Pressure Deficit (>75% RH) and High Vapor Pressure Deficit (<55% RH) may reduce the growth rate which caused a leaf area reduction (Mattson and Lieth, 2007) due to shortage of water (Aloni et al., 1996).

Most of the flower production in other countries is being done in climatically controlled greenhouse. This has also been identified as a trust area for conducting research in our country. The data on effect of climate on flower quality that have been conducted under fan and pad greenhouse.

Post and Howland (1946) stated that growth and flower production in rose were controlled by light intensity. More petals and bigger bloom were produced in the case of glasshouse grown rose variety Ma Perkins; when grown at lower temperature (62 to 72 °F) than those grown in higher temperature. Favorable temperature resulted increase petal number (Semeniuk, 1964) and annual flower yield depended to a great extent on weather condition, especially sunshine throughout the year (Matson and Widmer, 1970). Decrease in light intensity and duration of light period owing to seasonal changes affected the yield and quality of roses (Zieslin and Mor, 1990). Stems of summer flowers have been recorded with shorter, thinner, smaller leaves and bud than winter flowers (Mastalerz, 1987).

Bhattacharjee (1991) reported that quality rose blooms were obtained only during December to April with approximately 5 to 6 blooms per plant with a stem length of 60 cm and above. He also reported that well formed, good sized flower with more number of petals can be obtained during November to April.

Kumar and Kumar (2000) studies the 5 gerbera cultivars, viz., Lily, Blorosa, Rosabella, Goldspot and Liba bell a from April 97 to May 98 under modified environment and reported that the best cultivars was found to be Goldspot in the April 98 which recorded the highest number of flowers having better quality as compared to flowers produced in the other months.
Parthasarathy and Nagaraju (2003) stated that the days required for flower bud to burst after bud initiation was less (11.84 days) in warmer summer as compared to cooler winter season. The least number of days from bud appearance to bud burst (4.53 days), stalk diameter (3.88 mm) and flower diameter (9.65 cm) were maximum during April-May in gerbera cultivars under mid-hills of Meghalaya.

Dhatt et al. (2007) mentioned that flowers were available in abundance during winter season. During summer season, due to extreme high temperature the fresh cut flowers do not stay for longer under North Indian climatic condition.

Cristiano et al. (2008) showed that the 16% mean increased in autumn-winter yield for the plants cultivated under supplementary lighting as compared to the control (14.5 against 12.5 flowers/plant). Among the tested cultivars highest increase in production (25%) was obtained from the cv. Cornice whereas the lowest increase (8%) was observed in the cv. Rosalin under glasshouse in Italy.