ISSN 0973-354X
eISSN 2582-4899

JOURNAL OF HORTICULTURAL SCIENCES

Volume 16 December 2021 Issue 2

Society for Promotion of Horticulture
ICAR - Indian Institute of Horticultural Research, Bengaluru - 560 089

JOURNAL OF HORTICULTURAL SCIENCES

Volume 16 **Issue 2** **June 2021**

CONTENTS

J. Hortl. Sci.
Vol. 16(2) : 234-240, 2021

Original Research Paper

Performance evaluation of double type tuberose IIHR-4 (IC-0633777) for flower yield, quality and biotic stress response

Bharathi T.U.[1]*, Meenakshi Srinivas[1], Umamaheswari R.[2] and Priti Sonavane[2]
[1]Division of Flower and Medicinal Crops
[2]Division of Crop Protection
ICAR-Indian Institute of Horticultural Research, Bengaluru - 560089, India
*Corresponding author Email: t.ushabharathi@gmail.com

ABSTRACT

An experiment was carried out to evaluate an advance breeding line of tuberose double type IIHR-4 along with check for flowering, yield and resistance to root knot nematode and *Alternaria polianthi* leaf blight disease. The hybrid selection IIHR-4 was developed through hybridization by crossing Mexican Single x Pearl Double, followed by selection. Double type tuberose IIHR-4 was found to be novel with better flowering and quality traits such as relatively shorter spike (62.00 cm) and rachis length (25.59cm) and favourable diameter of floret (4.47cm) and number of florets per spike (50.75), more number of florets (7.10) open at a time on the spike and shorter internodal length between the florets (3.45cm). The florets are with shorter length (5.22cm) arranged very compactly on the spike making IIHR-4 ideal as cut flower. Added to this, the advanced breeding line IIHR-4 was found to be highly resistant to root knot nematode *Meloidogyne incognita* under field conditions and tolerant to *Alternaria polianthi* leaf blight disease.

Keywords: Advanced breeding line, cut flower, flowering, double type, tuberose and yield

INTRODUCTION

Tuberose (*Polianthes tuberosa* Linn.) is an important tropical bulbous ornamental plant belonging to the family 'Asparagaceae' and is native to Mexico (Bailey, 1919). There are two types of tuberose namely, Single and Double which are commercially cultivated across the globe for their exquisite flowers. Single types are used as loose flowers for garland purpose and perfumery industry whereas double varieties are highly preferred for cut flower and bouquets because of the longer keeping quality of the flower spikes. Double tuberose flowers have high demand in both local and international markets and are being exported to gulf countries. The increasing demand for superior and novel double type tuberose necessitates the development of varieties of this category. Tuberose is commercially cultivated in India in an area of about 16,190 ha, with a loose flower production of 1, 07, 910 metric tonnes and cut flower production of 89.29 lakh numbers of cut stems (Anon, 2016). Root knot nematode infects tuberose and leads to 10-14% of crop loss (Khan and Reddy, 1992). Leaf blight disease caused by *Alternaria polianthi* is extensive in tuberose growing regions of the country. Development of tolerant and resistant varieties to these biotic stresses is the need of the hour to help the tuberose growers. Keeping these objectives in view, an advance breeding line of double type tuberose (IIHR-4) developed by ICAR-IIHR was evaluated for flowering, yield, quality and reaction to root knot nematode and A.*polianthi* leaf blight disease.

MATERIALS AND METHODS

The investigation was carried out at the Division of Flower and Medicinal Crops, ICAR-Indian Institute of Horticultural Research, Bengaluru during 2015 - 2018. The advance breeding line of tuberose IIHR-4 with double flowers was evaluated along with the commercial check varieties Arka Vaibhav, Arka Suvasini, local checks Hyderabad Double and Pearl Double. Randomized block design was followed for the experiment with three replications. Uniform size of bulbs (2.5 cm diameter) were planted on raised bed

