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Conserving Honey Bees with Forage Plant Mexican Creeper - *Antigonon leptopus*



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## ***In this issue...***

### ***Hearty New Year Greetings from our Editorial Team to all the readers of JHS!***

*As the world is slowly coming out of glitches of pandemic, there is no other better way than celebrating 2021 as Year of Fruits and Vegetables as announced by United Nations Assembly to welcome the new year and recognize the importance of nutrition for better health. Fruits and Vegetables ensure the Nutritional Security to humankind. They play key role in addressing the malnutrition that is a major concern. We are proud that JHS creatins awareness of importance of fruits and vegetables by publishing the recent developments in research with respect to these crops.*

*Diversity of fruit crops and genetic resources available with respect to fruit crops are important for developing better fruit crop varieties. **Sankaran and Dinesh** have reviewed the “Biodiveristy of Fruit Crops in India” in a very comprehensive way. There is diversity in Jasmine species. **Ganga et al.** carried out the palynological investigations and recorded the variability in pollen morphology in different species of Jasmine by documenting images using scanning electron microscope. Biodiversity can be linked to livelihood also. One such success story with tamarind selection ‘Lakhamna’ is being reported by **Kanupriya et al.** This tamarind selection has been identified from participatory breeding programme. It has a better pod characters and more preferred by consumers.*

*Protected cultivation has seen greater momentum in last two decades. **Adeniji et al.** identified the best varieties of tomato for polyhouse cultivation in Nigeria. **Rao et al.** selected two gladiolus hybrid selections IIHRG-7 and IIHRG-11 with red purple and red coloured flowers respectively. These hybrids have resistance to Fusarium wilt and suitable for cut flower and flower arrangement purposes. **Sankaran et al.** analysed the variance for 6 quantitative and 30 qualitative traits in mango in 400 genotypes and identified 18 clusters. Selected genotypes from specific clusters can be used in hybridization programme.*

*The production aspects are important in perennial crops. It is crop management that needs to be prioritized for enhanced yield. **Adiga et al.** have reviewed the research work carried in “Canopy Management in Cashew”, providing the wholistic view of cultural operations to have a better crop. Use of soilless medium in nursery industry is gaining importance. Best suited potting mixture for mango stone graft of cv. Alphonso has been identified by **Lad et al.** They found that cocopeat + leaf manure + compost (1:1:2) as pot mixture provided better plant growth.*

*Growing Chrysanthemum in pots is practiced in home and terrace gardens. The cultivar Kikiobiory is well suited for this purpose. **Thakur** has studied the nitrogen requirement for this cultivar and has come out with the recommendation of 300 mg of N per pot applied*



twice in September and October in Punjab for best results. In another study, **Singh and Bala** confirmed that use of benzyl adenine at 200 ppm helped in extended vase life of *Chrysanthemum morifolium* flowers. **Nair et al.** recorded that foliar spray of 30:20:20 NPK at weekly interval recorded more number of flowers of *Dendrobium* cv. Singapore White with significantly longer spikes.

Crop production is directly influenced by pollinators. Decline in honey bee population is a serious concern and to conserve the pollinators community approach through ecosystem services is required. **Rami Reddy** reports the benefits of having ornamental plant Mexican Creeper (*Antigonon leptopus*) as forage plant. This creeper attracted all the four species of honey bees studied. This creeper can be used as bioindicator of honey bee population.

**Aravindaraj et al.** have reported the honey dew secretion by *Thrips palmi* and analysed the composition of it. They had identified different sugars present in the honey dew secretion of *Thrips*. *Thrips* not only cause direct damage but act as vectors of many plant viruses. Management of diseases in perennial crops is a challenge. *Phytophthora* incited root infection in citrus needs concerted efforts. **Ingle et al.** have demonstrated that use of potassium salt of phosphonic acid could help in management of *Phytophthora* root rot in Nagpur Mandarin.

Mushrooms can fill the gaps in nutritional security as they are rich in nutritive value. Iron deficiency is important issue to be addressed. Iron fortified oyster mushroom products have been developed by **Pandey et al.** The bioavailability of iron from Arka Mushroom Fe-Fortified Rasam Powder has been confirmed. In another study, the amino acid profile of 18 isolates of oyster mushroom species belonging to 4 species have been documented by **Azeez et al.** Quantification of essential and non-essential amino acids has been reported. Nutritionally superior isolates can be selected from these isolates.

The editorial team of JHS expresses the sincere efforts of reviewers who really complement the publication processes. All scientists and scholars can utilize the open access of JHS. Recently FAO has made JHS available through AGRIS. It is indexed by Redalyc, CABI\_Hort and Scopus. All subscribers, scientists and scholars are requested to continue their support in publishing quality information in **Journal of Horticultural Sciences**.

**S. Sriram**  
Editor in Chief

**Original Research Paper**

**Development and evaluation of novel gladiolus hybrid selections IIHRG-7 (IC620379) and IIHRG-11 (IC620380) for flower quality and *Fusarium* wilt resistance**

**Rao T.M., Janakiram T., Negi S.S., Aswath C., Dhananjaya M.V., Kumar R.\* and Ramachandran N.**

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**ABSTRACT**

The present study was carried out to evaluate the performance of two novel gladiolus hybrid selections IIHRG-7 and IIHRG-11 along with commercial checks, for flower quality traits and *Fusarium* wilt resistance in completely randomized block design, during 2012-13 to 2014-15. Three years data were pooled and analyzed statistically. The hybrid selections IIHRG-7 and IIHRG-11 had been developed through hybridization by crossing Arka Meera x Picardy and Gold Medal 412 x Arka Poonam, respectively followed by selection. IIHRG-7 has novel flower colour (as per RHS Colour Chart) *i.e.*, Red-Purple (65.B) having Red-Purple (62.A) streaks with Red-Purple (67.B) splash and spike with variegated florets, while, IIHRG-11 has novel floret colour as Red (41.C) having Red (41.A) margin. Blotch Red (46.B) with yellow (13.C) border and resistance to *Fusarium* wilt disease. These hybrid selections are suitable for cut-flower and flower arrangement purposes. Further, these hybrid selections will be useful for developing new gladiolus hybrid selections with novel traits and resistance to *Fusarium* wilt disease.

**Key words:** Evaluation, Flowering, *Fusarium* wilt and Gladiolus Vase life

**INTRODUCTION**

Gladiolus is one of the most important bulbous flowering plants commercially grown for cut flowers, garden display and floral arrangement. It belongs to the family Iridaceae and sub-family Ixioideae. It ranks second in area (20.53 thousand ha) and production (132.58 thousand tons) among the cut flowers grown in India (Anon., 2016). The main emphasis in gladiolus improvement has to be given on development of varieties having attractive novel colour and more number of well-spaced large sized florets mainly for cut flower, long spikes and good corm multiplication ability (Swaroop *et al.*, 2018). *Fusarium* wilt is the most devastating disease in gladiolus which is caused by the fungus *Fusarium oxysporum* f. sp. *gladioli* (Massey) W.C. Snyder & H.N. Hansen (Massey, 1926 and Nelson *et al.*, 1981). It is a major bottleneck in

gladiolus cultivation causing 60-80% crop damage and huge economic loss to flower growers (Lakshman *et al.*, 2012 and Kakade *et al.*, 2016).

As conventional management practices for *Fusarium* wilt disease include corm treatment with fungicides and soil fumigation are time consuming, labour intensive and increase the cost of cultivation, developing *Fusarium* wilt disease resistance gladiolus genotypes is an economically viable option in managing this disease. Identification of genetic resources for resistance to *Fusarium* wilt is crucial for harnessing resistance from these plants which can be deployed in development of resistant varieties. Therefore, the present study was carried out to evaluate two novel gladiolus hybrid selections IIHRG-7 and IIHRG-11 for their flower quality and *Fusarium* wilt disease resistance.