with the spacing of 30 x 30 cm. Standard cultural practices were followed throughout the experimental period. The growth, yield and quality parameters *viz*., days to spike emergence, days to opening of first floret, spike length, rachis length, number of florets per spike, length of floret, diameter of floret, bud length, matured bud weight, single flower weight, number of spikes per clump, vase life, number of bulbs per clump, number of bulblets per clump, internodal length between the florets and number of florets open at a time on the rachis were observed. The tuberose lines/cultivars were screened for the tolerance/ resistance against root knot nematode *Meloidogyne incognita* for three consecutive years. Gall Index (GI) was recorded in the roots in a 0-5 scale as per Taylor and Sasser (1978) at the time of bulb harvest. Per cent disease index and host reaction of tuberose genotypes against leaf blight disease caused by A. *polianthi* under field condition was recorded thrice at15 day interval using 0-5 scale (Narayanappa and Chandra, 1984). The pooled data of three years were statistically analyzed as per Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The results of the study revealed significant differences among the tuberose lines for flowering and yield parameters (Tables 1 and 2). Days to spike emergence ranged from 133.73 (Arka Suvasini) to 198.00 (Pearl Double) with the general mean of 161.53 days. The advanced breeding line IIHR-4 recorded 154.15 days to spike emergence. Early spike appearance in tuberose cultivar Arka Suvasini was reported by Safeena *et al*. (2019) who noticed wide range of variation in days taken to flowering due to variation in genetic makeup and prevailing environmental conditions. Spike length ranged from 62.00 cm (IIHR-4) to 86.36 cm (Pearl Double) with the mean of 78.64 cm. The advanced breeding line IIHR-4 recorded spike length of 62.00 cm with upright stalk categorized into short spike group suitable for cut flower. Varietal differences for spike length was earlier reported by Madhumati *et al*. (2018), Prashanta *et al*. (2016), Safeena *et al*. (2019) and Dogra *et al*. (2020) in tuberose. Rachis length varied from 25.59cm (IIHR-4) to 33.71cm (Arka Vaibhav) with the general mean of 29.06 cm. The number of florets per spike was recorded the maximum in Arka Suvasini (55.33) and minimum in Pearl Double (48.78) with the mean of 50.91. The results are in line with findings of Ranchana *et al.* (2013), Rao and Sushma (2015), Bharathi *et al*. (2018) in tuberose and Rani and Singh (2005) in gladiolus. The variation observed in spike length and rachis length might be attributed to the inherent genetic characters of the individual cultivars and environmental factors.

The line IIHR-4 recorded least floret length of 5.22 cm and Arka Suvasini recorded the highest floret length of 6.22 cm with the general mean of 5.69 cm. Similar results on highest floret length of tuberose cultivar Arka Suvasini was stated by Ranchana *et al*. (2013). The florets of IIHR-4 are short and arranged closely without any gap between the internodes, making the spike very attractive and rendering the line highly suitable as cut flower. Such variation might be due to the varietal characters and similar observations were made by Bharathi and Umamaheswari (2018).

Diameter of floret varied from 4.44 cm (Pearl Double) to 4.77 cm (Arka Suvasini) with the general mean of 4.56cm. This may be due to varied growth rates and genetic make-up. The results are in line with the findings of Rao and Sushma (2015) and Gandhi *et al.* (2017) and Safeena *et al*. (2019) in tuberose. Bud length ranged from 4.86 cm (Hyderabad Double) to 5.68 cm (Arka Suvasini) with the mean of 5.40 cm. Single flower weight was varied from 2.29g (Arka Vaibhav) to 3.57g (Arka Suvasini) with the mean of 2.73g. The variation in floral parameters might be primarily governed by the genetic makeup of the varieties and these results were also experimentally supported by the findings of Andrew *et al.* (2017).

Number of florets open at a time on the spike is an important trait for cut flower spike since it depicts the exquisiteness of the cut flower. The line IIHR-4 recorded the highest number of florets (7.10) open at a time on the spike. The lowest was observed in Arka Vaibhav (2.40) with the general mean of 4.50. The advanced breeding line IIHR-4 was very appealing with highest number of florets open at a time on the spike and this character makes the line IIHR-4 highly suitable as cut flower, especially for flower arrangement and bouquet (Fig.1). The line IIHR-4 was found to be superior over the commercial check for the above character. The variations in number of florets open at a time on the spike might be due to different genetic make-up of the different cultivars and prevailing environment conditions of the experimental area. The results are in conformity with the findings of Kusum (2010) in tuberose who also reported the variation among the tuberose cultivars for the maximum open florets per spike.