## MATERIAL AND METHODS

Hybridization followed by selection was employed to develop novel gladiolus hybrid selections IIHRG-7 and IIHRG-11 involving crosses Arka Meera x Picardy and Gold Medal 412 x Arka Poonam during 1986 and 1988, respectively. From hybrid seeds, cormels were produced. After the period of dormancy, cormels were planted and corms were harvested. Promising novel hybrid selections *viz.*, IIHRG-7 and IIHRG-11 were selected and multiplied vegetatively. Further, these hybrid selections with commercial checks Pink Friendship and *Psittacinus* hybrid, were evaluated for flower quality traits and resistance to *Fusarium* wilt disease, in replicated trial in completely randomized block design for three consecutive years *i.e.*, from 2012-13 to 2014-15. The data on various biometrical parameters recorded were subjected to statistical analysis (Panse and Sukhatme, 1967).

Screening for resistance was undertaken in pot culture inside polyhouse in replicated trial in completely randomized block design. Uniform sized corms (5.5 cm to 6 cm) of IIHRG-11 and Pink Friendship (check) were planted in plastic pots containing 2 kg sterilized growing media @ 2:1:1 v/v (soil: sand: FYM). Sorghum based *Fusarium oxysporum* f. sp. *gladioli* inoculum was mixed in the soil at 4 g per 100 g of soil one day before planting and watering

was done. The response of genotypes to *Fusarium* inoculation was evaluated at 90 days after planting (Elewa *et al.*, 2001). The disease incidence in per cent was recorded according to Riaz *et al.* (2010) and categorization of gladiolus genotypes based on disease incidence percentage was carried out as reported by Shanmugam *et al.* (2009) as follows: 0-10% = Highly resistant (HR); 10-25% = Resistant (R); 25-50% = Moderately susceptible (MS); 50-75% = Susceptible (S); 75-100% = Highly susceptible (HS). The results have been presented and discussed at the probability level of one per cent. The data regarding disease incidence and mortality were recorded using following formulae:

$$\text{Disease incidence (\%)} = \frac{\text{No. of diseased plants}}{\text{Total No. of plants}} \times 100$$

$$\text{Mortality (\%)} = \frac{\text{No. of plants died due to disease}}{\text{Total number of plants}} \times 100$$

## RESULTS AND DISCUSSION

Perusal of data presented in Table 1 indicated significant differences between hybrid selection IIHRG-7 and Pink Friendship (check) for most of the vegetative and floral characters, however, plant height,

**Table 1. Vegetative and floral traits of Gladiolus hybrid selection IIHRG-7 with check Pink Friendship (pooled data of three years)**

| Genotype        | Days to spike emergence | Days to flower | Plant height (cm) | Spike length (cm) | Rachis length (cm) | Floret diameter (cm) | No. of florets per spike | Florets remain open at a time | No. of spikes/corm | No. of marketable spikes/corm | Flowering duration (days) | Vase life (days) |
|-----------------|-------------------------|----------------|-------------------|-------------------|--------------------|----------------------|--------------------------|-------------------------------|--------------------|-------------------------------|---------------------------|------------------|
| IIHRG-7         | 63.95                   | 72.25          | 142.06            | 123.11            | 46.77              | 10.66                | 12.66                    | 5.55                          | 1.66               | 1.43                          | 9.61                      | 9.33             |
| Pink Friendship | 53.00                   | 62.67          | 144.88            | 113.70            | 57.41              | 10.79                | 17.10                    | 6.12                          | 1.40               | 1.40                          | 12.03                     | 9.00             |
| C.D. at 5%      | 3.01                    | 9.67           | NS                | 6.23              | 2.97               | NS                   | 0.97                     | 0.41                          | 0.28               | NS                            | 1.11                      | NS               |

floret diameter, number of marketable spikes per corm and vase life were found non-significant. The genotype Pink Friendship (check) recorded significantly early spike emergence (53.00 days) and flowering (62.67 days) in comparison to IIHRG-7 (63.95 days and 72.25 days, respectively). IIHRG-7 recorded significantly higher spike length (123.11 cm) than the check Pink Friendship (113.70 cm), however, longest rachis was recorded in Pink Friendship (57.41 cm). The spike length is one of the major criteria in selection

of superior hybrid selection in gladiolus. The Pink Friendship (check) recorded more number of florets per spike (17.10) and florets remain open at a time (6.12) than IIHRG-7 (12.66 and 5.55, respectively). However, IIHRG-7 recorded significantly maximum number of total spikes per corm (1.66) than the Pink Friendship (1.40). The more number of spikes per corm are directly related to the higher productivity per unit area. The Pink Friendship recorded higher flowering duration (12.03 days) than the IIHRG-7