Fig. 1. The field view of tuberose line IIHR-4 and flower spikes

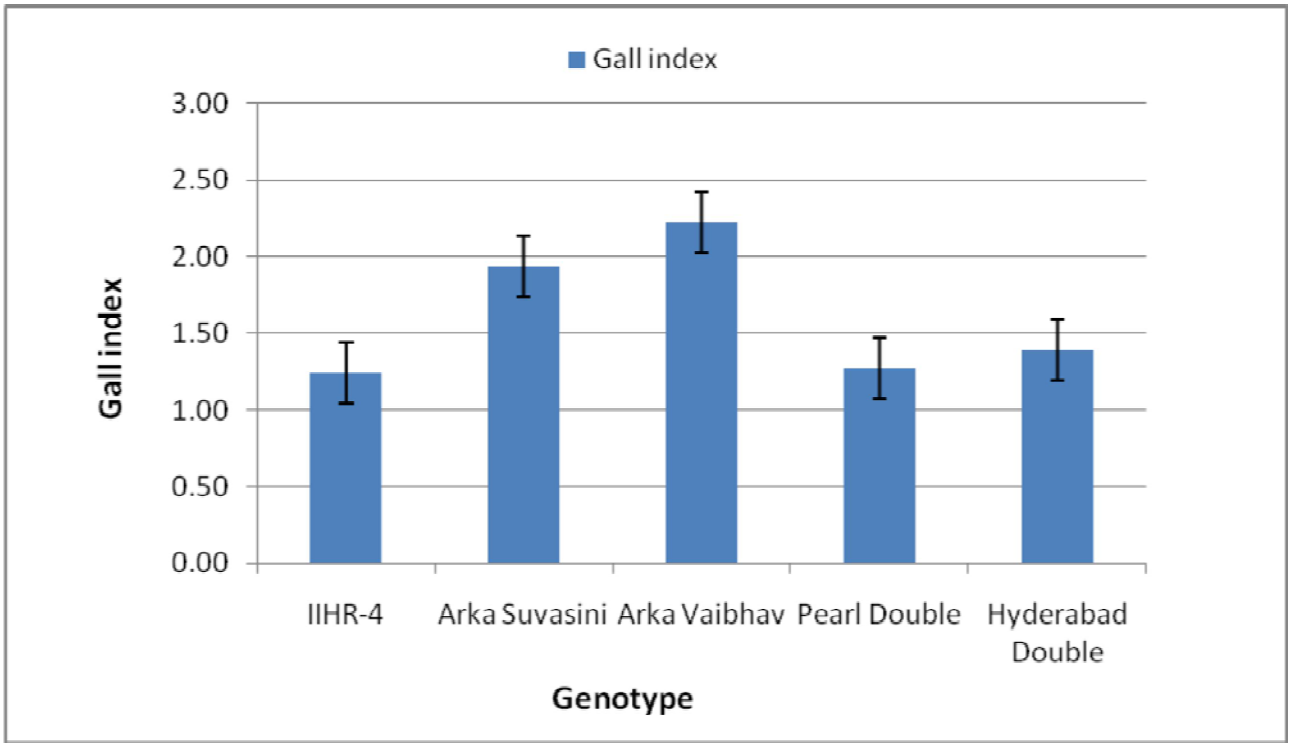

Fig. 2. Reaction of tuberose cultivars to root knot nematode

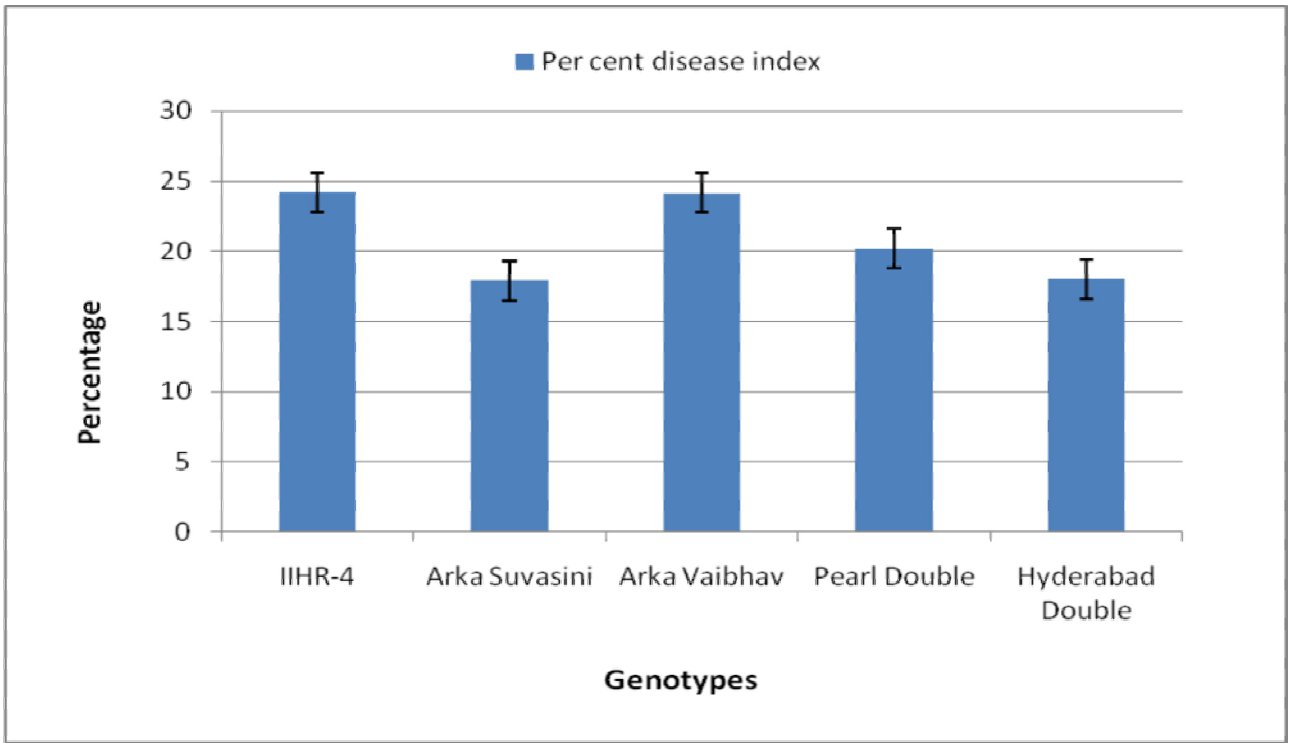

Fig. 3. Per cent disease index and host reaction of different tuberose varieties to leaf blight disease caused by *Alternaria polianthi* under field condition

Table 1. Performance evaluation of advance breeding line of tuberose double type for flowering parameters

Genotype	Days to spike emergence	Spike length (cm)	Rachis length (cm)	No. of florets per spike	Length of floret (cm)	Diameter of floret (cm)	Bud length (cm)	Single flower weight (g)	No. of florets open at a time on spike	Internodal length (cm)
IIHR-4	154.15	62.00	25.59	50.75	5.22	4.47	4.98	3.16	7.10	3.45
Arka Suvasini	133.73	79.66	31.41	55.33	6.20	4.77	5.68	3.57	3.70	4.45
Arka Vaibhav	137.60	80.43	33.71	52.35	6.02	4.49	5.49	2.29	2.40	5.79
Pearl Double	198.00	86.36	28.24	48.78	5.48	4.44	5.28	2.94	5.45	4.83
Hyderabad Double	184.18	84.77	26.35	50.10	5.51	4.71	4.86	3.05	3.85	4.17
Mean	161.53	78.64	29.06	51.46	5.69	4.58	5.26	3.00	4.50	4.54
Range	133.73-198.00	62.00-86.36	25.59-33.71	48.78-55.33	5.22-6.20	4.44-4.77	4.86-5.68	2.29-3.57	2.40-7.10	3.45-5.79
CV%	3.49	5.77	4.82	5.45	3.32	3.23	3.84	5.83	7.27	9.67
CD (P=0.05)	8.69	6.99	2.16	NS	0.29	0.23	0.31	0.27	0.50	0.68

Table 2. Performance evaluation of advance breeding line of tuberose double type for flower, bulb yield and vase life

Genotype	No. of spikes per clump	No. of spikes per m^2	No. of spikes per ha/year	No. of bulbs per clump	No. of bulblets per clump	Vase life (days)	Nature of spike	Tinge on flower bud	Type of flower opening
IIHR-4	4.43	33.94	398781.25	4.25	44.63	6.50	Straight	Green	Wide
Arka Suvasini	2.91	22.82	261593.75	2.69	32.81	7.25	Slightly bent	Pink	Wide
Arka Vaibhav	4.00	33.77	360125.00	8.19	54.81	7.25	Straight	Green	Wide
Pearl Double	2.14	19.24	192750.00	5.00	71.00	7.00	Slightly bent	Pink	Shy
Hyderabad Double	2.66	22.83	239156.25	5.56	63.13	7.13	Straight	Pink	Wide
Mean	3.23	26.52	290481.25	5.14	53.28	7.03	-	-	-
Range	2.14-4.43	19.24-33.94	192750.00-398781.25	2.69-8.19	32.81-71.00	6.50-7.25	-	-	-
CV%	6.26	7.74	6.28	15.03	10.44	7.63	-	-	-
CD (P=0.05)	0.31	3.16	28095.99	1.19	8.57	NS	-	-	-