(9.61 days) owing to presence of more number of florets per spike in Pink Friendship which opened in acropetal successions for longer period. Sankari *et al.* (2012) reported variation in flowering traits in 42 gladiolus genotypes and recommended genotypes Pusa Swarnima, Pusa Shagun, Thumbolina, Priscilla and Candyman for cut flower production under Eastern Ghats of Tamil Nadu. Safeena and Thangam (2019) also evaluated ten cultivars of gladiolus for flowering traits and recommended Arka Amar and Darshan for cut flower purpose under Goa conditions.

Data presented in Table 2 indicate significant differences between hybrid selection IIHRG-7 and Pink Friendship (check) for corm and cormel characters. IIHRG-7 recorded significantly higher number of corms (1.46) than Pink Friendship (1.03); however, Pink Friendship recorded more number of cormels per corm (52.11) than IIHRG-7 (26.63). Significantly higher diameter of corm (6.75 cm), cormel (1.17 cm), weight of corm (72.44 g) and cormel (0.57 g) was recorded in IIHRG-7. Corm diameter and corm weight are important traits for

**Table 2. Corm and cormels traits of Gladiolus hybrid selection IIHRG-7 with check Pink Friendship (pooled data of three years)**

| Genotype        | Corm per corm (Nos.) | Cormel per corm (Nos.) | Diameter of corm (cm) | Diameter of cormel (cm) | Weight of corm (g) | Weight of cormel (g) |
|-----------------|----------------------|------------------------|-----------------------|-------------------------|--------------------|----------------------|
| IIHRG-7         | 1.46                 | 26.63                  | 6.75                  | 1.17                    | 72.44              | 0.57                 |
| Pink Friendship | 1.03                 | 52.11                  | 5.65                  | 1.02                    | 61.33              | 0.44                 |
| C.D. at 5%      | 0.23                 | 4.07                   | 0.29                  | 0.04                    | 9.58               | 0.08                 |

producing quality spikes, with higher number of florets with bigger size. Sankari *et al.* (2012) and Safeena and Thangam (2019) reported that genotypes Thumbolina, Priscilla, Candyman, Arka Amar and Darshan were found superior for corm number, corm weight and corm diameter.

The qualitative traits of IIHRG-7 and Pink Friendship are given in Table 3. The IIHRG-7 has novel flower colour (RHS colour chart) as Red-Purple (65.B) having Red-Purple (62.A) streaks with Red-Purple (67.B) splash with variegated spikes.

**Table 3. Qualitative traits of Gladiolus hybrid selection IIHRG-7 with check Pink Friendship**

| Sl. No. | Trait            | IIHRG -7   | Pink Friendship  |
|---------|------------------|--|--|
| 1.      | Floret Type      | Open-faced   | Open-faced   |
| 2.      | Floret texture   | Medium   | Medium   |
| 3.      | Floret structure | Wavy   | Wavy   |
| 4.      | Floret placement | Good   | Good   |
| 5.      | Floret colour    | Red-Purple (65.B) having Red-Purple (62.A) streaks with Red-Purple (67.B) splash | Red (50.D) having Red (51.C) margin and White (155.D) lines with Yellow (2.D) blotch |

On the perusal of the data presented in Table 4, significant differences were observed between hybrid selection IIHRG-11 and *Psittacinus* hybrid (check) for most of the vegetative and floral characters, however, flowering duration and vase life were found non-significant. The hybrid selection IIHRG-11 recorded significantly early spike emergence (66.66 days) and flowering (76.65 days) in comparison to *Psittacinus* hybrid (check) (78.24 days and 89.245 days, respectively). Shaukat *et al.*, (2013) also reported early spike emergence in Applause and Peter Pears and early flowering in Priscilla and Peter Pears.

*Psittacinus* hybrid recorded significantly maximum plant height (150.38 cm), spike length (120.43 cm) and rachis length (60.07 cm) than IIHRG-11 (120.72 cm, 95.18 cm and 48.81 cm, respectively). However, IIHRG-11 recorded significantly maximum floret diameter (9.46 cm), number of florets per spike (17.54) and florets remain open at a time (6.86) than *Psittacinus* hybrid (8.25 cm, 16.68 and 4.75, respectively), while, maximum total number of spikes per corm (3.92) and marketable spikes per corm (2.43) were recorded in *Psittacinus* hybrid than IIHRG-11 (1.92 and 1.70, respectively). The genotypes

**Table 4. Vegetative and floral traits of Gladiolus hybrid selection IIHRG-11 with check *Psittacinus* hybrid (pooled data of three years)**

| Genotype                  | Days to spike emergence | Days to flower | Plant height (cm) | Spike length (cm) | Rachis length (cm) | Floret diameter (cm) | No. of florets per spike | Florets remain open at a time | No. of spikes/corm | No. of marketable spikes/corm | Flowering duration (days) | Vase life (days) |
|---------------------------|-------------------------|----------------|-------------------|-------------------|--------------------|----------------------|--------------------------|-------------------------------|--------------------|-------------------------------|---------------------------|------------------|
| IIHRG-11                  | 66.66                   | 76.65          | 120.72            | 95.18             | 48.81              | 9.46                 | 17.54                    | 6.86                          | 1.92               | 1.70                          | 11.70                     | 7.12             |
| <i>Psittacinus</i> hybrid | 78.24                   | 89.24          | 150.38            | 120.43            | 60.07              | 8.25                 | 16.68                    | 4.75                          | 3.92               | 2.43                          | 11.96                     | 7.00             |
| C.D. at 5%                | 1.96                    | 2.14           | 3.96              | 2.75              | 2.47               | 0.21                 | 0.64                     | 0.25                          | 0.46               | 0.40                          | NS                        | NS               |

with more number of florets remain open at a time on the spike are more suited for exhibition purpose. The more number of spikes per corm are directly related to the higher productivity per unit area. Swaroop *et al.* (2018) evaluated 27 gladiolus hybrids and reported that hybrids Suchitra x Melody and Green Pasture x Regency recorded maximum plant height, spike length and rachis length, while, hybrids Suchitra x Melody and Bindiya (mutant) recorded more number of florets per spike, whereas, hybrids Suchitra x Melody and Green Pasture x Regency

recorded higher number of shoots per plant. Bhat *et al.* (2017) evaluated 60 genotypes of gladiolus for growth and flowering traits and recommended that genotypes Eurovision, Jester Gold, Priscilla, Vink's Glory, White Friendship *etc.* are best suited for cut flower under temperate conditions of Kashmir.

Data presented in Table 5 indicate significant differences between hybrid selection IIHRG-11 and *Psittacinus* hybrid (check) for most of the corm and cormel traits except number of cormels per corm. *Psittacinus* hybrid recorded significantly higher number

**Table 5. Corm and cormel traits of Gladiolus hybrid selection IIHRG-11 with check *Psittacinus* hybrid (pooled data of three years)**

| Genotype                  | Corm per corm (Nos.) | Cormel per corm (Nos.) | Diameter of corm (cm) | Diameter of cormel (cm) | Weight of corm (g) | Weight of cormel (g) |
|---------------------------|----------------------|------------------------|-----------------------|-------------------------|--------------------|----------------------|
| IIHRG-11                  | 1.91                 | 10.14                  | 6.64                  | 1.53                    | 64.44              | 1.08                 |
| <i>Psittacinus</i> hybrid | 3.64                 | 10.90                  | 5.22                  | 1.78                    | 44.33              | 3.10                 |
| C.D. at 5%                | 0.28                 | NS                     | 0.18                  | 0.06                    | 4.47               | 0.12                 |