According to Bharathi and Umamaheswari (2018), the trait internodal length indicates compactness of the florets arranged on rachis, which is the ideal character for the selection of suitable cut flower. In the present investigation, internodal length between florets ranged from 3.45 (IIHR-4) to 5.79 cm in Arka Vaibhav with the general mean of 4.54 cm. Among the double types evaluated, the line IIHR-4 recorded the shortest internodal length and the florets are arranged very densely on the spike. In agreement with findings of the present study, the highest internodal length in Arka Suvasini was reported by Singh and Singh (2013) in tuberose under Delhi condition. Variation in the internodal length might be due to the genetic makeup of the cultivars under study and similar observations were reported by Bharathi and Umamaheswari (2018) in single type tuberose.

Number of spikes per clump ranged from 2.14 (Hyderabad Double) to 4.43 (IIHR-4) with the mean of 3.23. Number of spikes per m^2 varied from 19.24 (Hyderabad Double) to 33.94 (IIHR-4) with the mean of 26.52. This variation in spikes per clump is in line with the findings of Rao and Sushma (2015), Ranchana *et al*. (2013), Gandhi (2017) and Safeena *et al*. (2019) in tuberose. Number of spikes per hectare ranged from 1,92,750.00 (Hyderabad Double) to 3,98,781.25(IIHR-4) with the mean of 2,90,481.25. The advanced breeding line IIHR-4 was found to be superior in flower yield than the commercial check Arka Vaibhav. This variation in the production of spikes/plant and spikes per plot might be due to the genetically controlled factor and also due to the hereditary traits of different cultivars under prevailing environment.

The vase life ranged between 6.50 and 7.25 days for the genotypes evaluated. Significant differences were not noticed among the double genotypes for vase life indicating that the advanced breeding line IIHR-4 has good vase life and it is on par with commercial cultivars interms of vase life.

Arka Suvasini recorded minimum number of bulbs per clump (2.69) and maximum number of bulbs per clump was recorded in Arka Vaibhav (8.19) with the mean of 5.14. Number of bulblets per clump ranged from 32.81 (Arka Suvasini) to 71.00 (Pearl Double) with the mean of 53.28. The variations in bulb parameters might be due to the presence of genetic variability of the cultivar and the results are in line with the findings of Madhumathi *et. al*. (2018) in tuberose. With respect to straightness of spike, the line IIHR-4, Arka Vaibhav and Hyderabad Double were found to bear straight spikes, while the cultivars Arka Suvasini and Pearl Double produced slightly bent spikes. The tinge on flower bud was recorded to be green in the line IIHR-4 and Arka Vaibhav and all the

other cultivars recorded pink tinge on flower bud. The type of flower opening was found to be shy in Pearl Double while all the other cultivars recorded wide flower opening. Differences in nature of spike, flower opening and tinge on flower bud was earlier reported by Bharathi and Umamaheswari (2018) in tuberose and these are due to the distinguished generic make up of the genotypes.

The advanced breeding line IIHR-4 was screened for the tolerance/ resistance against root knot nematode *M. incognita* for three consecutive years and the pooled analysis revealed that it was highly resistant under field conditions with least gall index of 1.24 (Fig. 1). Variations of tuberose genotypes for root knot nematode tolerance and resistance were reported earlier by Gandhi *et al*. (2018) who stated that this might be due to the inherent genetic character. Per cent disease index and host reaction of tuberose genotypes against leaf blight disease caused by *Alternaria* under field conditions were recorded and the results indicated that the breeding line IIHR-4 has better field tolerance to *Alternaria* leaf blight as compared to the other tuberose genotypes evaluated (Fig. 3).

CONCLUSION

It is concluded from the above study for three consecutive years that among the cultivars evaluated for flowering, yield, quality and biotic stresses, the advanced breeding line IIHR-4 with superior flowering and quality parameters namely the double type florets on shorter spike and rachis, more number of florets open at a time on the spike, shorter intermodal length between the florets with compact floret arrangement, straight spikes with wide open florets and green tinge on flower buds makes the IIHR-4 as most ideal cut flower cultivar. It was also found to be highly resistant to root knot nematode *M. incognita* under field conditions with better field tolerance to *Alternaria* leaf blight disease.