of corms per plant (3.64), diameter of cormel (1.78 cm) and weight of cormel (3.10 g) than IIHRG-11 (1.91, 1.53 cm and 1.08 g, respectively), whereas, IIHRG-11 recorded significantly higher corm diameter (6.64 cm) and corm weight (64.44 g) than *Psittacinus* hybrid (5.22 cm and 44.33 g, respectively). Bhat *et al.* (2017) evaluated 60 genotypes of gladiolus for

corm and cormels traits and recommended genotypes Buff Beauty, Mayur, Priscilla, Pusa Suhagin, Regency *etc.* are best suited for corm production under temperate conditions of Kashmir.

The qualitative traits of IIHRG-11 and *Psittacinus* are given in Table 6. The IIHRG-11 has novel flower colour (RHS colour chart) as Red (41.C)

**Table 6. Qualitative traits of Gladiolus hybrid selection IIHRG-11 with check *Psittacinus* hybrid**

| Sl. No. | Trait            | IIHRG -11  | <i>Psittacinus</i> hybrid                                     |
|---------|------------------|--|---|
| 1.      | Floret Type      | Open-faced   | Hooded  |
| 2.      | Floret texture   | Thick  | Medium  |
| 3.      | Floret structure | Slightly ruffled   | Plain   |
| 4.      | Floret placement | Double row   | Fair  |
| 5.      | Floret colour    | Red (41.C) having Red (41.A) margin. Blotch Red (46.B) with Yellow (13.C) border | Red (39.A) with orange-Red (34.A) margin. Blotch Yellow (8.B) |

**Table 7. Disease incidence (%) and mortality (%) in IIHRG-11 with Pink Friendship (check) as influenced by *Fusarium* inoculum**

| Genotype        | Disease incidence (%) | Mortality (%) |
|-----------------|-----------------------|---------------|
| IIHRG-11        | 18.52 (18.47)         | 0.00 (2.87)   |
| Pink Friendship | 33.33 (30.95)         | 18.52 (18.47) |
| SEm±            | 3.46                  | 3.14          |
| CD (P=0.01)     | 20.63                 | 18.70         |

Note: Values within parenthesis are *arc sign* transformed values

having Red (41.A) margin. Blotch Red (46.B) with Yellow (13.C) border and have resistance to *Fusarium* wilt disease.

Data presented in Table 7 indicate that the hybrid selection IIHRG-11 recorded 18.52% disease incidence with zero per cent mortality which comes under resistant category, while, check Pink Friendship recorded 33.33% disease incidence with 18.52 per cent mortality which comes under

moderately susceptible category as categorized by Shanmugam *et al.* (2009).

On the basis of three years of evaluation, gladiolus hybrid selections IIHRG-7 was found promising for novel flower colour and variegated spike, and IIHRG-11 for novel flower colour and resistant to *Fusarium* wilt disease. These hybrid selections will be useful in developing new gladiolus hybrid selections with novel flower traits and resistant to *Fusarium* wilt disease.