REFERENCES

Andrew, L., Rokolhu, K., Angngoi, B.Y., and Lokam B., 2017 Evalution of tubrose (*Polianthes heberosa* L.) cultivaers under the foothill conditions of Nagaland, *J.Orn. Horti.* **20**(2): 69-74

Anonymous. 2016. *Indian Statistics*, Ministry of Agricultureand Farmers' Welfare, Government of India.

Bailey, L. H. 1919. *The standard Cyclopedia of Horticulture*. *Macmillan,* Vol. 2.

Bharathi, T.U and Umamaheswari, R. 2018. Evaluation of advance breeding lines of tuberose (*Polianthes tuberosa* L.) for yield and quality. *J. Plant Development Sciences*, **10**(12) : 683-687.

Dogra, S., Pandey, R.K., Laishram, N and Singh, A. 2020. Varietal evaluation of tuberose under agro climatic conditions of Jamm. *Pharma Innovation Journal*, **9**(2): 499-501.

Gandhi, D.P. 2017. Evaluation of tuberose (*Polianthes tuberosa* l.) for quality, yield and tolerance/resistance to root knot nematode (*Meloidogyne incognita*). M.Sc thesis. DR. Y.S.R. Horticultural University, Venkataramannagudem.

Gandhi, D.P., Bharathi, T.U., Umamaheswari, R., Kalaivanan D. and Prathibha, S. 2019. Response of tuberose genotypes to root knot nematode, *Meloidogyne incognita*: Biochemical, histological and nutritional characterization of host-pathogen interaction. *J. of Environmental Biology*, **40**: 1151-1158.

Gomez, K. A. and Gomez, A. A. (1984). Statistical procedures for Agricultural Research. John Wiley and Sons, New York.

Khan, R.M. and Parvatha Reddy P. 1992. Nematode problems of ornamental crops and management. *Nematode Pests of Crops*.250-57.

Kusum, M. 2010. Varietal evaluation of tuberose (*Polianthes tuberosa* L.) for flowering, concrete and absolute content under Tarai conditions. Ph.D. thesis. G.B. Pant University of Agriculture and Technology, Pantnagar.

Madhumathi, C., Bhargav, V., Srinivasa, R. D., Sreedhar, D., Nagalakshmi, T. 2018. Evaluation of tuberose genotypes for vegetative, flowering and yield traits. *Int. J. Chemical Studies,* **6**(6):88-90.

Narayanppa, M. and Chandra, J. K. 1984. Fungicidal control of leaf spot of marigold caused by *Alternaria tagetica.* Indian J. Agri. Sci.; 54(5):691-692.

Prashanta, M., Punetha, P., Rana, D.K. 2016. Evaluation of tuberose genotypes for vegetative, floral and bulb yielding attributes under the valley conditions of Garhwal Himalayas. *Int. J. Chemical Studies,* **8**(62):3522-3524.

Ranchana, P., Kannan, M., and Jawaharlal, M. 2013. Evaluation of tuberose (*Polianthes tuberosa L.*) genotypes (Double) for yield and genetic variability. *J. Orn.Horti*. **16**(1-2):10-14.

Rani, R. and Singh, C. 2005. Evaluation of different gladiolus cultivars for quality flower production. *Journal of Research,* **17**(2): 227-30.

Rao, K.D. and K.Sushma. 2015. Evaluation of certain tuberose (*Polianthes tuberosa* L.) double genotypes for assessing the yield and quality traits under agro climatic conditions of Telangana. *The J. Res. Pjtsau*, **43**(1&2) 51- 56.

Safeena, S.A., Thangam, M. and Singh N.P. 2019. Evaluation of different cultivars of tuberose (*Polianthes tuberosa* L.) under humid agro climatic conditions of Goa. *J. Hortl. Sci.,* **14**(2) : 109-114.

Singh, K.P. and Singh, N.C. 2013, Evalution donble he halled cultivars of tuberose (*Polianthes tuberosa Linn.*) under Delhi conditions. *The Asian J. Horti,* **8**(2): 512-514

Taylor, A. L. and Sasser, J. N. 1978. Biology, identification and control of root knot nematode *Meloidogyne* spp. North Carolina State University Graphics, Raleigh, NC, 111 pp.

(Received on 15.01.2021, Revised on 24.07.2021 and Accepted on 27.07.2021)