## REFERENCES

- Anonymous. 2016. Horticulture crops estimates for the year 2015-16. National Horticulture Board, Haryana. Ministry of Agriculture and Farmer's Welfare, Government of India.
- Bhat, Z.A., Nazki, I.T., Nelofar and Hamid, B. 2017. Evaluation of gladiolus cultivars for growth, flowering, spike yield and corm yield under temperate regions of Kashmir. *Ind. Hort. J.*, 7(3/4): 203-207.
- Elewa, I.S., Hilal, A.A., Hassan, S.E. and Abd El Malak, S. 2001. Studies on *Fusarium* disease (*Fusarium oxysporum* f. sp. *gladioli* (Massey) Synd. and Hans. of gladiolus. *Egyptian J. Phytopathol.*, 22(2): 83-95.
- Kakade, D.S., Jadhav, S.B. and Katwate, S.M. 2016. Management of *Fusarium* wilt in gladiolus. *Int. J. Pure App. Biosci.*, 4(5): 127-132.
- Lakshman, D.K., Pandey, R., Kamo, K., Bauchan, G. and Mitra, A. 2012. Genetic transformation of *Fusarium oxysporum* f. sp. *gladioli* with *Agrobacterium* to study pathogenesis in gladiolus. *Eur. J. Plant Pathol.*, 133(3): 729-738.
- Massey, L.M. 1926. *Fusarium* rot of gladiolus corms. *Phytopathology*, 52: 567-572.
- Nelson P.E., Toussoun T.A. and Cook R.J. 1981. *Fusarium: Diseases, biology, and taxonomy*. Pennsylvania State University Press; University Park, Pennsylvania, USA.
- Panase, V.G. and Sukatme, P.V. 1967. Statistical methods for agricultural workers, Indian Council of Agricultural Research, New Delhi. p.155.
- Riaz, T., Khan, S.N. and Javaid, A. 2010. Management of corm-rot disease of gladiolus by plant extracts. *Nat. Prod. Res.*, 24: 113-118.
- Safeena, S.A. and Thangam, M. 2019. Field performance of gladiolus cultivars for growth, yield and quality cut flower production under humid agro-climatic conditions of Goa. *Int. J. Agr. Sci.* 11(3): 7797-7800.
- Sankari, A., Anand, M. and Arulmozhiyan, R. 2012. Evaluation of gladiolus cultivars in eastern ghats of Tamil Nadu. *J. Hortl. Sci.* 7(2): 206-208.

- Shanmugam, V., Ajit, N.S., Ram, R., and Dhyani, D. 2009. Screening carnation and gladiolus cultivars for vascular wilt resistance. *Indian Phytopathol.*, **62**(1): 117-118.
- Shaukat, S.A., Shah, S.Z.A., Shaukat, S.K. and Shoukat, S.W. 2013. Performance of gladiolus (*Gladiolus grandiflora* L.) cultivars under the climatic conditions of Bagh Azad Jammu and Kashmir Pakistan. *J. Cent. Eur. Agric.*, **14**(2): 158-167.
- Swaroop, K., Singh, K.P., Kumar, P. and S.S. Sindhu. 2018. Improvement and performance of gladiolus hybrids for flower traits/novel colour and higher corm multiplication. *Int. J. Agric. Innov. Res.*, **6**(4): 2319-1473.

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Panse, V. G. and Sukhatme, P. V. 1978. Statistical methods for Agricultural workers. ICAR, New Delhi, p 108.

Srinivas, K. 1987. Response of watermelon (*Citrullus lanatus* Thunb. Musf) to drip and furrow irrigation under different nitrogen and plant population levels. Ph.D thesis, UAS, Bangalore

Mehta, N. K. and Sharma, S. D. 1986. Studies on flowering and fruit retention in some cultivars of peach (*Prunus persica* Batch). In: Advances in Research on Temperate Fruits. *Proc. Nat'l. Symp. Temp. Fruits*, Solan (India), Dr. Y. S. Parmar Univ. Hort. and Forestry, pp 37-42

Krishnamoorthy, A. and Mani, M. 2000. Biological Control of Pests of Vegetable Crops.p367-78. In: Biocontrol Potential and its exploitation in sustainable Agriculture. Vol. 2: Insect Pests. Upadhyay, R. K. Mukerji, K. G. and Chamola, B.P. (ed.). Kluwer Academic / Plenum Publishers, New York

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## New Varieties/ Technologies of ICAR-IIHR



**New Water Melon - Arka Shyama variety**



**Arka Red - New Gerbera variety**



**Leaf curl resistant chilli varieties Arka Tejaswi, Arka Saanvi and Arka Tanvi**



**Arka Abhi**



**Arka Shuba**

## New Varieties/ Technologies of ICAR-IIHR



Arka Herbiwash - Safe way of removing pesticide residues



Arka Bharath - New teasel gourd variety

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